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MANAGING THE EXPLOITATION OF INTELLECTUAL PROPERTY:

AN ANALYSIS OF POLICY AND PRACTICE IN NINE UK UNIVERSITIES

Thesis Presented By

Kerron Harvey

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ABSTRACT

In May 1985 the Government removed the British Technology Group's (BTG) right of first refusal on intellectual property arising in the course of Research Council-funded projects UK universities were offered the opportunity to assume rights and responsibilities previously enjoyed by the BTG, provided their policies and procedures fulfilled certain conditions. In particular, the government wished universities to·

a) give the fullest opportunity and scope to researchers to assume responsibility for exploiting their research findings;
b) encourage researchers to assume this responsibility;
c) provide guidance and help for those academics who wished to assume this responsibility.

The aims of this thesis were.

i) to generate a body of data about the ways in which nine UK universities handled the exploitation of IP between 1970 and 1990;
ii) to use this body of data to assess - in relation to those same universities - the extent to which current policy and practice *vis-a-vis* the exploitation of IP accommodate the government's wishes, as outlined in a letter from the Chairman of the SERC and a statement issued by the Secretary of State for Education, both dated 14 May, 1985,
iii) to begin to develop theory in relation to the exploitation of IP in these nine universities

This thesis adopts a research design based exclusively on case studies. It adopts a grounded rather than a logico-deductive approach to data collection and theory development, initially, data collection was informed by an extensive literature review. Data were elicited in 1989/90, primarily through tape-recorded, face-to-face, structured interviews with policy-makers and policy-implementers in the nine universities, and with policy "users" (heads of department, deans, enterprising and entrepreneurial academics with IP to exploit) Data from histories, documents and records were also collected

The thesis analyses policy and practice and evaluates the nine universities' performance with regard to measures a) - c) above Establishing widely differing performance, it explores the processes which led to this Further, it explores the extent to which policy "users" were aware of their university's policy and practice in relation to the exploitation of intellectual property, and their views on it

The thesis concludes that universities which created structures and made appointments to manage the exploitation of IP with a view to its extrinsic value have a less considered approach than those which did so on grounds of its intrinsic value, they are also less likely to have accommodated the government's wishes. More broadly, it also concludes that the introduction of this mechanism to replace exploitation via the BTG is a classic example of the UK government transplanting policies and mechanisms from other countries with no prior attempt to identify the processes and contexts which contribute to their success or failure in their native country, and little or no prior attempt to get to grips with the implications of transplanting them into the UK Further, it concludes that local conditions can - and do - impact (positively or negatively) on the operation of a transplanted mechanism such as this Finally, it concludes that identifying and evaluating those local conditions is unlikely to be a straightforward task

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CHAPTER 1

1 INTRODUCTION

1.1 Prologue

The problems researched and reported in PhD theses seem to be identified in a variety of ways. In science and engineering, in particular, the subject is often proposed by the research group leader, who wishes his/her specialism to be advanced, or by the research sponsor, who has a self-serving interest in a particular area At present, this is probably less prevalent in the arts, where students still tend to identify their own research problems, motivated largely by "academic" interest The problem investigated in this PhD thesis was identified by the investigator in a grounded way The investigator spent the mid-late 1970s and the early 1980s working as a journalist, specialising in news and features on advances in science, technology and medicine By chance, initially, this work brought her into close contact with academics at four neighbouring universities

The academics in question often had technology to transfer Their efforts to effect technology transfer by finding licensees had generally been unsuccessful, however. In some instances, sheer frustration led them to triple mortgage their houses in order to start up their own company to exploit the technology In one instance it led to an attempted suicide. On many occasions, a well-placed article seemed to solve the immediate problem. License deals were struck, new companies were founded, technology was transferred - sometimes to UK companies, more often to overseas companies

Over the years, following an honorable tradition as it turned out, the journalist metamorphosed into a social scientist, interested in discovering why it was that outward technology transfer from Britain's universities seemed sometimes to depend on the serendipity of a journalist making contact In the mid-1980s the decision was taken to seek funding to support an investigation into this broad problem

The eventual focus of the resulting study was chosen in the light of three related events which took place on 14 May, 1985 On that date

i) Parliament rescinded the British Technology Group's right of first refusal with regard to the exploitation of intellectual property arising out of Research Council-funded studies,

ii) the Department of Education and Science issued a press release in which the Secretary of State outlined the main features of the new arrangements governing the exploitation of intellectual property arising out of Research Council-funded studies,

iii) on behalf of the five Research Councils, the Chairman of the Science and Engineering Research Council wrote to vice-chancellors and principals to ask whether their university wished to assume the rights and responsibilities relating to the exploitation of intellectual property arising out of Research Council-funded studies, now that there was no obligation to offer it to the British Technology Group

1.2 Background

As one might expect, these three carefully orchestrated events did not come out of the blue, for the Prime Minister had announced the government's intention to remove the monopoly of the British Technology Group (BTG) two years earlier at Lancaster House

The BTG was formed in 1981 from the merger of the National Enterprise Board (NEB) and the National Research Development Corporation (NRDC) The history of the NEB need not concern us here. The history of the NRDC is pertinent, however. Established by the Development of Inventions Bill in 1948, the NRDC was charged with "securing,

where the public interest so requires, the development or exploitation of inventions resulting from public research and or any other invention as to which it appears to the Corporation that it is not being developed or exploited or sufficiently developed or exploited, acquiring, holding, disposing of and granting rights (whether gratuitously or for consideration) in conection with inventions resulting from public research and, where the public interest so requires, in connection with inventions resulting from other sources" (quoted in Haigh, Pearson *et al*, 1971) Thus, the NRDC became the first technology transfer organisation in the world to be founded by a government, ultimately, it also became the largest technology transfer organisation in the world (Reimers, 1980).

The principle trigger for the establishment of the NRDC was said to be the events surrounding the discovery of penicillin A great deal of mythology has built up around this story, but the key events appear to have been as follows The discovery of penicillin is credited to Fleming, Chain and Florey, who received a (joint) Nobel Prize for their work Chain wished the basic discoveries and the production methods used on a research scale - which led to the first generation of products (penicillin F, G *etc*) - to be patented (Crespi, 1982) However, Oxford University, where most of the research was done, was persuaded by the British medical establishment that this was not appropriate, given its importance as a therapeutic aid (Davis, 1981). The British medical establishment apparently thought that Oxford University's know-how should be made freely available to any company which wished to manufacture the drug This sentiment did not stop US companies involved in scaling-up to mass production from taking out process patents, thereby controlling postwar commercial penicillin production for many years (Crespi, 1982) As a result, British drug companies ended up paying royalties after all - only to US companies, rather than to Oxford University A 1944 report by Nuffield College concluded that when universities become possessed of knowledge of high commercial value, there is a need for them to

secure utilisation of such discoveries in the interests of economic progress and the public good - but that universities were both unwilling and incapable of successfully commercialising the results of their research. In 1944, in the wake of this report, Attlee announced the government's intention to establish a fund and a body which could assume these responsibilities As we have seen, the body was duly established four years later.

In 1950, the Research Councils which existed at the time voluntarily agreed to observe the provisions of a Treasury Circular (TC 5/1950); they agreed, in essence, to give the NRDC the right of first refusal on any "inventions" arising out of research which they funded - whether in universities, Research Council institutes or wherever This agreement was still in force in the early 1980s, having been extended to apply to the new Research Councils established in the intervening years By this time, however, the NRDC and its successor, the BTG, had been "widely criticised as inefficient and rapacious, an obstacle to industry-HEI co-operation and a barrier to the exploitation of academic inventions" (ACARD/ABRC, 1983) The NRDC's failure to obtain a UK patent on monoclonal antibodies seemed to provide conclusive proof that complaints which had been levelled for many years against the organisation by individual academics and universities were well-founded (Ince, 1986) Moreover, there was evidence that some universities had managed to license discoveries which the NRDC/BTG had not succeeded in licensing - but were nonetheless obliged to share the resulting income with the BTG (McKenzie & Rhys-Jones, 1985) In the light of this situation, both the ACARD report "Exploiting Invention" (ACARD, 1982) and the joint ACARD/ABRC report "Improving Research Links Between Higher Education and Industry" recommended that the BTG's right of first refusal should cease. On 14 May, 1985, as indicated, Parliament duly rescinded it

We may regard this as part and parcel of successive Conservative governments' drive to do away with monopolies and create competition - as exemplified by the privatisation of British Telecom, British Gas *etc*, and subsequently, in 1992, the privatisation of the BTG itself. It is clear from the Department of Education and Science (DES) press release mentioned in paragraph (ii) above that the government did, indeed, wish to create competition. However, it is fair to say that this was not an end in itself, so much as the means to an end The principle objective of the three events outlined in the opening paragraphs was to do away with the existing, inefficient mechanism for the exploitation of intellectual property (IP) arising out of research funded by the five Research Councils and to replace it with one which would lead to an increased incidence of outward technology transfer from UK universities. This was not seen as desirable simply to get some kind of payback on the public funds invested in UK universities. There was something far more important at stake policy-makers believed there was a relationship between technological advance and economic growth - and a corresponding relationship between technological advances and science - *ie* between science and technology The new mechanism was intended to harness more effectively what Webster (1988) called "public sector research science" in the service of the nation's economic growth

The existing mechanism for exploiting IP arising in the course of Research Council-funded projects was characterised by lack of control over the exploitation of IP by the university where the IP was generated or the academics who generated it - by virtue of the fact that the IP was intended to be indirectly exploited via the BTG It was also characterised by a bias in favour of existing companies, for the BTG almost invariably granted non-exclusive licenses to companies with a track record in the relevant market/industrial sector - which was usually synonymous with large companies Thus, there was little or no opportunity for new companies to exploit IP arising out of publicly-funded research projects The BTG

did eventually bow to pressure - from *eg* the Spinks Report (Spinks, 1980) - to adopt a more entrepreneurial approach In 1981 the BTG launched the first round of the Academic Enterprise Competition with a three-quarter page advertisement in the Times Higher Education Supplement (THES, 1981). At the same time it started to establish joint ventures to exploit IP which had been assigned to it The resulting companies include Agricultural Genetics (Ince, 1986), Compeda, Gensys (Reimers, 1980) and Laserfix (BTG, 1985), but they were few in number and, it has been argued, they were handicapped by the BTG's refusal to grant exclusive licenses The new mechanism offered to universities in its place in May 1985 was characterised by direct control by the institution(s) in which the intellectual property had been generated, or by the academics who generated it - and, potentially, direct exploitation by the same institution or the academic staff concerned The shift from indirect towards more direct mechanisms was motivated largely by changing views of the nature of the technology transfer process and changing views of the job creation process - and hence the wealth creation process, occasioned by the publication in the US of a seminal report which argued that some two-thirds of all new jobs created in the US in the period 1969-76 took place in firms with fewer than 20 employees (Birch, 1978)

Since this new, more direct mechanism is the focus of this investigation, it is appropriate to consider the theoretical rationale underpinning it - and the extent to which that theoretical rationale appears to be justified. It is also appropriate to place this new, more direct mechanism for the exploitation of intellectual property in its proper context by detailing some of the mechanisms which preceded it and which complement it.

1.3 Theoretical Rationale

1.3.1 Relationship Between Science and Technology

The assumption that there is a relationship between science and technology dates back at least to the 1930s, when it was widely assumed not only that there was a relationship between the two, but that the relationship was linear and causal - *ie.* that basic science was the precursor of applied science and that technology was the practical embodiment of applied science Perceptions of the effectiveness of science and technology in the second world war reinforced the supposed validity of this "science push" model. It is not surprising, therefore, that it was this linear model which underpinned Vannevar Bush's famous 1946 report to President Truman, "Science the Endless Frontier" - a report which, it has been claimed, was the single most critical determinant (apart from the second world war) in the decision to provide massive federal support for basic research in the US (Price, 1978)

However, the validity of the linear model has long been questioned by commentators who believe that there is a relationship between science and technology, but that the nature of that relationship is far more complex and unpredictable than that proposed by the linear model, moreover, the relationship is not necessarily characterised by "science push". Bode (1965), for instance, suggested that the history of science and technology could be represented by imagining a graph containing two curves, each denoting the relative rates of advance of the two over time. The S (science) curve would start several millennia BC reflecting advances in astronomy in Egypt and Asia Minor, and would exhibit a conspicuous bump at the time of the Greeks Since the Greeks were not noteworthy for technology, the T (technology) curve would not rise until science and technology flourished together as Greek culture merged into the Alexandrian The S curve then flattens at the time of Christ, reflecting the Romans' interest in things practical and

relative disinterest in science After the fall of Rome, both curves go negative, indicating that previous knowledge and skills were being forgotten at a faster rate than new knowledge and skills were being generated Continuing in this vein, Bode's S curve rises significantly in the mid-16th century with the Copernican revolution, followed in the 17th century by Galileo, Newton *et al*, the S curve levels out until 1800, with discoveries in mathematics, physics (electricity), chemistry *etc* Bode's T curve rises from 1100, advancing steadily to 1500 or so with the invention of the crossbow, the longbow, gunpowder, firearms, the compass *etc*, but then levels out until the industrial revolution. In Bode's view, until the mid-19th century science was far more indebted to technology than technology to science, it is only in the 20th century that science and technology have become more closely intertwined

Bode and many other commentators see science and technology as separate streams of knowledge which flow through time independently, but which have the capacity to interact with and advance each other - as, for example, when X-ray crystallography helped to determine the structure of DNA (Gibbons, 1984) Price (1969) quoted Toynbee's vivid description of the relationship between science and technology as akin to a pair of dancers; both know the steps and the music, and either can lead or follow; the two exist in symbiosis; neglect of one would make the other stale, even moribund Commentators like Reiss (1969) and Ben-David (1968) stressed that it is not possible to predict when that symbiosis might lead to a practical use for science, that this is a matter of chance - as exemplified by communications satellites which became possible after totally unexpected research results in semi-conductor physics - *ie* the discovery of the maser and of solar batteries (Bode, 1965) Ben-David suggested that ways might, however, be found to increase the likelihood of such chance interactions Kistiakowsky (1965) argued that this would require us to rethink how we organise research, recalling that the reason that the

US did not develop a jet engine prior to the second world war was that the National Advisory Committee for Aeronautics was organised in accordance with the design criteria of piston engines, there was no administrative provision for work on totally new ideas.

The separateness of science and technology has been emphasised by empirical studies such as those done by Price, who observed that the sociology of publication revealed science to be papyrocentric whereas technology is papyrophobic - even in the Soviet Union, where industrial development was regarded as public rather than private property (Price, 1965b). Similarly, Allen (1977) contrasted science (which consumes, transforms, produces and exchanges *information* encoded in a language which is immediately comprehensible to humans) with technology (which uses information to formulate the problem and to develop solutions to the problem - but the output of technology is information encoded in a *physical product or process*) This view was contested by commentators like Schmookler (1967), who saw technology as a pool of knowledge which could be communicated linguistically by published papers

Some commentators have come to doubt Toynbee's assertion that a relationship of some sort between science and technology - albeit an unpredictable one - is required before technological advance can occur. Empirical research into the sources of the ideas on which technological innovations are based has revealed that in many cases it was previous technology, not science, which was the source (Price, Ashley *et al*, 1969, Gibbons, 1984)) In other words, technology frequently builds upon itself (Allen, 1977). There are commentators (see, for example, Narin (1985)) who have challenged this separatist, self-generating view, arguing, for instance, that the similarity in timing and content of recent papers in the biosciences and patents in biotechnology indicate that in high tech areas like this science and technology are actually converging. Dickson (1984) came to a similar

conclusion with regard to information technology. This is what lies behind the view that the patent system has a dangerously limited concept of "technical invention" - *ie.* one which excludes scientific research and "non-technical" creations which are becoming more and more prevalent in the 20th century as an increasing proportion of important inventions are science-based (Beier, Crespi & Straus, 1985)

There may simply be no cut and dried answer to this debate, the relationship may vary depending on the historical period in question, the level of development of individual industries and disciplines *etc* and the individual's view of what constitutes progress (Gibbons, 1984) Of course, such ambivalence is not helpful to policy-makers, who would prefer to work with one, widely-accepted model for the interaction of science and technology. It has been suggested, therefore, that since neither model is sufficiently developed as to indicate whether funding science or funding technology will be the most productive economically (Ben-David, 1968), public policy should be directed towards keeping open the lines of communication between the two (Gibbons, 1984) - until such time, perhaps, as the relatively new field of "science, technology and society" is able to shed more light on the inter-relationship of scientific activities and other, social, economic and political activities (Gibbons & Gummett, 1984)

It is evident, however, that the governments of some Western economies - most notably the US, the UK and France - have continued to focus on the development and refinement of science policy at the expense of developing a complementary technology policy, a strategy described by Rothwell & Zegveld (1985) as more an act of faith than understanding These governments appear to be wedded to what have been described as mission-oriented policies which are conceptually rooted in "science push" models of radical innovation, despite the fact that economic growth in these countries has been lower

in recent years than in countries like Japan, Germany, Sweden and Switzerland These countries have adopted contrasting, diffusion-oriented policies which emphasise incremental innovation in low-risk fields. Japanese policies, in particular, appear to be founded on the hypothesis that there is a science and technology development cycle which has four recognisable stages manufacturing production, technology innovation, scientific discovery and scientific infrastructure Japan's recent overtures to Western research labs are motivated, it is argued, not by the need to expand its basic research capability - for Japanese companies have a vast reservoir of basic research at their dispoosal - but to build themselves a global scientific infrastructure (Sheen, 1992)

There is evidence to suggest that diffusion-oriented policies could be appropriate in countries wedded thus far to mission-oriented policies For instance, a study of the utilisation of technology by NASA (Wright, 1969) showed that US companies showed eight times as much interest in incremental innovation as in new technology, new products and processes. However, it has recently been argued that the solution to the UK's problems does not necessarily lie in transplanting the Japanese approach to innovation into the UK, even if this could be achieved It lies in correcting the lack of a tradition of research and analysis to support policy choices in the UK, in ceasing to conduct lightning, superficial studies of candidate (science or technology) policies which pay little attention to the processes that contribute to the success or failure of such policies in their home setting, or to the complexities of trying to transplant them into the science and technology tradition of the UK The solution, it is argued, lies in prior evaluation of how candidate policies are likely to be shaped, for good or for ill, by local interests (SPSG, 1992)

As we shall see, however, the removal of the BTG's so-called monopoly is another manifestation of a long-standing tradition in the UK of importing policies and mechanisms

from other countries, with no prior attempt to assess the likely impact, let alone a programme to assess whether the policy/mechanism in question is achieving what it was intended to achieve. The investigator hopes that this study will make a small contribution to that evaluation process

1.3.2 Relationship Between Technological Change and Economic Growth

Whatever the source(s) of technological change, the proposition that there is a causal relationship between technological change and economic growth dates back at least to Marx, who saw invention and technological change as the driving forces of economic growth - though Marx's view was complicated by his belief that the particular manifestation of technological change at any given time was a response to the wishes and needs of society (Price, 1969) A century or so later we find political economists - most notably Schumpeter - still regarding the processes of technological advance as central to the evolving economies not just of particular industries but also of nations - indeed, of the whole of the West. This view is supported by analyses which indicate that since the beginning of the industrial revolution, prolonged periods of economic growth and high employment have been associated with clusters of interrelated technological innovations of considerable novelty (Saviotti, 1984) Indeed, it is been claimed that technological advances made since the second world war alone have led to economic - and hence social - change comparable in magnitude only to the birth of agriculture some 9000 years earlier (Denielou, 1985) In Schumpeter's view, the relationship between technological change and economic growth is not constant and unvarying, the processes involved in technological advance manifest themselves in a series of long cycles (detailed in Mackenzie, Cambrosio *et al*, 1988) This view has been supported by the empirical work Freeman (1982), whose analysis of patent and scientific publication aggregates suggested a strong correlation between longwave economic cycles and the evolution of inter-related

technology groups - *eg.* synthetics, electronics *etc.* Political economists are not alone in propounding the causal relationship between technological advance and economic growth. Historians and even social psychologists have supported this view, as we can see from the contributions assembled by Nelson (1962), still regarded as a major statement and source book of economic ideas (Griliches, 1984b). It is evident that in the past, certainly, Organisation for Economic Co-operation & Development (OECD) policy-makers also accepted this view without question The 1966 report "Fundamental Research and the Policies of Governments" (OECD, 1966), for instance, accepted not only the existence of a scientific gap between Europe and the US but also the view that this scientific gap had economic implications (Ben-David, 1968)

The proposition that there is a simple, causal relationship between technological change and economic growth has had its critics. It has been observed, for instance, that after the second world war the US and the UK devoted more of their GNP to R&D than other industrialised nations - and yet these were not the nations which exhibited the fastest rate of economic expansion, it was, in fact, Germany which expanded fastest in the post-war period (Verhoogen, 1965). This would not unduly surprise commentators whose empirical studies seem to support Marx's view that technological advance is a response to the wishes and needs of society Myers & Marquis (1969), for instance, established the primacy of demand over technological capability as determinants of new product success - *ie* market "pull" over technology "push" Schmookler, too, claimed that market - or rather demand - "pull" has been a stronger influence on patterns of innovative activity in the US than technology "push", an interpretation supported by more recent studies by Scherer (1984)

However, Pavitt (1984) warned that most generalisations derived from empirical examples are liable to be wrong, no matter how simple and elegant they are, in his view analytical

models of technological change are likely to become more complex and more numerous. We may refer back to McClelland (1969) for anecdotes which illustrate this complexity. He recalled that the Romans invented clocks, but treated them as toys, clocks did not become widely used until the industrial revolution, when they were needed - a classic example of the primacy of demand "pull" over technology "push". McClelland pointed out that technology can sometimes create the need, however, observing that if Gutenberg had commissioned a market survey to assess the demand for printed books, he would have given up the idea since few people could read and there was no identifiable need for printed books on a major scale McClelland's final anecdote encapsulated an example of a widespread need being met by technological advance (a device to condition children against bed-wetting) yet failing to take off - due to the threat of litigation from paediatricians who felt their territory was being invaded by an outsider (the inventor was a psychology graduate) Like Pavitt, Mansfield (1984) stressed that even though it is over a century since Marx highlighted the role of technological change as one of the major economic forces, we still suffer from deficient models and scant empirical work. In his view, policy-makers should recognise that there are considerable gaps in our knowledge and not place all their eggs in the one proverbial basket. It is evident, though, from the public utterances of policy-makers and policy-implementers alike that the majority is wedded to the view that economic growth depends on the rate at which a country advances technologically (see, for instance, Cranfield/UMIST, 1984)

1.3.3 The Technology Transfer Process

Traditionally, technology transfer was believed to happen relatively spontaneously; progress along the linear model from basic science to technology was seen as the occurring naturally without the intervention of government (Burns, 1969) During the second world war, of course, governments did intervene, planning and implementing

major projects, the Manhattan Project being one such example. After the war, however, the US government, in particular, reverted largely to a non-interventionist approach to technology transfer, relying on industry (Wade, 1984) and foundations like the Research Corporation, the Battelle Development Corporation, Scientific Advances Inc *etc* to do whatever needed to be done (Goodwin, 1971). In the late 1940s Senator Kilgore made a lone attempt to focus government's attention on the appliance of science by sponsoring a bill proposing that technology should be advanced by subsidising not only science but also its application, but the bill failed.

In the UK, as we have seen, a distinction was made between the industry-to-industry technology transfer process and that required for effective outward technology transfer from universities and government laboratories The NRDC was established to secure the commercial development and exploitation of relevant research results from the public sector - and from individual inventors. Eventually, similar, though smaller organisations were set up in a number of countries, most notably ANVAR in France

More recently, governments have considered other approaches to technology transfer, belatedly picking up on evidence that there might be a different - and possibly more effective - approach. When Schumpeter first wrote about innovation in 1912, for instance, he placed great emphasis on the role of new firms in the innovation process - though by the time he published "Capitalism, Socialism and Democracy" in 1943, he was placing less emphasis on this, predicting that innovation would become a routine function in large corporations (Williams, 1985a). Historical research seemed to bear out Schumpeter's earlier assertion. For instance, Burns & Stalker (1961) established that in the late 18th century Scottish universities were centrally involved not only in making discoveries in chemistry and engineering which were crucial to the industrial revolution, but also in the

technical application of the discoveries and even the entrepreneurial exploitation of them Ben-David (1968) argued that where, historically, there had been a direct relationship between fundamental research results and industrial growth (*eg* Germany in the second half of the 19th century, the US in the 20th century), this had been due to effective entrepreneurship. By the mid-1960s Schumpeter had demonstrated that in periods of economic stagnation entrepreneurs with new ideas come forward to lead capitalism into technologies which form the basis of new industries Roberts & Wainer (1967) showed that the most effective transfer of space technology from universities and quasi-academic institutions had been effected by the researchers concerned leaving their laboratories and founding their own businesses It was shown that new industries or major shifts in industries had typically been the result of radical innovations by a small business or an inventor outside of the industry (*eg* Kodachrome was developed by two musicians, xerography developed by a patent attorney, *etc*) (Myers, 1986) It was argued increasingly that established companies and industries practiced dynamic conservatism, that during the previous 50 years "invasions" by outsiders had been the principle sources of technological change, and that since information, materials and processes were merely the luggage of technological change rather than agents of change, government policy should facilitate the mobility of such outsiders (Menzel & Schon, 1969) Moreover, studies showed that new technology-based firms (often started by outsiders) continued to be just as inventive as their larger counterparts (Johannisson & Lindstrom, 1971), contrary to the theory advanced by economists like Galbraith (Watkins, 1973) It was suggested that this was because the entrepreneur often served as the technologist, the business manager and the product champion simultaneously, with the result that no formal technology transfer was required (Myers, 1986).

Some of the mechanisms set up in response to such findings will be detailed in sub-section 1.3 5 below

1.3.4 The Role of Public Sector Research Science

The discussion so far has employed the words "science" and "technology" without considering in organisational terms what the principal source(s) of each might be In countries which subscribe to mission-oriented policies, policy-makers, as we have seen, have put their faith in the linear model. Thus, universities and government laboratories are regarded as the chief sources of science - particularly basic science

In the US, initially, universities were only tapped as source of science *in extremis* The first example of the US government using universities to solve economic and social problems dates back to the American Civil War, when the Morrill Act of 1862 and the Hatch Act of 1887 actually created "land grant" colleges and gave them a responsibility to conduct research - initially pioneering research into human nutrition (hybrid crops *etc*) on agricultural research stations (OECD, 1982) These were exceptional circumstances, however, as was the second world war, when the Office of Scientific Research and Development was created and Vannevar Bush, former President of MIT, and James Conant advised the US military on the possible applications of science to the war effort - resulting in the Manhattan Programme, amongst others (Kenney, 1986) Otherwise, as de Tocqueville wrote in 1899 "science is taken up as a matter of business and the only branch of it which is attended to is such as admits of an immediate practical application" (quoted in Price, 1968)

The depression was the first occasion on which the peacetime potential of universities was really considered by the US federal government The Science Advisory Board (1933-35)

was the first committee of scientists to be invited to advise on national policy - specifically, on how to beat the depression The Board recommended a programme of federal grants to public and private universities, following the example of federal aid to land-grant colleges (Price, 1968), but there is no evidence this was acted upon in a comprehensive way. It has been suggested that governments were unwilling, prior to the second world war, to support academic researchers because a dominant belief of the time was that technology caused unemployment - precisely the problem they were trying to cure (National Science Foundation, 1983) This perspective changed in the light of the second world war, after which federal policy essentially sought to maintain the technological momentum brought about by funding public-sector research science at that time (Price, 1968) The emphasis was on the beginning of the supposedly linear model, on funding basic science Government departments and agencies later followed the same *modus operandi*, it was still felt that basic research in a field relevant to the government agency's mission would result in their problems being solved (Orlans (ed), 1968)

In Britain, too, it was recognised that universities had made significant scientific and technological contributions to Britain's war effort - both in the first world war (after it had belatedly been recognised that academics might serve their country more effectively as scientists than as cannon fodder) and in the second, as we can see from Sanderson (1972), whose painstaking study detailed the precise contributions made by individual universities After the second world war science funding in Britain was guided by the "Haldane principle" which held that scientists should be free to pursue the scientific research they thought most appropriate without interference from government (Haigh, Pearson *et al*, 1971, Brooks, 1973), essentially, this meant basic science Thus, although the type of science funded in Britain was very similar to the type of science funded in the US, the federal government in the US had an overt agenda influenced by its belief in the linear

model, it was actively seeking to promote economic growth This was less the case where the British government was concerned It has been claimed that the first policy document in Britain to overtly enshrine the belief that public sector research science could - and should - be mobilised, developed and exploited, that science could and should be made to contribute to economic growth, was the Rothschild Report of 1971 (Webster, 1988)

In the late 1960s, economic growth began to slow down in the West. Disturbing sets of statistics seemed to reinforce the view that technological advance and economic growth were related and that this slow-down in economic growth was due to a slow-down in technological advance There is, apparently, a relationship between patenting and prosperity (see *eg* Rahn, 1983, quoted in Beier, Crespi & Straus, 1985, who argued that economic advances made by countries like Japan and Israel since the second world war could not have been accomplished without the introduction of a patent system) In the 19th century, the US outstripped Europe in terms of useful technological inventions; in 1965, too, US companies filed more than 100,000 patents abroad, based on 20,000 original applications in the US, while in the same year foreign countries filed only 22,000 patents in the US, in other words, the US accounted for nearly half the world's total inventions (Ben-David, 1968). By the late 1970s there was a marked decline in the number of patents granted to US citizens as opposed to foreigners (Hannay, 1978, quoted in Dean, 1981) In fact, judged by patent applications, at a time when R&D expenditure had remained more or less constant, inventions per scientist/engineer had declined from the late 1960s to the late 1970s in almost all of the 50 countries for which data were available, Japan and West Germany peaked in 1971, while the US, UK and France peaked in 1967; in 1979 there was an extraordinarily low level of patenting, since patenting was usually highly correlated with R&D expenditure in most of these countries, this was cause for concern (Evenson, 1984)

Researchers responded by considering whether this could be a reflection of technological exhaustion, whether there was an inevitable decline in the inventive potential of highly developed economies; whether there was a pool of potential innovation which was depleted and recharged in ways not yet understood (Evenson, 1984), whether it might simply be that patenting was perceived to be less valuable in view of the rising costs of litigation and an increasing need to litigate, due to improved communications systems, computer searches of patent databases and an increased incidence of infringement (Griliches, 1984b) *etc etc* Governments took a different view. In the US the economic relevance of science had started to become an issue towards the end of the 1960s (Gibbons, 1984) The Bureau of the Budget argued that the Executive Office should provide an annual statement on the substance, organisation, costs, goals, problems and progress of science and technology - similar to the annual Economic Report, it should provide a framework for proper consideration of the state of science and technology in the larger economy, in the manner that the Steelman Committee had attempted in 1947-48 (Carey, 1968) The federal government had already started to focus its attention further along the linear model, on applied research (Greenberg, 1971). A similar change took place in Britain In 1971 the Dainton Report redefined science as **tactical** (needed by government or industry to further their immediate executive or commercial functions), **strategic** (more general scientific effort needed as a foundation for tactical science) and **basic** (no application in view). The report concluded that the Research Councils needed to become more well-informed about national needs and objectives, and that universities should be undertaking **strategic** as well as **basic** research (Dobbs, 1972)

The supposed spontaneity of the process of outward technology transfer from universities and government laboratories began to be questioned, too It was widely assumed in the US that the slow-down in economic growth was due to the erosion of innovation and the

postwar decline in university-industry linkages (Praeger & Omenn, 1984), though some felt there was scant evidence of this (Kenney, 1986) There is evidence to suggest that the relationship between industry and universities has been far more stable than politicians would have us believe In the early part of the 20th century the relationship between the two was kept alive principally by consulting relationships, especially in chemistry and engineering (Webster & Etzkowitz, 1991), but this was disrupted by the depression In the 1930s charitable foundations became an important source of research sponsorship, especially in the US, and from the second world war to the end of the 1960s government sponsorship of research eclipsed all other sources, with the result that industrial support for academic research declined in relative terms, though support remained level in constant dollar terms (National Science Foundation, 1983) It was assumed that university/industry relationships had likewise declined In fact, there is evidence to suggest that university/industry relationships were spontaneously being manifested in increasingly novel ways without the intervention of government During the immediate postwar period the development of the science park and the university spin-off company spring to mind as examples (Webster & Etzkowitz, 1991) In the US banks, too, played their part, as did successful entrepreneurs, by making venture capital available to new, high technology firms (Bullock, 1983) Following a major study in the early 1980s, the NSF characterised university/industry relationships in the US as "numerous, constructive and important since the turn of the century" (National Science Foundation, 1983), though it conceded that the pre-war period had not been systematically documented In more recent years these have extended to incorporate long-term research alliances This started with the famous 12-year agreement between Harvard Medical School and Monsanto More recently similar arrangements have been made in Europe - *eg* the 15-year agreement between University College, London and Eisai and the 10-year agreement between Oxford University and Beecham

Similar assumptions about university-industry relationships - or the decline in them - were made in Britain in the light of the UK's low growth rate; (between 1950 and 1973 this had averaged 3 1 per cent, compared to 4-5 per cent in Belgium, Denmark and Holland and 5-6 per cent in France, Italy and Germany (Williams, 1985b)). The director of research at English Electric claimed, for instance, that this was due to the barrier between university and industry being re-established after the second world war - though he was unable to say why this had happened (Eastwood, 1969). Fakstorp & Idorn (1978) argued that Europe had wished to recreate the pre-war *status quo* - including the relationship between academia and industry, which had largely resulted in two separate cultures once more, this had been exacerbated by the political and social unrest of the 1960s The few remaining examples of strong university-industry relationships (*eg* chemical industry, instrument technology) were seen as unusual and highly industry-specific (Eastwood, 1969). Similar assumptions were made with regard to other countries, too it was claimed that outward technology transfer from universities in Canada and Australia was slow, deficient, below expectation and therefore disappointing and this, too, was due in part at least to the state of university-industry relations (Declercq, 1979) In Britain, though, it was the universities rather than industry which received the lion's share of the blame on account of the supposedly anti-industrial culture of their courses and research programmes (Williams, 1985b)

The period 1982-86 saw the publication in Britain of several reports which concentrated on the relationship between HEIs and industry and the industrial relevance of public sector research science The Merrison Report (ABRC & UGC, 1982) urged universities to make their relationship with industry more of a priority in view of the cuts imposed by the UGC A report commissioned by the Prime Minister (ACARD/ABRC, 1983) reviewed the effectiveness of research links between industry and HEIs and constraints upon them, it

recommended, among other things, that the Department of Industry should set aside a minimum annual sum over the following five years to be used for projects proposed by HEIs which would contribute significantly to the infrastructure for university-industry co-operation, and that the SERC should establish a national database of HEI research capabilities The Muir Wood Report (ACARD/ABRC, 1983) argued for the balance between basic and applied research in universities to be shifted more in favour of applied research, the concept of "strategic" research was reintroduced - and universities were directed to obtain strategic research funding from industry The Reece Report (ACARD, 1986) took this concept one stage further; UK universities were not only expected to do strategic research, they were also expected to think in a far more market-oriented way about the outcome of strategic research (Webster, 1988) In 1987 the White Paper "Higher Education. Meeting the Challenge" (Cmnd 114) stated that the aims and purposes of higher education should be to "serve the economy more effectively, to pursue basic scientific research to have closer links with industry and commerce, and to promote enterprise". Mattison (1987) reported that similar statements were being made by the governments of other EC countries

Industry has not been universally in favour of this emphasis on applied research; the head of research at GEC, for instance, giving evidence on the science budget to the Education, Science and Arts Committee of the House of Commons in 1984, queried the wisdom of universities being pushed into doing more and more applied research or even development "of the kind that ought to take place primarily within industry" (Williams, 1985b) Two years later the Mathias Report (ABRC, 1986) questioned the extent to which intellectual and financial collaboration between universities and industry should be taken, lest academic and scientific standards be compromised (Webster, 1988)

It is not at all clear whether the assumptions made in these reports concerning universities' potential to contribute significantly to economic growth rest on a sound theoretical basis. There has been a long-standing debate about the principal organisational sources of technological advance Some studies purport to show that universities, specifically, have played a key role For instance, a study of important advances in clinical medicine from 1940-75 found that basic research conducted largely in universities or government laboratories contributed to more than 60 per cent of the new knowledge that made these advances possible (Comroe & Dripps, 1976). A review of leading technological breakthroughs from 1950-73 suggested that the critical patents involved relied increasingly on basic research undertaken in universities, from 1962 onwards, over half of all citations in patent applications referred to knowledge produced through work performed in universities (National Science Foundation, 1974) It has been claimed that citation research findings demonstrate that academic research in Britain is a major source of patents taken out by foreign manufacturing firms and that British industry is simply failing to capture the full benefit of the country's advanced science base (Sheen, 1992) University research was judged to have been important in the development of chemistry, solid-state physics, aerodynamics, computer sciences, econometrics, agriculture, aspects of engineering, medicine and biotechnology (Omenn, 1982; Sun, 1980) Mackenzie, Cambrioso *et al* (1988) averred that the creation of monoclonal antibodies in a UK government research laboratory resulted within a few years in a Nobel Prize, the creation of some 150 companies in the US, at least 20 in the UK, a market value estimated at $300-500m by 1990 for *in vitro* diagnostic kits alone, or $900-1500m including *in vivo* kits, therapeutics *etc* Moreover, universities - or their staff - have often played a direct role in the commercialisation of biotechnology. Indeed, some commentators (Zegveld & Prakke, 1978, Bullock, 1983) have come to feel that universities were more important for their role as incubators of entrepreneurs than for their collaboration with existing companies.

Kenney (1986) claimed that the pervasive role of professors in managing and directing new companies founded to exploit biotechnology was unique in the annals of business history, judging by the results of Krimsky's 1984 survey of 20 per cent of biotechnology start-ups, which identified the involvement of 345 academics in these publicly held companies However, Kenney conceded that this may be atypical, since academics were not the driving force behind companies started to exploit advances in organic chemistry, electrical engineering, physics or computer science - though the achievements of Hewlett Packard, DEC, Sun *etc* - all spin-offs from US universities - would tend to make one question the inclusion of this last discipline Nonetheless, Kenney concedes that academics were involved in one way or another in the exploitation of these areas - and Freeman (1987) argued that those new technologies which are exploited by SMEs with strong links to universities are the key technologies for the regeneration of industrial capitalism as it begins a new longwave of growth.

Some researchers have been sceptical about claims regarding the relative contributions made by universities to technological advance - whether those claims are general or industry-specific Project Hindsight was the first attempt to trace technological advances back to their origins, within the 20-year horizon adopted, this transpired to be a relatively unproductive exercise (Sherwin & Isenson, 1967, quoted in Allen, 1977). Project TRACES attempted a similar analysis over a larger time frame and was marginally more productive (Allen, 1977) Langrish (1971) traced 84 British award-winning inventions back to their origins, differentiating between universities, government laboratories and industry; he found that the role of the university as a source of innovation was quite small. Gibbons & Johnston (1974) tried to refute this, but Allen (1977) argued that their evidence was not compelling, since time-lags of 14-15 years were involved where scientific information was used and such information represented only one sixth of the

necessary information. Pavitt's (1984) analysis of two thousand significant innovations made in Britain between 1945 and 1979 conceded, however, that only about 7 per cent of the knowledge inputs came from public sector research science - *ie* from government laboratories, higher education institutions or research associations combined Pavitt conceded however, that the data probably underestimate the contribution made by public sector research science to person-embodied knowledge and essential background knowledge, due to problems of definition and time-scale It is precisely because of such problems that some commentators argue that claims in respect of the contribution made by any organisational type are suspect. Other commentators take this a stage further, rejecting the practice of categorising scientific or technological breakthroughs by organisational type on the grounds that all breakthroughs build on previous knowledge and should not be compartmentalised in this way

Clearly, given the ongoing debate, it is not possible at present to resolve the question of whether policy-makers' assumptions rest on a sound theoretical basis

1.3.5 Mechanisms Employed to Harness Public Sector Research Science

This sub-section will review some of the mechanisms employed in the attempt to harness public sector research science in the service of technological change, and hence economic growth The tendency for UK policy-makers to try to transplant policies formulated in other mission-oriented countries has already been noted It will become clear that this tendency extends to individual mechanisms, too - primarily from the US, though recently there have been attempts to import mechanisms from Germany Since there are by now literally thousands of such mechanisms, they will be considered under the following broad headings·

* funding mechanisms,
* the organisation of research,
* changing research objectives,
* other mechanisms to bridge the university-industry divide;
* measures designed to encourage universities themselves (and/or individual members of their staff) to take responsibility for the commercial exploitation of research findings, where appropriate

In view of the number of mechanisms, sub-section 1 3 5 will be highly selective, no attempt will be made to be comprehensive Nor will sub-section 1 3 5 attempt to gauge the relative success of the mechanisms detailed - partly because, as Joyce & Woods (1986) observed, no systematic studies have been done This, in turn, is partly due to the fact that the available data - incorporated in reviews such as those undertaken by the OECD and the OTA - are difficult to aggregate due to differeing degrees of analytical range and depth (Webster & Etzkowitz, 1991). The objective of this sub-section is simply to place the events of 14 May, 1985 in a meaningful context

(i) Funding Mechanisms, the Organisation of Research, Research Objectives

Since these three mechanisms are intimately bound up with each other, they will be reviewed together As indicated in sub-section 1 3 4, in the wake of the second world war efforts were made in the US to maintain the momentum which it was felt had been established during the war (Price, 1968) In the aftermath of the second world war the primary mechanism for harnessing public sector research science was quite simply funding for basic science - in both non-academic and academic contexts [1] The National Science Foundation (NSF) was set up in 1950 specifically to disburse federal funding to individual academic scientists and individual laboratories to assist them to expand the country's

scientific knowledge (Page, 1968) This was done on a project basis, with projects scientifically evaluated by the process of peer review, since this was the only way that private universities could be persuaded to accept federal funding [2]. The government appeared to accept the view that "the pursuit of science by independent, self-co-ordinated initiatives assures the most efficient possible organisation of science" (Polyani (1962), quoted in Ruscio (1984)) Federal funding for basic research was also made available to universities by federal government agencies and departments [3] - and on a far greater scale than by the NSF; in 1972, for instance, the NSF supported less than 10 per cent of all federally supported research in universities (Brooks, 1973) By this means and others, the US soon became unique in the extent to which it supported research though grants to universities [4] Private universities as well as public universities in the US soon became increasingly dependent on federal funding

A similar though more parsimonious approach was taken in Britain after the war Funding for (basic) research in universities was disbursed via the dual support system, that is to say, partly through the University Grants Committee (UGC) and partly through the Research Councils Funding was disbursed by the UGC on an institutional basis. Until the 1980s, when formula funding was introduced, the UGC employed unspecified criteria to determine the level of funding for each individual institution Funding was disbursed by the Research Councils on the basis of unsolicited projects evaluated in terms of scientific merit and (supposedly) national importance by the peer review process This system has been described as tacitly supporting a heterogeneous society with diverse and shifting goals which is incapable of hewing to a larger national purpose, institutional grants for specific purposes would be more appropriate for articulated national goals (Price, 1968) In Price's view, the institution-based funding disbursed by the UGC did not overcome this problem since each institution was free to use it as it saw fit and was not called to

account; cynics have suggested that research funding was often used for non-research purposes such as resurfacing the car park

In 1955 the Ford Foundation made the first attempt to strengthen institutions in the US, rather than individual scientists and their laboratories, it is said to have taken US universities five years to accept the institutional judgements implied in the Ford Foundation's Challenge Grant Programme (Page, 1968, Price, 1968) By 1960, however, the federal government had also become preoccupied with quality The concept of "centres of excellence" was introduced [5] and it was recommended that existing "centres of excellence" should be doubled in number over the following 15 years These recommendations were implemented by the NSF through its Science Development Programme (Page, 1968) The US concept of "centres of excellence" was taken up by the OECD shortly afterwards (OECD, 1966) The OECD recommended that efforts should be made to pursue similar tactics in Europe [6] There is no evidence that this happened to a significant degree, or certainly not on a supranational basis Oddly, it was twenty years or so before the Department of Trade & Industry (DTI) picked up the concept and established Britain's first centre of excellence [7] In 1988, the concept was taken up by the Department of Education & Science (DES) and repackaged as interdisciplinary research centres (IRCs), funded through the SERC [8]

As a result of US policy-makers beginning to focus their attention on applied science, the NSF's charter was amended in 1968 to allow it to support applied research and it duly established the RANN (Research Applied to National Needs) Programme. This supported problem-oriented, multi-disciplinary research related to domestic needs, rather than single-discipline, science-oriented research, and aimed to promote close co-operation between academic, government and industrial research (Brooks, 1973, Greenberg, 1971, Price,

1978) In Britain in 1970 the SRC began to adopt a policy of "selectivity and concentration" *vis-a-vis* the science which it funded, while in 1977 it instituted a formal scheme of "specially promoted programmes" in designated areas (*eg* robotics, instrumentation), thereby reducing support for unsolicited grant applications to 40 per cent of the total available Williams (1985b) observed that by doing this the SERC (formerly the SRC) had effectively accepted the criticism that hitherto universities had been too preoccupied with the challenges arising from unsolved problems of pure science and not concerned enough about applied research, design and development The SERC then created its Engineering Board, to allow it to begin to act as a customer for research in the manner that the Rothschild Report propounded (Catterall, 1984). The Engineering Board identified programme areas which reflected industry's interests and needs, on the basis that this should lead to a greater chance of technology transfer taking place once research results were available

During the late 1970s and 1980s there was a concerted effort to stimulate university-industry relationships in Britain through the introduction of collaborative funding opportunities Literally dozens of collaborative funding opportunities were introduced during this period by a variety of funding agencies, both on a national [9] and an EC basis [10]. The rationale behind these collaborative funding schemes was not only to identify common research interests, but to increase the likelihood that research results would be used by the industrial partners to the country's technological and hence economic advantage

Collaborative research between universities and industry had been initiated on an experimental basis in the US but was slow to take off - particularly collaborative research which involved consortia of companies and universities - due to concern about anti-trust

laws designed to discourage cartels in the US However, after the Justice Department published "Antitrust Guide Concerning Research Joint Ventures" in 1980, highlighting the potential illegality of joint research ventures between universities and industry (ACARD/ABRC, 1983), the federal government was persuaded to ease anti-trust restrictions on collaborative R&D (Rogers, 1986) The Economic Recovery Tax Act of 1981 introduced changes in fiscal policy with respect to extra-mural expenditure on research and development, shorter depreciation periods for research instrumentation and equipment were also permitted (ACARD/ABRC, 1983) In fact, the US Congress is said to have introduced over 100 bills since the 1970s to facilitate technological innovation (Des Forges, 1986) During the 1970s the NSF ran three principal schemes to foster collaborative research between universities and industry the University-Industry Co-operative Research Centers Experiments, the Co-operative Research Centre Programme and the Small Business Innovation Research Programme, targetted specifically on small and medium-sized enterprises (SMEs) - *ie* upto 500 employees (ACARD/ABRC, 1983)

(ii) Other Mechanisms to Bridge the University-Industry Divide

A wide range of other mechanisms was introduced during the 1970s and 1980s to bridge the perceived university-industry divide Some sought to create an interface of one sort or another between university and industry, while others sought to stimulate understanding of industry by universities and *vice versa* Others again sought to create relatively permanent structures within which collaborative research could be undertaken, funded from a variety of sources. Some sought to create intermediate organisations, some with a general or subject-specific technology transfer remit, others, more recently, with an innovation remit Others sought to encourage the physical proximity of university and industry on a more permanent basis (This categorisation is an *ad hoc* one, made purely for the sake of clarity, it should be noted that some mechanisms do not fall neatly into any of these

categories, while others overlap a number of categories)

Interfaces

The first attempts to create interfaces between universities and industry were not, in fact, made by governments, but by enlightened individuals in the private sector and by isolated universities themselves [11]. In 1948, though, as we have seen, the UK government created the NRDC to provide a highly specific type of interface between HEIs and industry - *ie* to act as a public sector, free-standing invention broker. This contrasted with the approach of the US federal government, which tried to achieve the same objective in a less centralised way, the federal government departments agencies which funded the research were themselves held responsible for finding licensees This was often attempted through the National Technical Information Service (Reimers, 1980) and resulted in around 95 per cent of patents not being exploited, a figure which compared miserably with the 30-50 per cent which US universities themselves managed to license, where they held title (Fornell, 1975, Reimers, 1980) The UK approach was adopted by the Japanese government, however, which founded the Japan Research Development Corporation in 1967 to promote technology transfer from universities to industry (Cutler, 1989) A similar organisation - ANVAR - was founded in France in 1968, though the use of ANVAR by academics was voluntary and it shared royalties exclusively with the inventors, not with their university (Reimers, 1980) In the late 1970s and 1980s public and private sector brokers began to proliferate in the UK, some concentrating exclusively on products and processes, others having a wider remit [12]. When it rescinded the BTG's monopoly the UK government stressed that it wished to see competitors to the BTG develop, by 1988 there were said to be around 800 rival technology brokers at work in the UK (Webster, 1988). Some worked on a hands-on, person-to-person basis, while others adopted a more detached approach - like, for example, Longman Cartermill which established the British Expertise in Science

& Technology (BEST) database and "Innovation", a quarterly technology directory (McKenzie & Rhys-Jones, 1985)

In the late 1960s the UK government first supported the establishment of a few within-university structures designed to interface with industry in a more general way [13] Funding was cut off unexpectedly in 1973, however (McKenzie & Rhys-Jones, 1985) and until 1992 no follow-up funding specifically for this purpose was made available to (the majority of) UK universities which had not received funding in the 1960s [14] Nonetheless, many UK universities managed to establish some kind of in-house industrial liaison structure in the intervening years - encouraged, from 1983 onwards, by the government's announcement that the costs entailed in providing the necessary infrastructure for collaboration with industry represented a proper use of an institution's Exchequer grant (McKenzie & Rhys-Jones, 1985) Within-university industrial liaision offices were also founded in some European countries - some in the 1960s, some somewhat later [15] Recently, the trend in both the UK and Europe has been for universities to create what TII has called "external" structures, that is to say legally independent technology transfer organisations over which the parent universities exercise an element of control through a majority share-holding or appropriate clauses in the articles of association (TII, 1990) Free-standing university-industry/industry-industry interfaces of a more general nature have been founded in the UK [16] and in Europe during the 1980s, too

Promoting Contact and Understanding

Some of the mechanisms designed to stimulate contact and understanding of industry by universities and *vice versa* were purely temporary arrangements such as the appointment of industrialists to honorary or "visiting" positions in universities, industrially-funded lectureships and Chairs, industrial fellowships [17] and studentships (see [9]) Here, the

emphasis was often on a high turnover of people, since it was increasingly understood that the most effective technology transfer mechanism was the movement of people (Burns & Stalker, 1969)

Semi-Permanent Structures for Collaboration

In the 1970s the focus in the US shifted towards asking how science could best be interpreted and repackaged to stimulate technological innovation (Brooks, 1973) From 1973 the NSF started to award five year pump-priming grants to research centres founded by a university or a consortium of universities and industry to undertake co-operative research, these were known as Innovation Centres [18] (Kenney, 1986) It is not clear how these more permanent frameworks for the conduct of co-operative research were not felt to clash with the anti-trust laws of the US In Europe, however, as DesForges (1986) observed, the competition laws of the Treaty of Rome did not seem to preclude co-operative, pre-competitive research In Britain the Wolfson Foundation had initiated a similar programme to the NSF's Innovation Centres [19] During the 1970s and 1980s many institutes/centres/units were established at UK universities to do industrial contract research in their own specific areas, similar arrangements were made in Europe, too, either on the initiative of universities themselves or governments [20] General [21] and subject-specific [22] technology transfer institutes/centres/units were also created in Europe and the US - designed to reactively transfer technology arising in universities and government laboratories .

Building Intermediate Organisations

Recently, intermediate organisations with a more proactive remit have been proposed as a vehicle for technology transfer and innovation Based loosely on Germany's Fraunhofer Society Institutes, it is proposed to call these new organisations Faraday Centres (CEST,

1992). There is an ongoing debate about where they should be located and how they should be funded

Permanent Proximity

The principle mechanism to encourage the physical proximity of university and industry on a more permanent basis has undoubtedly been the science/research park. The first such research park was founded by Stanford University in 1951 Observation of its impact on local industry led to the concept being widely adopted in the US By the mid-1980s some states in the US had set up campus-linked research/science parks on their own initiative, rather than on the initiative of the universities concerned (Babbitt, 1984). Science/research parks have differed in their principal objectives Some have been dismissed as glamorous real-estate projects, others have actively sought to attract branches of large, existing high technology companies, many have concentrated on stimulating new, high technology firms to locate in their premises - particularly since the publication of the so-called Birch Report (Birch, 1978), which, as we have seen, identified small firms as those with the greatest job creation potential Some have also established incubator facilities (Watson, 1987) with a view to providing special assistance for new technology-based firms

In 1980 the UK government amended the Development Land Tax Act of 1976 in order to encourage the development of science parks in the UK by removing universities' liability for tax on such schemes In the following year the UK government introduced the Business Start-up and Business Expansion Schemes, which allowed tax relief on investments (upto a ceiling) on investments in new and expanding small firms - either through direct equity participation or by investing in general funds (Sharp, 1985) By 1986 the UK had 28 operational science parks (Rowe, 1987), many of which represented a co-operative venture between the public and private sector - and many of which were initiated

by universities themselves. Some parks (*eg* Warwick) borrowed the concept of the incubator unit from the US (Watson, 1987) in order to provide additional assistance for new technology-based firms Science/research parks have also been created adjacent to university campuses in many European countries, most notably Belgium (O'hEocha & Watson, 1984), Germany [23] (Allesch, 1987), but apparently less so in Italy (Mattison, 1987).

(iii) Mechanisms and Measures to Encourage Universities or Their Staff to take Responsibility for the Commercial Exploitation of Research Findings

For many years there was an implicit assumption on the part of policy-makers in both the US and the UK that scientific advances might be made in universities, but development of those advances would be undertaken by someone else, not by the universities themselves or members of their staff. In the mid-1960s the UK government flirted briefly with the idea of funding academics to do development work in-house in order to make their research discoveries more attractive to industry [24]; similar schemes were established briefly in one or two European universities (Declercq, 1979), but these were exceptional.

As we can see, there was a similar, implicit assumption on the part of policy-makers that the commercial exploitation of scientific advances made in universities would be undertaken by someone else - despite evidence from the so-called "route 128 phenomenon" in Massachussetts that this need not necessarily be the case This view began to change in the early 1970s in the US In 1973, when the NSF experimentally funded innovation centres, training funds were provided as well as research funds, innovators - including academics - were offered entrepreneurship training (Colton & Udell, 1976). (A review of the literature on entrepreneurial education (Cachon, 1987) suggests that this must be one of the few occasions when academics - as opposed to

students or post-experience employees in industry and commerce - were offered entrepreneurship training, though in the context of the UK Manchester Business School has recently run short courses in entrepreneurship specifically for academics)

Given that federal government agencies tended to retain ownership of IP arising in the course of federally-funded research (though as we shall see in chapter 2, some attempted to persuade universities to take title), the potential for academics to entrepreneurially exploit IP with commercial potential was somewhat limited in the US where IP arising out of publicly-funded research was concerned Moreover, the licenses granted were almost invariably non-exclusive, which was not conducive to company start-up In 1980, however, the federal government enacted the Uniform Federal Patent Policy Act (DesForges, 1986), which vested ownership and exploitation rights arising out of federally-funded research in the universities where the IP was generated Wittingly or unwittingly, the US federal government was following in the footsteps of the Japanese government, which had taken the same step in 1978 (Cutler, 1989) There is no evidence to suggest that it was the federal government's intention specifically to stimulate "campus companies" through this Act, but there is little doubt that it did stimulate universities and their staff to entrepreneurially exploit research discoveries by means of university companies, joint ventures and independent academic spin-off companies - so much so that by the end of the 1980s the Small Business Administration Advocacy Task Group on Government Competition with Small Business felt it necessary to stimulate a dialogue between university representatives and small businesses to develop protocols to limit unfair competition Campus companies may not have been on the US federal government's agenda when it passed the Uniform Federal Patent Policy Act in 1980, but they were certainly one of the items on the UK government's agenda when it rescinded the BTG's right of first refusal and offered universities the opportunity to assume the rights and

responsibilities previously enjoyed by the BTG, as will be demonstrated in chapter 6.

It should be clear from this resume that we should not be surprised by the UK government's decision to rescind the BTG's so-called monopoly and offer the rights and responsibilities previously enjoyed by the BTG to universities themselves It was quite in keeping with the government's long-standing attempts to transplant not only policies but also mechanisms from the US to the UK On this occasion, it was done quite blatantly. The ACARD/ABRC report which called for the rescinding of the BTG's right of first refusal (ACARD/ABRC, 1983) described the Uniform Federal Patent Policy Act (1980) - also known as the Bayh-Dole Act - and the Small Business Innovation Development Act (1982) as "the two main steps of interest" with regard to improving research links between higher education and industry in the UK There is no doubt that we should view this mechanism as having key importance in relation to the exploitation of IP arising out of publicly-funded non-collaborative research Moreover, the very recent dismantling of the dual support system, which has led to the Research Councils being asked to disburse the research element of funding previously disbursed by the UGC/UFC, can only increase the importance of this more direct exploitation mechanism, since we can be more sure that the sums disbursed will be spent on research (or the research infrastructure) than was hitherto the case Furthermore, the government's and the Research Councils' requirement that universities should develop appropriate policies and procedures before assuming rights and responsibilities previously enjoyed by the BTG should, theoretically, improve the chances of university-funded or "unfunded" discoveries being exploited more effectively, too.

The problems inherent in transplanting policies and mechanisms without first evaluating how they are likely to be shaped by local interests and conditions have already been noted, as has the government's reluctance to fund assessments of their actual impact The

investigator's hope that this study will make a small contribution to the process of evaluating this particular mechanism has also been noted However, the investigator would wish to emphasise that this study focusses exclusively on one aspect of this new mechanism - *viz.* the policies and procedures put in place by UK universities as a prerequisite to being granted those rights and responsibilities - *ie* the context in which the mechanism is supposed to operate. The investigator makes no pretence at evaluating this mechanism *per se* This remains a fruitful topic for future research.

1.4 Aims of the Investigation

The two primary aims of this investigation are as follows

i) **to generate a body of data about the way(s) in which selected UK universities handled the exploitation of IP between 1970 and 1990;**

ii) **to use this body of data to assess - in relation to those same universities - the extent to which current policy and practice *vis-a-vis* the exploitation of IP accommodate the government's wishes, as outlined in the letter from the Chairman of the SERC and the statement issued by the Secretary of State for Education, both dated 14 May, 1985.**

This investigation also had a secondary aim, namely

iii) **to begin to develop theory in relation to the exploitation of IP in selected UK universities.**

There were reasons for choosing these particular aims, rather than any other The wish to generate a body of data about the way(s) in which selected UK universities have handled the exploitation of IP was motivated by the fact that this is an area which has not benefitted from study, let alone serious, comprehensive study. Thus, to generate a large body of data was felt to be intrinsically worthwhile Clearly, such a body of data also has extrinsic value, in so far as it is the means to achieving the second aim of this investigation. It could be argued that generating a body of data which relates to the past 20 years, rather than, say, the past five, is a little excessive However, it was felt that universities were unlikely to have formulated their current policy and practice purely in response to the letter from the Chairman of the SERC and the accompanying statement from the Secretary of State for Education It seemed more likely that universities' current policy and practice would be informed to a considerable degree by past policy and practice, by critical events, critical personalities, *etc etc* It was seen as important to establish whether this was, in fact, the case, and if so, what kind of impact these had - hence the 20 year time-frame

The second aim was motivated by concern about procedural aspects of the change-over from the conventional mechanism for the exploitation of IP arising from Research Council-funded projects to the new mechanism The statement issued by the Secretary of State made it clear that universities which were minded to assume the rights and responsibilities previously enjoyed by the BTG would be reviewed - assuming, that is, that their policies and procedures were deemed to pass muster in the first place A document circulated some months later indicated that in the first instance, universities wishing to assume those rights and responsibilities would be authorised for only three years During those three years, universities would be expected to submit annual reports, detailing patents, copyright and registered designs obtained, assignments and licenses granted, a

statement of expenditure on and income from the protection and sale of IP and any additional comments they might like to make [25]. The decision as to whether to extend individual universities' authorisation would be made in the light of the three year review, which would be based in large part on the content of these annual reports The investigator's concern centred on the fact that assessment of individual universities' performance seemed to rely entirely on output data - that is to say, patents/copyright/designs, assignments/licenses and income *versus* expenditure. There was no indication that input data - *eg* the disciplinary breakdown of each individual university, the number of Research Council grants awarded, the objectives of those Research Council grants *etc* - would be taken into account. Clearly, many of these data are at the disposal of the Research Councils, so their failure to take these data into account may be an unwarranted assumption Of greater concern was the absence of indications that the three-year review intended to take into account data relating to the process of generating, identifying, evaluation, protecting and exploiting IP It is some years since Moore (1975) pertinently observed

"*So much has been said and written about technology transfer that it has become a catch phrase With respect to universities, more attention seems to have been given to the broad overall concept than to its fine structure [ ] We must depart from the large picture and begin to identify those particular barriers in the pipeline obstructing the flow of research accomplishments into the stream of technology utilisation*"

It seemed that the Research Councils had no way of obtaining such process data - beyond, perhaps, reference to brief policy statements provided by each university prior to receiving authorisation and any comments volunteered in the annual reports Accordingly, it was felt that there was both intrinsic and extrinsic value in conducting an investigation on the most

micro level As a result, this study will focus on the many discrete steps entailed in the identification, evaluation, protection and exploitation of intellectual property generated in UK universities

The third and final aim - albeit a secondary aim - is a logical extension of the first Since UK universities' handling of the exploitation of IP has not been studied, there is not only no body of data relating to this subject, but there is also no theory relating to it

1.5 Structure of the Thesis

This thesis is in four volumes The first comprises chapters 1-8, while the second comprises chapters 9-13, these contain the thesis proper. As we have seen, the first chapter has identified the broad subject of investigation, the "researchable problem" - *ie* the new mechanism for the exploitation of IP arising out of Research Council-funded projects, introduced in May 1985 It has considered the theoretical rationale underpinning this new mechanism and the validity of that theoretical rationale. It has placed the new mechanism in context by outlining other mechanisms (preceding and ongoing) designed to harness public sector research science in the service of economic growth In so doing, it has shown that this new mechanism is of critical importance in relation to the exploitation of IP arising out of non-collaborative public funding Finally, chapter 1 has outlined the three aims of this investigation and explained why these particular aims were chosen

Chapters 2-4 present a review of the literature which was felt to be relevant to this investigation Specifically, chapter 2 reviews the literature dealing with the identification and protection of intellectual property, while chapter 3 concentrates on the literature relating to various exploitation routes and chapter 4 focusses on academic entrepreneurship. Taken together, these three chapters present a fairly lengthy literature

review The length is occasioned in part by the fact that the subject - the way(s) in which universities handle the exploitation of IP - cuts across numerous disciplines - *eg* intellectual property law, education, business, finance, entrepreneurship (It is worth noting at this juncture that, given the cross-disciplinary nature of the subject, the literature review is not written from any particular theoretical perspective) Comparisons between the UK, the US and Europe add to the length of the literature review, too International comparison was felt to be necessary in view of claims which are commonly made concerning the performance of UK universities when it comes to technology transfer. These range from more general claims (*eg* US universities transfer far more technology than UK universities) to more specific claims (*eg* the staff of UK universities are not as entrepreneurial as their counterparts in the US when it comes to exploiting their research findings) Despite the confidence with which some commentators assert that there are significant national differences, their assertions are usually based on anedcotal evidence We do not have comprehensive, comparable data concerning the relative "quantity" of technology transferred by universities in different countries - nor, indeed, data which would allow us to establish a rank order of preferred exploitation routes in any one country This is unimportant, unless we could relate preferred routes to operational factors, the rank order would be meaningless. Whether or not we have these kinds of comparable data, the question of operational differences from one country to the next is important, however. Accordingly, the literature review attempts to shed light on this, where possible. It is worth emphasising, though, that the main purpose of the literature review is to place this study in context and to inform the fieldwork for, as we shall see, the decision was taken to embark upon a grounded study, rather than a logico-deductive one.

Chapter 5 presents a critical analysis of sources of assistance which UK universities could draw upon in 1985 and the months which followed, if they were so minded, to help them formulate appropriate policies and procedures *vis-a-vis* the exploitation of IP, should they not already have done so. This is presented in a separate chapter because it proved impossible in the course of the literature review to identify much in the way of published material of this ilk relating to the UK As a result, the search for sources of assistance took on the character of fieldwork, rather than a literature review, effectively, it acted as a "prologue" to the main fieldwork.

Chapter 6 outlines why the decision was taken to conduct a grounded study, rather than a logico-deductive one; the operationalisation of the secondary aim of this investigation, *viz* to develop theory, is dealt with at the same time Further, chapter 6 details and justifies the choice of research design (case studies) and the manner in which the research design was implemented It also shows how the primary aims of the investigation were operationalised It concludes by evaluating both the chosen design and the manner of implementation, and by detailing any modifications which were required in practice

Chapters 7-11 are the substantive chapters of this thesis - that is to say, these are the chapters devoted to the data elicited in the course of the fieldwork Chapters 7-9 assess the extent to which current policy and practice, as described by policy-makers and policy-implementers in the universities selected, accommodate the government's wishes, as outlined in the letter from the Chairman of the SERC and the statement issued by the Secretary of State for Education on 14 May, 1985. More specifically, chapter 7 considers the extent to which the universities selected for study give the fullest opportunity and scope to researchers to assume responsibility for the exploitation of IP they have generated Chapter 8 considers the extent to which these universities encourage

researchers to assume responsibility for the exploitation of their IP, while chapter 9 considers the extent to which they provide guidance and help for those academics who wish to assume this responsibility In the interests of (relative) brevity, the data relevant to each of these three chapters are presented and analysed exclusively on a cross-case basis; this was, of course, preceded by a case-by-case analysis of the universities in question On the principle that "the proof of the pudding is in the eating", chapters 10 and 11 consider current policy and practice from the perspective of heads of department/deans and entrepreneurial academics respectively In both chapters the relevant data are presented and analysed on a case-by-case basis prior to the cross-case analysis This was felt to be more feasible with regard to these two chapters, since they focus on a sub-set of the universities selected for study in chapters 7-9, rather than all nine It is acknowledged that this decision has led to chapters 10 and 11 being rather more lengthy than the preceding chapters

Chapter 12 considers the extent to which the data and the analyses presented in chapters 7-11 lend themselves to the formulation of hypotheses - and whether, in turn, any hypotheses formulated suggest the development of embryonic substantive theory concerning policy and practice *vis-a-vis* the exploitation of IP in the universities selected for study.

Finally, chapter 13 considers whether the study's findings contradict, broadly support or illuminate earlier empirical findings and associated substantive theories It considers, too, whether drawing broad conclusions might be productive when it comes to developing substantive theory in relation to aspects of this investigation which were novel Chapter 13 also suggests fruitful topics for future research It concludes by detailing policy and related recommendations

The third volume of this thesis comprises Appendices A-D, while the fourth comprises Appendices E-J. **Appendix A** contains copies of (i) the letter from Sir John Kingman, Chairman of the SERC, dated 14 May, 1985, to vice-chancellors and principals; (ii) the statement issued by the Secretary of State for Education on the same date and (iii) sundry other documents of interest. **Appendix B** contains (i) a copy of the introductory letter sent by the investigator to the universities selected to participate in this study; (ii) a copy of the four structured questionnaires devised and used by the investigator during the initial interview with policy-makers, policy-implementers, heads of department/deans and entrepreneurial academics respectively, *viz* Questionnaire A, Questionnaire B, Questionnaire C and Questionnaire D **Appendix C** contains copies of the transcripts of two interviews, *viz* (i) an interview with a head of department/dean, (ii) an interview with an entrepreneurial academic In order to honour agreements made with the interviewees, these must be presented anonymously **Appendix D** contains all the **Figures** referred to in the first volume, in numerical order In the investigator's experience, it is easier to relate text to diagrams/graphs/tables if one does not have to constantly leaf backwards and forwards through the pages **Appendix E** contains all the footnotes, which run sequentially but are divided into individual chapters and case study narratives **Appendix F** contains the case study reports relating to each of the universities selected for study These are presented in the traditional, narrative form The narrative is interspersed with direct quotes, which are intended to be <u>illustrative</u>, since this study is not concerned with testing theory or hypotheses, these quotes are not offered as proof The narrative sets the scene by briefly detailing the university's "vital statistics". They present information relating to IP policy and practice in chronological order - that is to say, each case study report focusses initially on the 1970s and early 1980s before concentrating on the period following 1985. In each case study report the narrative is organised around common headings, to facilitate comparison However, for reasons outlined in chapter 6, four of the

case study reports present data elicited from heads of department/deans, while five do not. Regrettably, none of the case study reports presents data elicited from entrepreneurial academics, since it was felt that doing this in the most meaningful way (*ie* presenting the data in an integrated way in relation to each entrepreneur in succession, rather than on a collective basis) would be certain to jeopardise the anonymity of the informants, particularly in the smaller universities. **Appendix G** details the complex formulae employed by Hull University to govern the distribution of income from the exploitation of intellectual property **Appendix H** contains resumes of key points in UK intellectual property law **Appendix I** contains a glossary of acronyms **Appendix J** contains the primary bibliography, together with a list of further reading

Finally, the investigator would wish to draw the reader's attention to two points Firstly, to the fact that she has abandoned the bibliographic conventions "*op cit* " and "*ibid* " advisedly - on the grounds that they create more trouble than they are worth Accordingly, all references will be given in full on each occasion they are cited For similar reasons, all footnotes are detailed (chapter by chapter, case study by case study) in an appendix Secondly, with an eye to economy and style, the word "he" is employed throughout as short for either "she" or "he", likewise, "his" is short for either "her" or "his".

CHAPTER 2

2 LITERATURE REVIEW, PART 1: IDENTIFICATION AND PROTECTION OF INTELLECTUAL PROPERTY

2.1 Introduction

Before scientific discoveries can be commercially exploited, their commercial potential must obviously be identified by somebody, that potential should ideally be evaluated and often the discovery in question needs to be "protected" in some way. It is generally accepted that in many industrial sectors scientific discoveries stand a much better chance of being commercially exploited if they acquire the status of a commodity which can be purchased, perhaps on a monopoly basis, in exchange for value (von Hippel (1982), quoted in Parkes (1984)). Logically, it makes sense for this literature review to begin at the beginning of the exploitation process - *ie.* by focussing on the identification of intellectual property (IP). However, for reasons which will become clear in due course it is more appropriate to focus first on the protection of IP. The literature relating to the identification of IP, such as it is, will therefore be reviewed at the end of this chapter.

2.2 The Protection of Intellectual Property

2.2.1 Introduction

The protection of intellectual property is a complex subject, since intellectual property can be manifested in a variety of ways, some formally protectable, others not formally protectable. Moreover, different types of intellectual property require different types of protection, and some types of intellectual property can be formally protected in more than one way. A description of the different types of intellectual property can be found in Appendix H, together with details of how

certain types can be formally protected. For the purposes of this literature review readers need know only that the key forms of formal protection are copyright, design right, patent and secret know-how.

The literature on the protection of IP is concerned principally with patenting - probably because it is the most expensive form of protection and the prerequisites of patent law are the most demanding. Thus, the bulk of this section will be devoted to a review of patenting, as it relates to universities and/or members of their staff. No literature at all was identified on the subject of copyright or designs, as they relate to universities and/or members of their staff. However, a short sub-section will review what little literature was identifiable on the subject of secret know-how, and how it relates to universities and/or members of their staff.

2.2.2 Secret Know-How

It is extremely difficult to assess universities' practices with regard to secret know-how. Universities have traditionally regarded secrecy as inimical to the academic ethos [1]. The issue was sufficiently controversial that in the early 1980s many US universities had deliberately neglected to formulate policies relating to the ownership and exploitation of non-patentable discoveries (Hooker, 1983). Since secret know-how can have greater commercial value than patented IP (Holdom, 1987), it is not surprising that in the absence of formal policies, secret know-how has been passed from universities to commercial organisations, often without the knowledge of fellow researchers or the university itself - and without recompense to either; it would appear that this is sometimes due to lack of caution and

sometimes knowingly (Etzkowitz, 1983).

In some cases, the literature indicates that universities/academics have explicitly opted to exploit research discoveries via secret know-how rather than patenting. A survey conducted at a Swedish technical university reveals that whereas only 30 out of the 100 laboratories had filed a patent application, 40 had generated a spin-off company to exploit research discoveries (McQueen & Wallmark, 1982b). Secret know-how may be less of a contentious issue in Europe than in it is the US.

2.2.3 Patents

Intellectual Property Law as Applied to Academics: An International Comparison

Although laws relating to ownership and exploitation rights of employees' inventions have become increasingly uniform in developed countries since the end of the war (Phillips, 1981), and ongoing discussions with regard to the General Agreement on Trade and Tariffs (GATT) aim to increase that uniformity [2], there is nonetheless considerable variation internationally in the applicability of these laws to employees - and to university employees in particular.

In the UK the traditions of the domestic master-servant relationship influenced the development of rules governing rights in employee inventions. Later, socio-economic changes brought about by the industrial revolution led to the employment relationship being interpreted in contractual terms - *ie.* in contract law. The 1977 Patent Act codified ownership irrespective of whether the invention was patentable or not. Significantly, ownership was made a superior qualification

to devisor in patent applications and the ownership test was made applicable to every UK employee who makes an invention. An invention belongs to the employer if it was made in the course of the employee's "normal duties" or duties "specifically assigned" in circumstances where an invention might reasonably be expected, or by an employee whose duties place him/her under a special obligation to further the interests of his/her employer's undertaking. All other inventions belong to the employee (Saxby, 1981). Crespi (1982) pointed out, however, that it is not clear how - or even whether - the principle should be applied to university workers, in particular. Doubts have been expressed about the correctness of equating the relationship between the university and academics who undertake research with the traditional employer/employee relationship in industry. It is felt that there is, in fact, no strict, legalistic answer to this question.

In France the laws relating to employee inventions specifically include university academics and are similar to UK law. Inventions which arise out of a permanent mission (which does not need to be specified in detail) are "commissioned inventions", to which the employer has rights of ownership. In exchange, the employee must be given fair compensation for the invention. The level of compensation takes account of the relative contributions of both parties and the commercial and industrial uses of the invention. These are evaluated on the day that rights to the invention are attributed and can be grossly unfair to the employee if previously unconsidered uses are found (Le Stanc, 1981). In the recent past, this requirement has undoubtedly made some French universities' reluctant to file patent applications. In fact, Declercq (1979) reported that uncertainty over the

division of intellectual property rights between academic and university was deterring the majority of European universities from routinely taking out patents. This can make it difficult to exploit research discoveries, since under French law, for example, nobody can have right of ownership over technical knowledge which has not been registered at the patent office (Le Stanc, 1981).

In several European countries academics are explicitly excluded from the laws relating to employee inventions. In the former West Germany, for example, academics' inventions are by definition "free inventions" rather than "service inventions", even though the German constitution indicates that academics are expected to perform research as part of their job specification (Ruete, 1981). Unlike their counterparts in industry and the rest of the public sector, West German academics are not obliged to tell their employers they had invented something, nor to offer their employers a non-exclusive license. This is said to account for the low number of patents reportedly held by German universities - and inevitably limits universities' ability to control the commercial exploitation of research findings. However, German university policy usually dictates that academics are obliged to share the income from exploiting the invention if they used university resources in developing it. Moreover, German universities can obtain title where untenured scientists are concerned, provided they undertake to patent and/or license the invention and to give a share of the proceeds to the inventor(s) (Reimers, 1980). The literature does not yet reveal whether any changes have been made as a result of the unification of West and East Germany. In Sweden and Norway, too, university teachers are explicitly excluded from the

regulations relating to employee inventions. Under Swedish law, university inventors own the resulting intellectual property (Rausing, 1981). The law appears to be much the same in Denmark (Reimers, 1980).

The US is one of the few highly industrialised nations in which employers still have virtually unlimited rights to acquire the rights to inventions made by their employees. Employee-inventors have no protection in federal law and challenging their employer entails raising a court action as plaintiff. By implication, academics are subject to the same conditions (Orkin, 1981), but in some states the law deals more specifically with academics - in quite contrasting ways. During the 1960s, for example, state law required academics at the University of Florida to seek patents on their work via the university, even if their discoveries were made without using university personnel, facilities or time and were unrelated to their duties as university employees. In Wisconsin, in contrast, neither the state nor the university have right of ownership through contracts of employment to discoveries made by members of the academic staff (Omenn, 1982).

Universities which have no legal ownership and hence no exploitation rights over employees' research discoveries could abdicate all responsibility, or they could try nonetheless to encourage researchers to protect the resulting intellectual property or even to assign their rights to the university. The literature does not deal adequately with this: we find only passing references to American universities pressuring academics who are disinterested in patenting to assign their rights to the university (Omenn, 1982; Kenney, 1986), with no indication of whether this is

commonplace or not. It is not clear whether, in the face of such legal constraints, universities have devised other strategies to encourage the protection and exploitation of staff research discoveries [3]. There is evidence that Denmark has adopted a different approach, having established a non-profit, government-supported organisation - the Danish Invention Centre (DIC) - in 1972. The DIC incurs patenting costs at its own risk if academic (and non-academic) inventors approach it on a voluntary basis, returning between 10 and 20 per cent of the net exploitation income to the inventor. However, it would appear that universities/academics have not been a significant source of patents to date (Reimers, 1980).

In some cases, imaginative solutions to the problems imposed by legal constraints have been dreamt up and put into operation by third parties, with the co-operation of the university and its academic staff. The classic example is that of nine alumnae from the University of Wisconsin, who co-founded the Wisconsin Alumnae Research Foundation (WARF) in 1925, putting up $100 each. WARF represents the first instance of university-based scientific discoveries being exploited in an organised manner, chiefly through patenting and licensing. To this day, although WARF operates solely for the benefit of the university, the university has no legal rights to the intellectual property exploited by WARF and no faculty member, university administrator or regent sits on the WARF board (Jordan, 1975). It is worth noting, however, that WARF was founded with very specific objectives in the face of a very specific problem. The university regents had prohibited the university from accepting funding from the newly established

foundations, regarding Rockefeller's money as "tainted". This rule cost the university an estimated $740,000 before it was rescinded in 1930. Although WARF now claims its primary purpose is technology transfer out of the university community and into public use, and that money-making is incidental to that purpose (Bremer, 1975), WARF's founders were not motivated by technology transfer or boosting the local and national economy so much as by the desire to profit from research, to replace a prohibited source of funding - and between 1928 and 1982, it distributed over $100m to the university (Jordan, 1975). Part of this $100m came from investment in the common stocks of young, growing companies, complementing its royalty income (Reimers, 1980). However, WARF's undoubted success in exploiting IP assigned to it may be related to the fact that when it was founded, it already had the offer of of a valuable piece of IP to exploit (a synthetic form of vitamin D, which, it is worth noting, had first been synthesised in the UK at Liverpool University [4]). It may also be relevant to note that at that time the University of Wisconsin generated more science doctorates than any other university in the US (Omenn, 1982).

We have concentrated so far on legal constraints which prevent some universities from protecting the intellectual property resulting from their employees' research activities. In some countries there are also legal constraints which prevent employees from patenting their research discoveries, should their employer decide not to exercise their intellectual property rights. As Phillips (1981) observed, patent law is often designed to encourage exploitation of patents by employers, not employees. This represents a statement of probability about the position of

employers versus employees in economic and resource terms. It is also morally motivated, preventing employees from offering their discovery to a rival organisation. However, this often has the effect of freezing the inventor out of the decision-making process: the decision to patent or not to patent is dependent on the economic position of the employer. In Sweden and the former West Germany, the law has dealt with this contingency: if an employee discloses an invention to his employer, the employer is under a duty to patent it. (In Sweden and the former West Germany, of course, this law does not affect academics, in any case.) In the UK, in contrast, the employer has no duty to patent employees' inventions, nor to pay compensation if a patent is not taken out. Phillips argued that these differences in national policies are indicative of the level of concern for private interest as opposed to public interest.

In the UK, as we have seen, it is claimed that the 1977 Patent Act does apply to academics, who are thus dependent on universities acting upon CVCP recommendations that they should waive their rights if they do not propose to exercise them (CVCP, 1978). It is not clear whether in fact UK universities do routinely waive rights to intellectual property which they do not believe it is worth protecting, or whether they do this within a timescale which avoids jeopardising the academic's chance of protecting it. It is also unclear what would happen to a British academic who decided to apply for a patent in the absence of a formal waiver. In the past, this situation has occasioned lengthy court cases in the US [5] (Omenn, 1982).

Attitudinal Considerations

Unlike other forms of property ownership, intellectual property is not an end in itself, but the means to social policy (Evenson & Putnam, 1987). In the US the founding fathers incorporated intellectual property laws into the Constitution, following the precedent created by the common law of monopolies, applied to inventions in England from 1623. The objective then, as now, was to stimulate the dissemination of knowledge and the rate of technological change by rewarding inventors when their invention is exploited commercially (Kintner & Lahr, 1975; Phillips, 1981). The patent system is the tool which most nations employ to achieve this objective. The theory is that the disclosure requirement not only contributes to what has been described as one of the largest published bodies of knowledge in existence (Ditzel, 1975a), but is designed to stimulate both follow-on and derivative invention (Evenson & Putnam, 1987). This is believed to offset the effects of granting a limited monopoly (Evenson, 1984).

In fact, the validity of this theory remains to be established, since economists have neglected to research either the value of disclosed information as a stimulus to follow-on invention or the inherent ease or difficulty of inventing around patents (Evenson & Putnam, 1987). There appears to be justification for scepticism about the true value of the disclosure requirement. The art of writing patents has been described as saying as much as possible and as little as possible at the same time (Quinn, 1986b). Moreover, patent agents routinely establish the broadest possible claim regarding an invention, precisely to prevent rivals from getting around the patent by doing the same thing in a different way (Comerford, 1987). It has also

been suggested that although the patent register represents one of the largest published bodies of knowledge in existence, it is under-utilised; as a result it is not unusual for a company to discover that its latest research discoveries cannot be patented because of "prior art" - indeed, there have been instances of companies discovering that they themselves had been granted patents for the same basic discoveries several decades earlier [6]. Moreover, the cost of searching patent databases may also deter small companies and academics from making use of this resource.

In the mid-1970s it was observed that only a small fraction of inventions generated in American universities had been patented (Ditzel, 1975a). Some commentators attributed this to the fact that by the end of the 1960s federal agencies were funding an unprecedented proportion of the nation's research effort - and routinely retaining title to resulting patents (Bok, 1982). Others claimed that this is a mistaken interpretation, that, in fact, federal funding agencies had long tried to encourage the development of institutional patent agreements [7], without a great deal of success (Omenn, 1982). Figures suggest that by the early 1980s US universities and non-profit organisations had obtained patents on just 1,000 discoveries resulting from National Institutes of Health (NIH) funded work over a period of 20 years (Wyngaarden, 1983). This low take-up rate was common, irrespective of the funding agency, with the result that most discoveries were patented by the federal government (Fornell, 1975).

Ditzel (1975a) attributed this state of affairs to "negative perceptions" of the patent system. In his view, universities saw the patent system as promoting short-term profit measured in dollars, achieved through proprietorial and monopolistic control. This was felt to be incompatible with the kind of profit which universities should be seeking: profit which matured over decades and was measured in non-monetary terms. This may explain why, in practice, many private universities in the US chose to interpret the law relating to rights to employees' inventions considerably more liberally than industry (Orkin, 1981). In the past, it would appear, many US universities waived their patent rights in favour of their employees (Owens, 1975b), giving up not only legal ownership of their intellectual property but also the income which might be derived from exploiting it. Woessner & Terry (1988) cite examples of this happening as late as 1982, but doubt that this would happen today. The 1990 President of the Society of University Patent Administrators (recently renamed the Association of University Technology Managers (T'Squared, 1989) believes the relatively liberal approach to income-sharing which still prevails may also be due to the fact that universities do not think of academics as employees in the corporate sense of the word [8].

Ditzel advocated that universities should adopt a more sophisticated approach to the patent system, using it to achieve the objective for which it was created, even though industry may use it out of "more base" motives. At the time that he was writing, a few prominent, private universities in the US had already adopted an active patenting policy. In some cases, this represented a considerable *volte-face*, especially where health care research was concerned [9] (Wade, 1984). (Moreover,

this *volte-face* was at odds with the approach of some fairly influential institutions at the time [10].) There is evidence to suggest that the major US research universities have now overcome qualms they may have had in the past. In 1976, for instance, it was estimated that about 230 patents were issued to US universities; by 1986 the figure had risen to about 700 and by 1987 it had leapt to around 900 [11]. In Europe academics seem to have increased the rate at which they disclose patentable inventions. A survey of academics conducted at UMIST in the early 1970s found that the pure and applied science departments generated an average of 86 inventions per year, or one per 18 staff members [12] (Norris, 197?). A similar study at Imperial College established a rate of one per 20 staff (Launder & Webster, 1969). These figures are reportedly equivalent to around two inventions per academic career. McQueen & Wallmark (1982b) report that patent activity at a Swedish technical university has increased steadily over the previous 15 years, despite the fact that numbers of university staff were reduced considerably during the 1970s, following the expansion of the 1960s [13]. They attribute this to academic staff having a more positive attitude towards patenting; possibly European academics have not been confronted by the down-side of patenting in quite the same manner as their colleagues in the US.

In recent years, too, many US universities have introduced royalty-sharing schemes on patents held by university staff, apparently motivated more by the desire to generate an income than by the desire to belatedly exercise their legal rights. (In fact, US universities which hold patents arising out of discoveries made in the course of federally-funded research must share the royalties with the

inventors (Woessner & Terry, 1988).) This gives academic scientists and engineers considerable financial advantage over their *confreres* in industry, for American companies have no statutory obligation to compensate employees for their inventions, even if they generate a huge income (Phillips, 1981). This lack of incentives for employee inventors in industry has been implicated in the US' decline in innovation, indeed, Orkin (1981) regards it as a major causal factor. Anecdotal evidence suggests that many UK universities have also introduced royalty-sharing schemes, but it would appear to be the University Directors of Industrial Liaison (UDIL) - the umbrella organisation for ILOs from UK universities - which made the first attempt at a comprehensive survey of UK university practices (UDIL, 1988); UDIL's findings will be discussed in detail in chapter 8.

It is not at all clear whether financial incentives such as these do actually influence academics to "flag" and to patent IP or ensure that their university patents it. However, a recent OECD survey revealed that universities have come a long way since their original position on patents 10-20 years ago. Beier, Crespi & Straus (1985) reported: "At that time universities scientists were [either] unaware of the patent system [or] in some cases strongly hostile to the idea, particularly in medical fields, where financial rewards accruing from patents and legal restrictions on the exploitation of discoveries were considered immoral. [...] Today there is a wide spectrum of different and still evolving attitudes. At one end hostility against patenting can still be found among university scientists. [...] At the other end research scientists in the US have been astute to patent biotechnology discoveries

and their eagerness to do so has affected the internal life of their universities and led to intense legal and moral debates. Some faculty members and university administrators have been concerned that conflicts of interest would arise of the pursuit of research and industrial exploitation were not clearly kept apart, which is almost a reversal of attitudes, back to earlier, more restrained positions." The same OECD survey established positive attitudes to patenting on the part of university scientists in Denmark, Norway and Switzerland, too. However, it revealed that US academics were relatively well-informed about patent law, chiefly because so many US universities have full-time patent attorneys on their staff. In Holland, France and the UK, in contrast, patent awareness was not only very low, but academics also perceived it to be a field of "extraordinary complexity", which the information activities of existing bodies were unable to overcome. Europe, the report concluded, should possibly take a leaf out of the US Research Corporation's patent awareness programme of 1973/74, a highly successful 3-year programme co-sponsored by the NSF (Marcy, 1975).

The fact that universities in the US appear to have adopted a more positive stance towards patenting some years before European universities may be partly due to the fact that the patent system in north America imposes far fewer constraints on academics than the European Patent Convention. This is because it incorporates a substantial "grace period". In the US patents may be applied for upto one year after discoveries have been published in open literature - and even after they have been commercially exploited. For many years Canada had a 2-year "grace period", though recently there have been moves to reduce this to 12 or even 6 months

(Beier, Crespi & Straus, 1985). Signatories to the 1973 European Patent Convention gave up the "grace period" which had existed prior to this date (Dickson, 1985), with the result that in Europe academics may not disclose their research findings in virtually any shape or form without jeopardising their intellectual property rights [14]. The World Intellectual Property Organisation (WIPO), the United Nations body responsible for administering a number of international patent treaties, including the Paris convention of 1883 which provides the basic framework for the international patent law, is reportedly campaigning for the reintroduction of a grace period (Dickson, 1985).

Until such time as the WIPO succeeds, the rules of the European Patent Convention and of commonwealth countries whose patent system is based on the UK's can act as a constraint on universities and academics. The optimum time for filing a patent application may not be the moment a discovery is made, but at a later date, strategically chosen to gain as much time as possible for testing and documentation before overseas applications are filed (Comerford, 1987). Generally, patent applications are filed at an intermediate stage in the process of transforming the knowledge output of research projects into applied outputs (Pakes & Griliches, 1984), but many patent agents recommend filing an application at the latest possible date (Williams, 1987). Studies conducted in industry in the US and West Germany suggest that the average lag between conception of an invention and filing a patent application is around 9 months, after extensive work has been done on refining both the concept and its embodiment (Scherer, 1984). Unless universities are prepared to risk filing premature - and thus weaker - patents, there

may be an even longer delay between conception of the idea and filing, unless industrial partners can be found, because universities are not geared to progressing commercial ideas and cannot compete with the timescale achieved by industry. (On the other hand, it may be much harder for universities to maintain secrecy than it is for industry to do so; for this reason, universities may inevitably find themselves filing premature patent applications.)

Some US universities have permitted short delays in publication to facilitate industrial collaborators or professional patenting/licensing organisations to check for patentable discoveries. These limits are generally in the region of 30 days, though University Genetics demands to see material to be published at least three months prior to the proposed publication date. During this period researchers are strictly forbidden to discuss their research with scientific colleagues (Kenney, 1986).

A survey conducted at the end of the 1960s established that 23 per cent of UK universities would not tolerate any delay in the publication of research findings, even in the interests of patent applications (CBI, 1970), but it is not at all clear that they would take the same line today. There is evidence that UK universities are now permitting considerably longer delays than universities in the US would countenance. In the UK, UDIL recommended that restriction on publication "... should rarely exceed one year and should only in the most exceptional cases exceed five years" (UDIL, 1988), a substantially different period - and one which would be quite unacceptable in many American universities.

Patenting has raised a number of other questions for universities. The most notable concerns whether the demands of the patent system conflict with and have a detrimental affect on the character and quality of academic work. Bok (1982) suggested that scientists may do work of little intellectual value or pursue lines of work beyond the point of maximum intellectual value, just to secure a patent, especially if over-zealous patent officers mistakenly believe this serves the university's purpose. In an attempt to test the validity of this assumption, one study used citation counts as a measure of the value of an academic's work and related these figures to the numbers of patents held. The study found that the rank correlation coefficient of faculty's patenting and publishing activities was large and significant (+0.45), indicating that high-quality academic research and patent activity go hand in hand (McQueen & Wallmark, 1982b). The authors stressed that this did not establish cause and effect, but it did suggest that there was not a detrimental relationship between patenting and this aspect of academic performance. Many commentators remain to be convinced, however, given the highly competitive character which patenting has introduced into some academic disciplines; they believe it has led to hasty experimental work and erroneous "solutions" (Wade, 1981; Norman, 1985c) - a view which the University of Utah's "cold fusion" claims have only served to reinforce (Begley, Hurt & Murr, 1989).

This is a crucial issue, since the CVCP has indicated that patent counts will eventually be one of the indicators employed to evaluate the performance of UK universities (CVCP, 1987). One wonders whether the UGC was influenced by

recent claims about the reliability of patents as indicators of between-firm differences in the advancement of knowledge (Bound, Cummins *et al*, 1984). Whatever the origin of this idea, it is worth nothing that a number of commentators are very sceptical about using patents as measures of advances in knowledge. Pakes & Griliches (1984), for instance, claimed that our understanding had not progressed significantly since Kuznets', Sanders' and Schmookler's disagreements about the utility of patent statistics over twenty years ago (Nelson, 1962). Noticeably, none of these discussions refer to patents as indicators in the context of universities, either.

It is pertinent to consider whose attitudes, within a university, determine the stance of the institution. There is evidence that the patenting policies of universities in Europe have primarily been influenced by the views of members of the academic staff. Grin (1983), for example, reported that Swiss universities employed *ad hoc* patenting tactics in preference to a formal patenting policy, due to the negative feelings of academic staff. In the US, until recently the views of "the university" were generally synonymous with those of the faculty; university presidents and administrators (who were often ex-academics) generally ratified the decisions made by faculty. Recently the balance of power has shifted more in favour of career administrators and university presidents (Kerr, 1964). Where it is the administration which decides on an active patenting policy, the attitude or awareness of individual academics can - and sometimes does - influence the extent to which research discoveries become the subject of university patent applications, as the Cohen/Boyer story illustrates below. The attitude of academics to patenting

is obviously particularly crucial in countries where right to file a patent belongs to the academic, or is routinely waived by the university.

British scientists have often been accused of having a particularly negative attitude to patents. Some commentators blame this on the dominating influence of Rutherford, for whom "patent" was reportedly a dirty word (Curran & Busby, 1971). Others attribute it more broadly to the influence of left-wing scientists in the 1930s, who felt that private inventions could be and had been suppressed by corporate business. There is little doubt that this feeling was prevalent in pre-war Britain, for it became the subject of a Nuffield College inquiry in 1944 and was further explored by the Swan Committee in 1947 (Haigh, Pearson *et al*, 1971). However, it was by no means a purely British "disease", nor was it particularly new. In the 19th century, reputedly a golden entrepreneurial age, most scientists eschewed opportunities to sell scientific knowledge (Etzkowitz, 1983). Bernal (1953) gave a concrete example: Napoleon III asked Pasteur why he had not sought to profit personally from pasteurisation, in view of fact it had saved the country around £4m. Pasteur is said to have replied that in France scientists would consider they lowered themselves by doing so.

Even in the 1970s many prominent American academics shied away from patents just as much as their European counterparts were reported to (Declercq, 1979). In the early days of the biotechnology revolution, US academics either failed to think in terms of patents or consciously dismissed them as an option (Omenn, 1982; Wade, 1984; Kenney, 1986). Cohen and Boyer, discoverers of the original rDNA

"gene-splicing" technique, both regarded this as intellectual property which should be held in common, depending as it did on a number of earlier discoveries by other people (Wade, 1984). They agreed to a patent application only when they had accepted that it would benefit the university; both assigned their patent rights to their universities, specifying that royalties should be used to support the departments of medicine and genetics, basic research and post-doctoral research posts (Omenn, 1982). Similarly Harvard biologist Mark Ptashne was unwilling to patent his biotechnology discoveries, having long been unhappy about the commercial activities of his Nobel Prize-winning colleague, Walter Gilbert. When Harvard pressed the matter, he assigned his rights to the university (Kenney, 1986). However, the speed with which university biotechnology discoveries were commercialised in the US suggests that many researchers overcame their previous disinterest or scruples regarding patents [15]. In agriculture, too, researchers have increasingly had to accept the need for patenting or risk compromising one of their primary functions, the introduction of technically superior new plant breeds [16] (Stallman & Schmid, 1987). This is a particularly large attitudinal change for researchers at US Land Grant universities to make.

It is worth noting that, notwithstanding attitudinal changes, the biotechnology revolution has also served to confirm some academics' worst suspicions about patenting, motivated chiefly by concern for its effect on open scientific communication. A University of California (San Francisco) committee established that because so many scientists were affiliated to Genentech, others were loathe to ask questions or make suggestions in seminars in case their idea might be patented

by a fellow academic, or deployed to make money for a third party. Their fears were not groundless. A scientist at the University of California described an important new method for making synthetic vaccines to a colleague from another institution prior to publishing. He subsequently found his method described in an article, without any acknowledgement. His discovery was then patented by his colleague's institution, which entered into a joint venture with a large, established pharmaceutical company for the production of synthetic vaccines, in exchange for a figure rumoured to be in the region of $30 million (Wade, 1984). The University of Utah's patent applications relating to "cold fusion" triggered similar concerns about the negative impact of patents on conventional academic behaviour. When Pons and Fleischman (both chemists) made their very public announcement in March 1989, they made no reference to the work of a physicist at nearby Brigham Young University, who had had the greatest success to date with muon-catalysed "cold fusion". It was widely speculated that the physicist concerned had copied Pons and Fleischman's ideas after reviewing a grant application to the Department of Energy (Begley, Hurt & Murr, 1989). Ironically, some researchers in the US now feel that there is more scientific openness within companies than in academia.

Financial Considerations

Universities which have the legal right to patent employees' research discoveries may sometimes be constrained by the financial demands which patenting makes upon them. It has been claimed that generating an income of several thousand pounds per year in royalties on any one invention requires a comprehensive patent

portfolio which would cost around £20,000 (Duff, 1987a). The cost of obtaining a US patent in 1987 was around $5000. In Europe in the same year, initial European patent applications averaged at £300 per country or around £2000 at the end of the first year via the Patent Co-operation Treaty (PCT) [17] (Powell, 1987). By the time the patent is awarded two to three years later, the costs could be as high as £2,000 per country (Comerford, 1987). Even if the patent covers what Stankiewicz (1985) calls a "big hit" invention and quickly becomes the subject of a licensing agreement, unless the licensee agrees to cover the costs, the university may need to resource an aggressive and intelligent patenting programme pending the receipt of royalty income, which may not begin to flow - if it flows at all - for five years or more (Reimers, 1980). In some UK universities, this has led to a policy decision not to proceed with an initial registration if no potential licensees have shown an interest in the IP within the first twelve months. UDIL does not fundamentally disagree with this policy, but suggests that UK universities should consider the PCT route instead, to allow more time to evaluate the commercial potential of the patent and investigate exploitation mechanisms (UDIL, 1988).

There is considerable debate about the rewards which universities might realistically expect from pursuing an active patenting policy, which cannot help them to make informed decisions. Some commentators have focussed on celebrated examples of US universities making $millions from single patents [18] (see, for instance, Omenn, 1982). Others claim that patents have rarely produced significant income for universities in the US (Blumenthal, Epstein & Maxwell, 1986). MIT's vice-president for research estimated that in 1987 the total licensing income to US

universities from all academic science research was just $20m (Biddle, 1987). Some estimates have been more optimistic; Fuchsberg (1989a) reported that in 1988, for example, the total licensing income to US universities was more like $50m. However, to put this into perspective Fuchsberg also noted that this was less than the sums solicited by many individual universities in the US in private donations each year. Melchiori (1983) argued that the well-publicised $millions derived from some university research were dangerously misrepresentative: they gave no indication of the expense or the person-years of effort involved, nor of the number of failures which the universities in question had been obliged to underwrite. In his view, the most valuable reward which could accrue to universities with an active patenting policy was not likely to be financial: rather it was the ability to influence the application of research findings in ways which do not contravene academic values (*eg.* proscribing chemical warfare).

In the UK, UDIL took a fairly optimistic view of the income generation potential of university intellectual property, suggesting that it can make an important contribution to university funds, though most British universities have yet to recognise this (UDIL, 1988). Narin (1985) argued that the financial reward/cost ratio can only improve in the future, predicting that universities' income from patents would grow, due to industry's decreasing investment in basic and long-term research; universities would hold an increasing number of key patents. However, Williams (1985a) was sceptical about this scenario: science and technology may currently appear to converge in micro-electronics and biotechnology, but he saw these as exceptions since, as a rule, few patents

generate commercially viable innovations. The most commonly quoted ratio is as follows: 1000 reported discoveries will yield only 100 patents; 100 patents will generate only 10 licenses and only 1 license in 10 will yield more than $25,000 per annum in royalties (Bok, 1982). This ratio is supported by statistics released by the BTG, which revealed that of the hundreds of thousands of scientific discoveries passed to it for exploitation between 1949 and 1989, only 774 had earned any revenue. Moreover, only one had earned >£100m in (aggregate) licensing income, only two had earned >£10m and only 7 had earned >£1m. Indeed, less than ten per cent had earned >£100,000. The remaining 89 per cent had earned <£100,000 *in toto* [19]. On the other hand, Brown (1982) argued that these statistics result from a tendency for organisations like the BTG to "high-grade" opportunities offered to them, selecting only those perceived to be the most profitable and rejecting small-fry.

There is an ongoing debate about optimum institutional patenting policies and the literature is replete with conflicting advice. Bok (1982), former president of Harvard, advocated that decisions should be made bearing in mind the ratio of discoveries to patents to profitable licenses (*ie.* 100:10:1). Gilbert (1975) advocated a different approach - *viz.* the shotgun approach - that is to say "spraying one's filings in the general direction of the marketplace" and hoping that 10-20 per cent hit a target. Ditzel (1975a) warned against universities adopting a patenting policy which operates on the basis "will it pay?" He advocated that universities should attempt to patent everything, since it is seldom possible for anyone to determine in advance what will be productive in the long-term and what

will not. Orlans (ed) (1968) drew attention to the difficulty of evaluating the socio-economic benefits of basic science, especially "big" science; the value one might place now per $ spent on looking for the phenomenon of electricity would be completely different to the value which Faraday himself placed on it at the time. For the same reason, it is impossible to judge the ultimate value of, say, high energy physics. Moreover, inventors themselves are not particularly good at seeing even the more immediate potential of their discoveries; Marconi is said never to have conceived of the broadcasting industry resulting from his discovery of radio-communication, seeing it purely as a means of communicating where it was difficult to put wires - hence the name "wireless" (White, 1990). The time taken for xerography to become accepted as worthy of economic exploitation illustrates the fact that it is not always possible to find a licensee even when the existence a specific application fulfilling an identifiable need has been recognised (Gruber & Marquis, 1969a).

It is evident that making the wrong decision can have disastrous consequences in universities, both financially and from the point of view of staff relations (see [5]) (Omenn, 1982). Crespi (1982) recounted that Oxford University's postwar patenting strategy was to "protect" any development that could conceivably be significant in the long term in a field which was still totally open but with an uncertain future. The only limit on this policy was in regard to the territorial extent and the estimated cost-effectiveness, especially in countries where only process cover was available. This policy resulted in a number of product patents which transpired to be of minor significance. However, the limits of the policy

were responsible for an important 1961 discovery being insufficiently protected in territorial terms because its future importance was not realised at the time. Bremer (1975) recounted how WARF benefitted from several "late bloomers" - patents which were 6-10 years ahead of their time. Some universities have therefore established committees to consider the merits of patenting particular inventions, rather than leave it to, say, the ILO to assume the sole responsibility for deciding which technological horse to back (Freise, 1975; Treibel, 1975; McKenzie & Rhys-Jones, 1985). Others have argued that this approach should be "avoided like the plague" (Gilbert, 1975).

The literature also highlights the fact that patents are only as good as the owner's (or the licensee's) determination to enforce them. Infringement actions can be extremely expensive, especially in the UK, since the Patent Court is part of the High Court (Powell, 1987). This may also act as a constraint on universities' patenting activities, for there is evidence that industry is increasingly prepared to infringe patents. American universities are being drawn more and more into patent-related litigation (Wade, 1980c; Wade, 1981; Sun, 1985a). This trend led Stanford to offer its genetic technology to private firms at very moderate rates, sufficient to generate an income for the university, but too low to make it worthwhile for companies to evade the charge or attempt to do the research in-house (Etzkowitz, 1983).

If financial considerations act as a constraint to universities, it is likely that they will represent an even greater constraint to the academic who owns the IPR in his

discoveries. In the light of the above figures, it is not surprising that the Spinks Report concluded: "We doubt whether the majority of researchers would themselves wish to face the cost, complexity, time and effort involved in establishing effective patent protection" [20] (Spinks, 1980). It has certainly been observed that in Sweden rough and ready estimates of licensing potential affect the probability of an academic applying for a patent (McQueen & Wallmark, 1982a), since they must bear the patenting costs themselves - or persuade a third party to shoulder the burden (Rausing, 1981).

Skills-Related Considerations

Universities which decide to embark on an active patenting policy often find that this makes skill-related demands on them which they are not equipped to fulfil. In the UK, certainly, it is claimed that few universities have developed the skills to deal with intellectual property effectively on an in-house basis and they are prevented from acquiring or hiring the relevant skills because they are under-resourced (UDIL, 1988) In the 1990s this may be due to university's spending priorities, but it has been argued that in the past UK universities were uncertain about whether or not they could justify charging the administrative costs of exploitation to UGC funds (McKenzie & Rhys-Jones, 1985). Even today, they may also find it hard to justify the level of expenditure which would be required to resource the operation properly, given the roulette-like nature of the gains to be had from exploiting intellectual property - which figures cited below confirm.

The practice of delegation to professionals (*eg.* patent agents) clearly has budgetary implications, too, and some universities are happier to delegate the task to specialist organisations like the Research Corporation and the BTG. In the UK, universities have been advised against pursuing a path which effectively maintains the BTG's previous monopoly, or transfers it to a similar organisation. Many UK universities still see this as the solution to the problem, however.

In the US the trend is increasingly towards extensive in-house operations, however. It is reported that between 1984 and 1989 membership of the principal organisation of university patent officials virtually tripled to over 400 from 125 universities (Fuchsberg, 1989a).

Other Considerations

It is evident from the literature that other considerations may affect universities' patenting rates. At the level of individual universities, for instance, the arts/social science/physical sciences/engineering bias is likely to have an influence. Several studies have established that the distribution of inventions is skewed by discipline. Norris (197?), for instance, found that the proportion of patented inventions was higher in applied science than pure science departments and that dentists were particularly prolific inventors. McQueen & Wallmark (1982a) also established that the distribution of inventions was skewed by subject even within applied science faculties. More recently, microbiology has been found to generate an unusually high number of patents: 89 per cent of US universities report that microbiological research generated at least one patent between 1980 and 1984 (Blumenthal, Gluck

et al, 1987).

At the other extreme, the prevailing culture in a country may also have an influence. It may be significant that in the US, for instance, annual university patent league tables are compiled - most notably by the University of Minnesota - to check on how the main research universities are doing each year compared to their rivals. The figures for 1987 reveal that MIT was ranked first with 66 patents issued that year, while the University of California came second with 65 and Stanford was third with 42. However, Texas A & M had only seven patents issued that year, while Harvard had only five and California Institute of Technology had only one. In 1988 MIT, the University of California and Stanford retained their top positions, but Harvard came eighth with 20 patents issued that year, and California Institute of Technology came tenth with 18. These figures are presumably testimony to the element of serendipity involved in discovering something patentable They would also appear to be testimony to a certain pride on the part of these universities *vis-a-vis* their patent track record - a pride which is not evident in UK universities. Moreover, it is not only these research universities themselves which take an interest patent league tables. They are regularly reproduced in the US media, too [21]

2.3 Identification of Intellectual Property

Intellectual property with commercial potential will not be protected unless the university - or the academic researcher or someone acting on their behalf - is able to identify it in the first place In most countries the law relating to employee

inventions is very explicit about the responsibility of the inventor to formally bring his discovery to his employer's attention; it often imposes sanctions on employees who fail to observe this requirement (Phillips, 1981). This is very much more straightforward in industry than in a university, however. As a group, academics are reputed to be not particularly alert to the commercial possibilities of intellectual property. Wade (1984) posed a pertinent question: should Stanford and the University of California have "punished" Cohen and Boyer for failing to realise that their genetic engineering (rDNA) technique could or should be patented? He concluded that universities cannot legislate against a non-applied outlook (or an "open publication" outlook) and impose sanctions against offenders.

The Cohen/Boyer case is a classic illustration of the dangers of expecting researchers to identify the commercial potential of their research findings and notify their university. Stanford's in-house patent officer was unaware of the commercial significance of rDNA until he read about it in a newspaper article just one week before the deadline for filing a patent application (Wade, 1984). Since the technique had been widely diffused by this time, and had led to several new firms being formed expressly to exploit it, Stanford's application was the subject of considerable litigation. The university was finally granted a US process patent seven years later in 1980 and a product patent in 1984, but no generic patent (Daly, 1985). An OECD report noted that the Cohen-Boyer case was the most forceful demonstration to university researchers of the need to identify intellectual property in time (reported in Beier, Crespi & Straus, 1985).

In many American universities, administrators have taken on this responsibility, routinely arranging for the output from research projects (reports, papers *etc*) to be trawled for patentable and exploitable discoveries. At Columbia this yielded a world-wide patent on co-transformation, another genetic engineering technique; the scientist who discovered it had not alerted the university to its commercial potential (Etzkowitz, 1983). Judging by the columns of The Chronicle of Higher Education, the "trade paper" of American universities, US universities are coming up with increasingly novel solutions to the problem of identifying commercially exploitable research discoveries. In 1989, for instance, Cornell established a 10-strong panel of alumni which has taken on the job of "roam[ing] Cornell's campus to ferret out prospective projects" (Fuchsberg, 1989b).

Despite this accumulated experience, it has been claimed that in the UK the responsibility for identifying commercially exploitable inventions is left in most cases with the individual academic inventor (UDIL, 1988). In the past, outsiders have been allowed into universities with a view to trawling for discoveries with commercial potential. Prior to the rescinding of its right of first refusal, the BTG tended to send its regional officers into UK universities each six months or so [22]. It is not clear, though, whether this tradition has continued throughout the UK. Nor is it clear whether any of the hundreds of independent technology transfer agencies said to have set up in the UK (Webster, 1988) have been beating a path to the door of UK universities [23]. UDIL (1988) claimed that UK universities were making little use of the range of outside professional help available - suggesting, apparently, that the onus should be on universities to seek out professional help,

even if it is not spontaneously proffered. It is unclear whether universities are not making use of such professionals because of lack of awareness, or innate conservatism, or whether this is a matter of budgetary constraints. It is also unclear how UK universities would respond to the proposition of up-front fees for their services, when they are used to the BTG operating on a percentage-of-profits basis.

In 1991 the DTI sought to assist UK universities to establish the commercial potential of research discoveries made by their staff (and the commercial potential of their facilities, expertise *etc*) by part-funding comprehensive technology audits under the auspices of its Innovation Programme (DTI, 1991). However, limited funding (£1.9m) was made available on a competitive basis and only 44 (55%) higher education institutions were eventually funded, out of a total of 80 which sought funding (DTI, 1992). It is not clear whether further rounds of funding will be made available.

In any case, one-off technology audits do not provide a long-term solution to this problem. UDIL believes that a routine but non-intrusive interface between a university's research staff and its exploitation staff is needed, to identify intellectual property with commercial potential at an early stage (UDIL, 1988). It is suggested, though, that this is tantamount to a new tradition; it may therefore take time to develop along lines acceptable to both parties.

CHAPTER 3

3 LITERATURE REVIEW, PART 2: EXPLOITATION OF INTELLECTUAL PROPERTY GENERATED IN UNIVERSITIES

3.1 Introduction

Essentially, there are five ways in which intellectual property generated in universities might be exploited

i) licensing to existing companies,

ii) trading from within the university,

iii) setting up a wholly-owned university company;

iv) setting up a joint venture,

v) setting up an independent academic spin-off company.

Chapter 3 will review the literature on the first four ways, focussing specifically on the exploitation of university-generated intellectual property, where possible. The literature relating to independent academic spin-off companies will be reviewed *en passant* in chapter 4, which focusses on academic entrepreneurship

3.2 Licensing

3.2.1 Introduction

In several Western countries the exploitation of university-based research discoveries resulting from publicly-funded projects has traditionally been handled by government-sponsored brokers like the NRDC, subsequently the BTG, in the UK, ANVAR in France, the Research Development Corporation in Japan Licensing has generally been the preferred mechanism of these agencies, indeed, it was noted that the NRDC failed altogether to promote high-technology innovations by founding new technology-based firms, preferring to rely on the energetic co-operation of industry for the "big hit" innovations which it accepted into its portfolio (Stankiewicz, 1986) In response to the findings of the Spinks Report (Spinks, 1980) and others, the BTG subsequently invested in

a number of start-up companies intended to exploit IP which had been assigned to it, as chapter 1 revealed However, the number was insignificant compared to the number of licenses granted to existing companies, with the result that this new strategy did not do a great deal to redress the balance.

In countries where universities or academics are free to exploit discoveries arising out of publicly-funded research as they see fit, licensing to existing companies is just one of a number of exploitation mechanisms which might be employed, in the absence of constraints on other mechanisms. Nonetheless, it is often tacitly assumed in the literature that licensing to existing companies is still the preferred mechanism Isolated references in empirical studies appear to support this assumption McKenzie & Rhys-Jones (1985) reported that only 5 per cent of MIT's licences go to new ventures, for instance, while McQueen & Wallmark (1982b) observed that 60 per cent of the patents held by academics at a Swedish technical university had become the subject of license agreements with existing companies, whereas only 15 per cent had been exploited by academics forming spin-off companies It is generally believed that licensing is the least demanding and least disruptive mechanism from the perspective of the university/academic Although returns from licensing are likely to be lower than returns from setting up a purpose-built manufacturing and marketing operation, it has many advantages It requires little extra investment, there are no supply or labour problems and the technology can be transferred to other countries without incurring prohibitive sales and marketing costs, facing import quotas or positive discrimination towards indigenous suppliers [1] (Faulkner, O'Connor *et al*, 1988). Licensing has also been seen as the least risky way for universities to transfer technology, since liability for products or processes which cause unforseen problems is limited by the fact that the IP is usually transferred in a rough, early form, distant from the refined products or technologies which the companies eventually develop (This view

has been challenged recently by a nationwide group of university lawyers in the US, who feel that though US courts have generally been lenient to universities on grounds of their lack of experience and sophistication, this is unlikely to continue For this reason, many US universities now require the companies they license to carry liability insurance and to assume all risks for their products/processes (Fuchsberg, 1989a)) At the same time, licensing performs a vital economic role. Innovation is essential for the survival and growth of established companies Acquiring new technology via licensing is cheaper, quicker and less risky than in-house R&D, generates revenues faster and allows a greater proportion of the project to be financed out of cash-flow. It is particularly appropriate for small and medium-sized enterprises (SMEs), which do not generally have the capability to protect intellectual property against imitation or modification (Faulkner, O'Connor *et al*, 1988)

3.2.2 Objective Considerations

Nonetheless, universities attempting to exploit their IPR by means of licensing deals are immediately confronted by a number of objective problems which they need to overcome These range from identifying potential licensees and marketing the technology to vetting candidate companies and negotiating appropriate deals In the light of this, it may not be surprising to learn that, as a source of patents and licenses obtained by companies, American universities have ranked a low third behind companies in other fields and private research laboratories (Shapero, 1979)

Identifying one potential licensee may not be difficult, but identifying a number of potential licensees from which to select is no easy undertaking Licensees often find it equally difficult to identify suitable licensors This may partially explain the tendency for licensors and licensees to conclude a deal with the first willing partner they identify

Companies seeking technologies to license-in routinely search published sources, public sector organisations, exhibitions and trade shows It is often difficult for them to obtain information about technologies available in universities and colleges, while brokers and consultants who might have ready access to this kind of information are often insufficiently informed about specific markets and product areas (Faulkner, O'Connor *et al*, 1988). During the course of Congressional hearings in 1980, universities were accused of marketing their patents in a particularly chaotic way (Farley, 1980). Moreover, Patterson (1975) concluded that universities do put enough preparation into their licensing packages

Universities have tried a number of methods to license their technology These range from brokers to licensing pools, from bridging the development gap in-house to acquiring in-house licensing skills For many years US universities have used specialised patenting and licensing brokers to market their patents professionally on their behalf - brokers like the Research Corporation, founded in 1912, and University Patents, Inc, founded in 1974 (Declercq, 1979, Kenney, 1986) A 1979 study of patent marketing practices in US research universities revealed that in 59 per cent of the instances cited, the universities in question used the Research Corporation, while in a further 18 per cent of instances the Battelle Development Corporation was utilised and in another 11 per cent, University Patents Inc was brought in, the overall percentages exceed 100 per cent because 55 per cent of respondents said they used more than one mechanism for each item of licensable technology (Reimers, 1980) It has been claimed that this is a far from perfect way to transfer technology An observer with twenty years' experience of exploiting university research commented "Professional licensing organisations tend to high-grade the available ideas, choosing only those they perceive to be the very best"; moreover, outside organisations lack the inventor's enthusiasm for the idea (Brown, 1982). This echoes the

experience of some Canadian universities which have expressed dissastisfaction with the performance of Canadian Patent and Development Ltd (OECD, 1982, Doutriaux & Peterman, 1984). Moreover, using professional licensing organisations may also have cost implications over and above the standard fee/percentage levied In Brown's experience, licensing technological concepts which are not fully developed into working prototypes leads to problems downstream Once the concept has been expanded and modified, strong differences of opinion develop concerning its origin. This leads to disputes over whether royalties are payable. Some universities have tried to overcome this problem by bridging the development gap, either by setting up organisations to develop patented ideas to a commercially feasible state (Declercq, 1979, Bok, 1982, OECD, 1982) or by regarding it as part of the remit of the laboratory (McQueen & Wallmark, 1982b) This approach conflicts with many universities' view of their mission, however, and is unlikely to become the preferred solution

Some universities in the US, most notably Harvard and Stanford, decided to set up their own in-house patent and licensing administration offices Others, including Cornell, Purdue and Rutgers, established foundations modelled on WARF to market and administer their patents (Dalldorf, 1976) In the wake of complaints aired during the course of Congressional hearings, Stanford and the University of California proposed a new solution for one specific research area a university licensing pool for biotechnology Its objective was to act as a central resource for universities holding biotechnology patents which did not have good, in-house licensing administrations The project was abandoned after just two months for reasons which will be outlined below (Kenney, 1986)

Notwithstanding this variety of approaches, as a group American universities have not found an adequate solution to the problem As a result, many have continued to market

their patents in an unco-ordinated and competitive manner which is costly to industry and themselves because of the sheer number of transactions which the search for the right product/process can entail (Kenney, 1986) In part at least, this situation explains the preference of some American university departments for accepting large sums of research funding from multi-national companies, in exchange for the option on licenses in a defined area of R&D (Stankiewicz, 1986) Nothing in the literature suggests that UK or European universities have developed a more efficient method, though there are notable exceptions. At one Swedish technical university an extraordinarily high ratio of patents to exploitation has been reported only 29 per cent of the 170 patents held in 1981 had not been exploited (McQueen & Wallmark, 1982b) The authors omit to comment on the marketing strategies employed, which is a pity, since there is no evidence that European universities have devised more effective and coherent patent marketing strategies

Licensing to the first willing partner identified is a dangerous strategy, both from the point of view of securing an income from the license and transferring technology effectively. Companies license-in new technology for different motives Licensing-in may represent a defensive strategy geared to survival, or it may represent a positive strategy for growth and diversification (Mooring, 1984, Teece, 1976) Licensors need to establish the company's motives in wanting to license-in that particular technology, the company's strengths and weaknesses and its approach to the technology companies often concentrate on what they can make, rather than what they can sell (Faulkner, O'Connor *et al*, 1988).

Licensing usually takes place at an enterprise-to-enterprise level, not at a public sector research science-to-enterprise level There is a better chance of concluding a deal if licensor and licensee have a similar world outlook, similar aspirations, company size, organisation and experience, a management which is perceived as trustworthy and sharp -

and if the negotiations are conducted by a senior manager with a compatible personality Differences in "culture" create a bigger barrier to successful licensing than language differences (Faulkner, O'Connor *et al*, 1988) *De facto*, it seems, this puts universities at a disadvantage.

Licensing is a skill-intensive operation in which there is a cumulative learning effect (Lowe & Crawford, 1984) To date, it is claimed, the UK in particular has failed to develop an adequate understanding of the licensing process, which has severely inhibited its effectiveness as a mechanism for technology transfer (Quinn, 1986a) If universities wish to benefit from the learning curve, they clearly have two options - to buy in the necessary expertise on an *ad hoc* basis or to develop in-house licensing skills There is evidence to show that research universities in the US are acknowledging this in increasing numbers In the UK, however, it has been found that universities are relying on over-burdened and unskilled administrators taking time out from their mainstream activities to conduct the complex negotiations entailed in reaching a licensing agreement (UDIL, 1988) It is not clear whether this is due to a failure to appreciate the complexity of the process, or to financial constraints, or both It is claimed that licensing income seldom covers the cost of maintaining a patenting and licensing office, the odds of making money through betting on horses are reported to be substantially higher This is not a peculiarly British problem· even in the US, only five universities generated an income of over $1m in royalties in 1981 (Blumenthal, Gluck *et al*, 1987). UK universities which are not prepared or in a position to develop in-house licensing skills have been encouraged to employ outside expertise (UDIL, 1988), perhaps involving the Licensing Executives Society, which has shown an increasing interest in assisting universities with IPR to exploit It will be some time before we can assess whether they have heeded this advice

3.2.3 Attitudinal Considerations

In the US in particular, as chapter 2 revealed, universities and academics have increasingly accepted that a discovery generated by academics will be transferred more effectively if it is protected by patent, copyright, design right *etc* However, the practice of licensing has occasioned considerable controversy, on two main counts The first concerns the levying of royalties on research discoveries which were paid for out of the public purse In the case of health-related discoveries in particular, the prevailing view in the 1970s and even the early 1980s was that university research should benefit mankind at the least possible cost, not generate income for universities This reflects deep-seated and long-standing cultural values which permeate the public sector, as demonstrated by the discovery of cardiolipin [2] (Dalldorf, 1976) The history of the discovery and exploitation of penicillin indicates that these are by no means peculiarly American values, as we have seen.

The second relates to the issue of exclusive versus non-exclusive licences Again, this reflects deep-seated cultural values which have been endorsed by government During the early 1960s, the US federal government dictated that any discoveries which had been supported by public funds should be freely available to the public. NASA and a number of goverment agencies simply granted free licenses without patent protection (McClelland, 1969) The Department of Education, Health and Welfare and the National Institutes of Health (NIH) permitted universities and non-profit organisations to own the inventions developed with NIH funds (Wyngaarden, 1983) - and following the Kennedy Memorandum of October 1963 all government contractors were supposed to be allowed to retain the title to patents, subject to a government "shop right" [3] (Orkin, 1981) In

practice, many federal agencies ignored this ruling, however, with the result that the government retained ownership (Woessner & Terry, 1988) Federal policy almost invariably barred exclusive licenses, however, on the basis that they stifle competition, remove licensees' incentive to bring an invention quickly to market - and allow the invention to be suppressed altogether (Wade, 1984) Fornell (1975) records that between 1967 and 1972 the US government issued 12,204 non-exclusive licenses and just 20 exclusive licenses Even this insignificant number did not deter Public Citizen, Inc, Ralph Nader's consumer advocate group, from bringing a lawsuit against the government, alleging that the issuance by federal agencies of exclusive licenses to use and develop patents and inventions amounted to a disposition of government property in violation of Article 4, Section 3, Clause 2 of the Constitution Private plaintiffs also filed suits against federal agencies on the grounds that they could not obtain a non-exclusive license because an exclusive one had already been issued In the UK, the NRDC adopted exactly the same policy but this kind of debate does not seem to have taken place

Notwithstanding lawsuits, in 1980, in recognition of the fact that non-exclusive licenses were failing to attract industry, universities were empowered to offer exclusive licenses (Wade, 1984) The government's prime motivation was to transfer technology effectively, not to generate an income for universities (Bok, 1982) This change in policy did not gain overnight acceptance within academia - indeed, ten years later the idea is fiercely contested in some US universities, if we are to believe the columns of The Chronicle of Higher Education, US universities' "trade paper". Influential universities like Yale devoted considerable time and effort to exploration of the issues involved Like Yale, many concluded that they would prefer not to grant exclusive licenses unless exceptional circumstances indicate that the resulting benefit to society would be greater than the cost of diminished competition (Giamatti, 1982) When Stanford and the University of

California tried to establish the University Licensing Pool for Biotechnology, one of their objectives was to use their collective strength to insist on non-exclusive licenses, rather than exclusive The project was abandoned partly because US industry clearly preferred to acquire proprietary molecules and seek monopoly returns, rather than compete in the sphere of production (Kenney, 1986). It remains to be seen whether American universities will come to accept the concept of exclusive licences, or whether they will continue to seek non-exclusive deals It is pertinent to note that in recent years US Land Grant universities - traditionally wedded to free public release policies for new plant breeds - have begun to license some breeds on an exclusive basis in exchange for royalties (Stallman & Schmid, 1987) This change of policy will not go unnoticed by other universities, for the granting of licenses and extensions of exclusivity are well-publicised in the US by means of the Federal Register (Woessner & Terry, 1988) In the UK, in contrast, license deals are considered to be a matter private to the parties concerned, unless they actively wish to publicise it

It is conceivable that some universities may be influenced by the debate concerning the effectiveness of licensing as a mechanism for technology transfer Sun (1985b) reported, for example, that the chairman of Cetus (one of the "big four" US biotechnology start-ups) indicted universities' use of licensing on the grounds that it achieved "a minimum of technology transfer". Instead of teaching licensees the principles of constructing useful new organisms, it gave them a defined set of manufacturing techniques, specific to the organism being licensed.

Despite the fact that in parts of the industrialised West research universities are seen as a significant source of science/technology - and some of that science/technology may not have been publicly-funded, the manner in which it is transferred into economic use can be

a matter of public debate In the US, in particular, universities are expected to tread a fine line, judging by the columns of "trade papers" like The Chronicle of Higher Education. This regularly includes items on the commercialisation of research accompanied by headlines such as "Universities Said to Go Too Fast in Quest of Profit from Research" and quotes from potential licensees in the following vein "[Universities] all want million-dollar, up-front payments, royalties through the roof, and all sorts of research funds. Everybody wants to be the Donald Trump of licensing overnight" (Fuchsberg, 1989a). In the same issue of The Chronicle it was observed in a neighbouring column that in practice, the total licensing income to all US universities in 1988 was estimated to total only $50m - "less than many institutions receive from private donations each year". The two, juxtaposed items conveyed a strong message that The Chronicle perceived US universities to be greedy amateurs when it came to licensing out their research discoveries

There is evidence that the media in the US are coming round to the view that scientists in universities and government laboratories are guilty of hype with regard to research discoveries - and hype with an unambiguous ulterior motive, whether the discoveries are licensable or not The world-wide publicity orchestrated in relation to the University's of Utah's claims regarding cold fusion may have been the straw that broke the camel's back. An article in "Newsweek" commented "The time-honoured convention of publishing a scientific paper and *then* telling the world has been scuttled Floating fusion symposiums are being conducted by fax machine". It continued "The scientific frenzy - with its backbiting, reckless claims and unstinting search for glory - has already paid off. [ ] Last week at a packed hearing of the House Committee on Science, Space and Technology, well-briefed congressmen who last month didn't know an atom from Adam earnestly asked the Utah chemists about muons and neutrons - and then asked how big a cheque to write" Newsweek added "Science by press release can distort the proper distribution of credit

and funding [.] If grants are allocated by celebrity rather than by quality, science will suffer". The article quoted the University of Utah's vice-president as saying "... we've had 200 inquiries from Fortune 500 companies who are willing to give us you-name-it in terms of money [for a cold fusion license]" (Begley, Hurt *et al*, 1989) Significantly, perhaps, the UK media are beginning to take a similarly critical view In 1990 the Channel 4 programme "Dispatches" speculated about the motives of announcing the discovery of the link between the HIV virus and AIDS at a press conference at the Waldorf Astoria Hotel, instead of publishing in the usual way In 1992 an episode of the BBC television programme "Antenna", sub-titled "Breakthrough or Ballyhoo?", suggested that pecuniary motives explained the announcement at a press conference at Berkeley, instead of through the normal publication channels, of the discovery of radiation ripples in space - evidence, perhaps, to support the "big bang" theory, the provision of an allegedly spurious picture and the non-scientific caption "looking at God" aroused particular ire

3.3 Trading from Within

There is anecdotal evidence to suggest that instead of licensing intellectual property to existing companies, some universities - or academics within them - choose to market the product in question themselves, from within the university It stands to reason that "soft" IP and facilities may also be marketed in this manner. The literature is surprisingly silent on this more entrepreneurial way of transferring technology We can only speculate as to the reasons for this The most likely reason would seem to be that trading is carried on informally by departments, with the result that this is not a high profile activity, it is therefore difficult for researchers to identify instances of this happening An equally plausible reason is that trading from within may be done from the auspices of a research centre or institute - which may have a primarily commercial focus or may have a hybrid, part academic, part commercial focus Again, it may be difficult for researchers to

distinguish the more commercial centres/institutes and identify the entrepreneurial exploitation of research discoveries Whatever the reason, the literature is not able to shed much light on this

3.4 University Companies, Joint Ventures

3.4.1 Introduction

These two mechanisms are considered together here because of problems of definition in the literature The term "university company" is highly ambiguous, it is applied in the literature to both wholly-owned companies, joint ventures - including those in which the university has a very low share of the equity [4], and even to independent academic spin-off companies, on occasion When ascertaining a university's situation with regard to campus companies, it is important to distinguish which of these alternatives is involved, but not always possible to do so. Thus, in the context of this sub-section, the term "university company" is applied to both wholly-owned companies and joint ventures, unless one or other is specified

Our understanding of the role which university companies play in exploiting research discoveries is severely limited by a tendency to hyperbole in the literature, such as it is. There is an absence of comprehensive, aggregate data, let alone objective analysis University companies have not attracted the attention of business or management studies researchers in the way that women's businesses, ethnic businesses, craft businesses and technology-based businesses in general have, despite the surge of interest over the past decade in small business With the possible exception of one study commissioned by the CVCP, to which access is restricted [5], there have been no studies which review and evaluate their prevalence and character in the UK, for example, information has to be drawn from individual ILOs and university annual reports (Webster, 1988) The UK's

Science Policy Support Group has recently indicated that its academic-industry international study group, established in 1991, plans to focus on spin-off companies from academia (specifically on the degree of accommodation or conflict in organisational and individual values which this type of exploitation route requires) (SPSG, 1992) This is to be warmly welcomed, especially if it results in data being elicited on the incidence of such spin-off companies

The absence of reliable aggregate data may account for the widely diverging estimates of the number of university companies operating at any time In one study, it was claimed that UK universities had founded just ten "university companies" by 1984 (O'hEocha & Watson, 1984), it is unclear whether the authors meant wholly-owned companies or joint ventures Whichever they meant, it is worth noting that at that time the University of Bath alone had set up six new technology-based firms (NTBFs) (Cerych, 1985), while by 1989 the BTG recorded that Queens University, Belfast, had "sponsored" eleven jointly or wholly-owned companies (BTG, 1989). University companies are something of a mystery which is not unravelled by the literature on technology transfer, where we find the most frequent references outside the media It appears from this literature, which inevitably relates to individual cases, that an individual university's stance *vis-a-vis* exploiting research discoveries via campus companies can be influenced by legal, financial, managerial or even moral considerations It is less clear how much universities as a group in any particular university system or any particular country have been encouraged or deterred by these considerations The most recent literature concerning universities in the US suggests that American research universities have tended to go very much their own, individual way, but this is purely anecdotal.

3.4 2 Managerial/Operational Considerations

It has been claimed that the success or failure of a university company will depend much more on the motivation and management of those concerned in its direction than on the merit of the product it has been formed to manufacture (UDIL, 1988). In the UK the Jarratt Report warned universities wishing to establish limited companies to consider carefully the demands and the possible consequences. To be successful, university companies should be run "on a strictly commercial basis with objectives, management styles, and staff conditions different from those of the universities themselves" (CVCP, 1985). One could imagine the managerial and operational implications deterring universities from exploiting IP in this manner Universities are not regarded as being good at business, their committee-oriented management structure is inappropriate; they are adverse to risk and they cannot make timely decisions Moreover, correcting these deficiencies is not seen as the solution, since it is likely to compromise their ability to carry out their primary missions (Brown, 1982).

MIT attempted to solve this problem by setting up a professionally-run Development Foundation In fact, the Foundation was unable to identify effective entrepreneurs to run MIT's companies, or to establish sound patent positions and the project was abandoned in the late 1970s (Omenn, 1982). Other universities have been more successful, even where they have involved academic staff in the operation In the UK, for example, the University of Manchester has reportedly had considerable success in starting up a number of university companies. Yet its (former) industrial liaison officer is sceptical about the advisability of other universities following suit "Few universities will have the management skills and expertise to safeguard their investment in a joint venture over the longer term" (Duff, 1987a) In the US, efforts have been made in recent years to overcome these managerial/operational problems by a number of arrangements, too

complex to detail here (see Brown (1982) for details).

3.4.3 Legal Considerations

In some countries, universities have been unable to form university companies of any description, because of legal constraints which apply even though the university might own the IP resulting from its employees' discoveries. There are currently relatively few university companies in France or Holland, for example, because the French and Dutch governments have only recently amended the law to permit universities to set up companies (Mattison, 1987)

Even if universities are not legally proscribed from forming companies, in countries/states where the IP resulting from academic research is vested in the academic, wholly-owned university companies are a rarity they will only be formed if the researcher/research team assigns all rights to the university We do know that some universities have proposed joint ventures where academics with rights to valuable intellectual property have no plans to exploit it commercially (Bok, 1982) Some researchers are reported to have been extremely hostile to this suggestion, however (Etzkowitz, 1983) On balance, though, judging by anecdotal evidence in the more recent literature, academics seem to accept the idea of joint ventures, while some universities are becoming more cautious, for reasons which will be outlined below

Universities are frequently urged to ensure that their IP is exploited in as arm's length a manner as possible, in order to reduce their liability for products or processes which cause unforseen problems This may be why some universities prefer to license to an independent academic spin-off company, rather than set up a wholly-owned university company or a joint venture However, it now appears that universities may be sued

notwithstanding this even more arm's length arrangement In 1989 the University of Illinois was involved in two law suits arising out of a company founded by a member of the academic staff to exploit computer technology which he had developed The University of Illinois is reported to have spent two years negotiating the terms of the license agreement, but recognised in the light of the lawsuits, that due to inexperience it had "left holes a truck could go through" (Fuchsberg, 1989a)

3.4.4 Financial Considerations

The literature seldom makes it clear whether a university which decides to exploit research discoveries via a new, wholly-owned company is primarily motivated by income generation or by technology transfer During the early 1970s MIT, the university most associated with highly successful independent academic spin-offs, set up a number of wholly-owned university companies with a view to income generation However, MIT had difficulty securing second and third-round funding, it was duly recognised that MIT's gains were sufficiently limited as to put a question mark over the project and by the late 1970s MIT had abandoned the concept, precisely for this reason (Kenney, 1986). However, it now appears that despite its previous disenchantment, MIT has recently formed a number of wholly-owned companies, with the object of creating an environment in which university professors can interact with industrial clients in an atmosphere "more conducive to the commercial development of ideas"; Washington University is reported to be pursuing the same course (Marchello, 1987) This is more in keeping with the role of university companies in Europe, where the agenda is to transform the attitude of academics towards technology transfer (Declercq, 1979) It remains to be seen whether expectations related to technology transfer as opposed to income generation will make these companies more "successful" in the eyes of the university There are also severe doubts about their suitability as a technology transfer mechanism where revolutionary new

technologies are concerned In Williams' (1985b) view, history teaches us that an initial dependency on academia is usually followed by large, established companies or government gaining control of a new technology. It is not clear whether universities are sufficiently aware of this to think hard before rushing to found small, start-up companies exploit revolutionary new techniques

In the UK support for the concept of university companies seems more frequently to be motivated by the financial benefits it is believed will ensue. To academics university companies represent a potential source of income for their research, to university administrators they will generate income for the university, and to local government they are a key factor in local/regional economic development They are doubtless encouraged in this view by references to substantial sums of money being generated In 1986/87, for example, SUBS, the largest university-owned company in the UK, contributed over £5m to Salford University funds. On the other hand, in the same year Lynxvale contributed less than £0 5m to Cambridge University (Webster, 1988) Many university-owned companies probably generate even less, and it is certain that some operate at a loss Indeed, a number of university companies is rumoured to have failed dramatically in the UK Very little information relating to these cases has been allowed to circulate, however, so that it is difficult to establish the reasons for failure or to assess the impact of these failures on the future plans of the universities concerned and on other universities' decisions to form companies Significantly, UDIL has recommended that universities in the UK should not set up a company to market a new product unless the business plan demonstrates that it is capable of making around £100,000 in annual profits within four to five years (UDIL, 1988)

As we have seen from MIT's experience, a company's turnover and profit levels are determined in part by how well it is capitalised at start-up and subsequently Whilst the literature contains extensive information on the (under)-capitalisation of independent academic start-up companies, there is a striking lack of data on university companies. There are several examples of wholly-owned university companies in the literature [6] and there are indications that some universities have acquired grants from government agencies to help them found companies [7] while others have relied on bank loans guaranteed by the university, sometimes with far-reaching consequences [8]. We know very little about universities' practices in investing their own funds in such companies, nor about their experiences in raising additional start-up capital. It is therefore impossible to gauge how much this acts as a constraint on company formation

While universities exploiting, say, software or pharmacokinetics have managed to set up wholly-owned companies, universities attempting to exploit, say, biotechnology are unlikely to have sufficient funds at their own disposal [9]. Where the level of investment needed to exploit a particular technology is very high, one way of overcoming in-house financial constraints - and growing a larger company - is to seek partners for a joint venture It seems that even in the UK, where true venture capital is allegedly hard to find, some universities have successfully attracted venture capital [10] or engaged in a spot of corporate venturing [11]. (Unfortunately, of course, we have no record of failed attempts to attract investment to balance against these examples) The literature suggests that research universities in the US have been very successful in attracting joint venture partners. It is difficult to judge whether this is markedly more extensive than in, say, the UK, because no comprehensive study has been conducted, judging on the basis of anecdotal evidence is dangerous since it would appear that US universities are considerably less coy than their UK counterparts when it comes to revealing such intimate financial details US universities

publicise not only financial arrangements at the outset, but also provide updates and announce successes The Chronicle of Higher Education regularly carries details like the $2 28m earned by Cornell from royalties or the $880,000 earned from sale of its equity stake in a company founded by two professors to exploit "gene gun" technology (Fuchsberg, 1989b) Interestingly, it would appear that US universities have found European companies to be more willing than home-grown companies to become partners in high-risk, start-up ventures. A spokesperson for Dartmouth College is quoted in The Chronicle of Higher Education as saying "It's interesting that the most aggressive deal came from Europe I urge American companies to come in and be more aggressive" (Grassmuck, 1990)

It seems that some US universities do not intend the companies they start to remain joint ventures on a permanent basis. Fuchsberg (1989c) detailed the sums expended by the University of Boston to take control of Seragen, a biotechnology joint venture developing treatments for leukaemia Expenditure by 1989 totalled $49 2m, yielding a 73 4 per cent share of the company Seragen was costing the University of Boston an additional $1m per month while it refined its first products - an expenditure which it was estimated could amount to an additional $50m before any return on investment was received This estimate proved correct, since the University had invested $90m by September 1992, at which point the company was publicly floated (Bagalay, 1992) To put this into perspective, the University of Boston's total endowment is reported to be just $166m

Some US universities have opted to generate income by promoting the transfer of other people's intellectual property, as well as their own [12] (Etzkowitz, 1983, Kenney, 1986) This is a strategy which Williams (1985b) believes would not be legal for UK universities to attempt, and that even if it were, it would be far too risky to contemplate However,

there is evidence that some UK universities have contributed to venture capital funds which are not intended to be exclusively or even primarily to support the entrepreneurial exploitation of IP generated by their own staff [13]. This contrasts with the cautious view adopted by the president of Harvard in the early 1980s; he suggested that investment in established venture capital firms would be a more appropriate strategy, since institutional loyalty would be less likely to cloud a university's judgement (Bok, 1982)

More recently, a number of US universities has devised a less financially risky means of generating venture capital to support the entrepreneurial exploitation of IP generated by their staff. Fuchsberg (1989b) reported that in 1988 Harvard, Johns Hopkins University and the University of Chicago had announced the creation of multi-million dollar venture capital funds to finance start-up companies to entrepreneurially exploit IP generated by their staff. Harvard's $35m venture capital fund was created by nine investors ranging from pension funds to corporations, financial institutions and individuals Similar venture capital funds were planned for Brown, Northwestern, Princeton, Pennsylvania, Washington, Vanderbilt and the University of California At Cornell, however, attempts were being made to achieve the same objective by less formal means a panel of alumni with venture capital connections planned to approach individual venture capital funds on an *ad hoc* basis

3.4.6 Moral Considerations

In the US university companies - in the widest sense of the concept - have occasioned considerable controversy on moral grounds The issues which they raise have been openly debated both within and outside universities, in a manner which has not been reported in Europe Harvard's attempt in 1980 to persuade a faculty biology professor to set up a joint biotechnology venture with the university and venture capitalists serves to outline

these issues. Harvard's efforts to set up a university company failed, following outrage at the idea both within the university and outside With the benefit of hindsight the president, Derek Bok, wrote. "As my colleagues and I thought about the matter, we slowly came to realise that our pathway to riches would be marked by every kind of snare and pitfall ... [due to] conflicts with several constituencies" (Bok, 1982) Bok grasped that the stakeholders in the university had expectations of it which precluded it from exercising the rights which normally accrue to private corporations. The proposed venture was not perceived as an issue which could simply be determined internally on the basis of standard financial criteria

Harvard's interest in setting up the company, clearly motivated more by the desire for financial gain than promoting technology transfer, was widely seen as a significant endorsement of an area of R&D and of any resulting products/processes/services. Accordingly, it was argued, if it were to become known in due course that Harvard had sold its interest, this could be construed as a negative endorsement, with potentially disastrous financial consequences for the company and the other share-holders Some commentators judged Harvard from a wider perspective although it was accepted that universities should try to increase their income through investment, it was seen as incumbent upon them not to endanger their future through undue speculation; biotechnology companies were seen as highly speculative Moreover, it was felt that universities have a duty to protect the public from the creation of a financial bubble, which it was feared another biotechnology company would help trigger (Davis, 1981)

Bok reported that where faculty members' research interests gave them a potentially lucrative source of income, the proposed venture also threatened to change the character of the traditional university/faculty relationship He became concerned about the insidious

influence this might have on faculty applications for tenure, resources, funding, graduate students or leave It also became clear that a joint venture would effectively endorse the entrepreneurial activities of faculty members, when the university should be ensuring its ability to assess without bias whether academic entrepreneurship was in fact impinging on faculty members' prior commitments to the university, to open scientific communication, and to academic institutions such as journal editorship, refereeing manuscripts *etc*

Even entrepreneurial faculty members at Harvard were against the idea of the university embarking on a joint business venture Walter Gilbert, co-founder of Biogen, raised the possibility that his company could "push Harvard to the wall" in the event of strong competition [14] (Etzkowitz, 1983) Harvard alumni were also reported to be unhappy at the prospect of the university's joint venture Kenney (1986) gives some weight to the view of DeWitt Stetten Jr, a senior official in the NIH "While I was happy and proud to have been able to make a gift to the Harvard Corporation, I would have been far less happy and far less proud to have made a gift to the Harvard For Profit Business Syndicate In fact, I doubt that I would have made a gift at all". Kenney estimated that no mechanism for directly exploiting university research could match the sums which alumni donate to their *alma mater* - a situation without parallel in Europe, probably The sentiments of Harvard's alumni were echoed by the US media the New York Times suggested that Harvard faculty might "lose their academic souls" (13 Nov 1980) The Washington Star suggested that the word "*veritas*" in Harvard's motto should be replaced by "*cupiditas*". Congress also became involved, recommending that "middleman" mechanisms should be developed, to insulate universities from commercial activities and prevent conflicts of interest [15] (Gore, 1983) In the face of widespread disapproval, Bok conceded that Harvard should not participate in business ventures of this nature unless ways could be found to guarantee the university's integrity (Bearn, 1981)

The debate at Harvard generated considerable discussion in other American universities. Some saw university companies as likely to distort the future direction of research, exerting pressure towards short-term applied research goals in preference to longer-term basic research which may not have commercially exploitable applications [16] (Williams, 1985a) In others, campus companies were either not seen as controversial (Etzkowitz, 1983), or worries about universities jeopardising their integrity by founding companies were aired and dismissed (Brown, 1982) In the same year as the Harvard debacle, for example, Michigan State University Foundation quietly allocated $50,000 towards the cost of founding of a profit-seeking biotechnology company, Neogen, a joint venture with a retirement fund, a venture fund, a bank holding company and a venture capital company The relationship was by no means an "arm's length" one the university and the company had interlocking personnel and finances (Kenney, 1986)

In Europe university companies seem to have provoked less controversy Comerford (1987) went so far as to claim that in the UK "campus companies" had become highly fashionable and that many universities were proud of the successful businesses they had established There is a tendency to conclude that in the UK university companies are a product of the 1980s' enterprise culture (Sharp, 1985) In fact, a number of university companies were established during the 1960s and early 1970s Moreover, in Scotland at least, since the second half of the 18th century universities have not only made significant discoveries but have also developed the technical applications and commercial ventures which exploited them (Burns & Stalker, 1961, Eastwood, 1969) The number of university companies appears to have risen significantly during the 1980s, however This may be due in part to tax incentives, development grants and changes in the law (Sharp, 1985, Webster, 1988), in part to the substantial cuts in UGC funding which many universities experienced during this period

However, there is evidence of the beginnings of similar concerns to those which university companies have occasioned in the US Webster (1988) established that people feared that university companies could play too strong a role in influencing the research activities of academic staff They also foresaw a conflict of interest between staff *qua* academics and staff *qua* company employees, especially when companies moved from the "soft" to the "hard" stage of development Concern was also expressed about the extent to which the university could maintain control over the income generated, about how much autonomy companies should have from their parent university

Universities which are chary of setting up companies which they run, either wholly or jointly with partners, have sometimes considered assisting the exploitation of intellectual property (and hopefully profiting from it) by taking a minor equity stake in start-up companies formed by academics or third parties Equity has the advantage of ensuring continued benefits from future discoveries both within the university and outside the university (Davis, 1981) However, many universities in the US have rejected this as an option, largely on moral grounds In 1981, for example, Stanford University Committee on Research decided that as a general rule, the university should not take equity in companies exploiting university research in which a current faculty member is a significant stockholder or line manager [17] (Kenney, 1986) At the end of the 1980s, Stanford was reportedly adhering to this position, as was Harvard (Fuchsberg, 1989a) It is probably significant that in the mid-1980s fewer than five universities in the US had an equity stake in any biotechnology company owned or founded by a faculty member, few of those which did had seen their equity holdings appreciate, moreover (Blumenthal, Gluck *et al*, 1987)

American universities may be changing their attitude, however It is reported that the University of Utah changed its policy in the early 1980s (Brown, 1982), as did the University of Colorado (Etzkowitz, 1983), for example The situation in Europe is unclear The literature contains several examples of European universities taking equity [18] but gives no indication how common this is Again, we come back to the problems created by the lack of reliable, aggregate data

CHAPTER 4

4 LITERATURE REVIEW, PART 3: ACADEMIC ENTREPRENEURSHIP

4.1 Introduction

Of all the indirect and direct mechanisms which might be employed to commercially exploit *university* research discoveries, to date academic entrepreneurship is probably the mechanism which has attracted the most attention in the literature. In this context, however, we should interpret the word "literature" fairly liberally, since the calibre varies considerably Even at its best, much of the literature relating to academic entrepreneurship is relatively lightweight. There are historic reasons for this· even in the US where studies of entrepreneurship originated, entrepreneurship has taken a long time to gain academic credibility, first as a field of business studies and more recently, it could be argued, as a discipline in its own right The bulk of the literature relating to academic entrepreneurs derives from relatively small-scale studies conducted in the US at a time when entrepreneurship had not properly consolidated itself These studies were undertaken by researchers who came to the subject from a number of different fields - and a number of different traditions, with widely varying motivations for their interest in the subject Surprising numbers of them were academic entrepreneurs themselves or taught entrepreneurship, judging by the biographical details accompanying many publications This may account for the overtly partisan approach which many adopt towards the subject. Their style of reportage often lacks objectivity academic entrepreneurship is deemed *de facto* to be "a good thing". The wider issues are seldom explored Since research from this period still represents the seminal literature on academic entrepreneurship, its frequently partisan character may have encouraged interested parties, including some national and state governments, to view academic entrepreneurship in the same uncritical light In the intervening years this problem has been addressed to some degree in the US through contributions to the literature by commentators from other disciplines Very

recently, more rigorous studies of academic entrepreneurs have been conducted in the US, Canada and Europe, too. However, the wider issues still appear to be largely unexplored It is heartening to learn that academic entrepreneurship will shortly be subjected to a more critical analysis on an international scale (Webster & Etzkowitz, 1991).

Even where researchers of this early period adopted an appropriately disinterested stance, there are problems with the literature In keeping with studies of entrepreneurship in general, investigations of academic entrepreneurship during the late 1960s and early 1970s concentrated on three areas the entrepreneur, the organisation which "incubated" the entrepreneur and the business founded by the entrepreneur However, whereas research into entrepreneurship in general benefitted from a sustained interest, leading to numbers of replicated studies, this was seldom the case where academic entrepreneurship was concerned Much of the information exists in a vacuum, as a result Since at this time investigations were conducted almost exclusively by American researchers into academic entrepreneurship in the US, we cannot adduce parallel evidence from other countries to help us out of this dilemma Paradoxically, during the 1980s the converse situation appears to have arisen· studies of academic entrepreneurship have been conducted in Europe and Canada at a time when American researchers are paying relatively little attention to the subject It is not clear whether it is valid to compare recent findings with earlier American studies, although researchers commonly succomb to this tendency. Entrepreneurship is not an activity which takes place in a vacuum, but is subject to numerous influences The problem of whether it is possible to control for the changes wrought by the passing of almost two decades has not been solved, indeed, the question seems hardly to have been posed

In the intervening years, the problems pertaining to academic entrepreneurship literature have become more acute Today, in both the US and Europe, entrepreneurship in general has become the subject of major, methodologically rigorous investigations in the best sociological tradition However, whilst academic entrepreneurship enjoyed the attention of American researchers in the late 1960s and early 1970s, in the intervening years attention has focused more on female entrepreneurship, ethnic entrepreneurship, minority entrepreneurship, *etc.* There have been relatively few studies of academic entrepreneurship during the 1980s, so that the subject has not benefitted from sustained, major, methodologically rigorous investigations by specialists

It is possibly this shortcoming which has encouraged commentators from other disciplines to feel confident that they know as much about the subject as the next person The peripheral literature is dotted with naive and dogmatic claims about academic entrepreneurship which are quite unsupported by hard evidence One obvious example is the widespread belief among European commentators that in the US university research discoveries are commonly exploited by academics who found new technology-based firms expressly for this purpose, whereas in Europe academic entrepreneurs are a rare phenomenon (see, for instance, Sharp, 1985, Swinnerton-Dyer, 1989) They seem willing to draw their conclusions from what appears to be purely anecdotal and impressionistic evidence (see *eg.* Spinks, 1980) - unless, perhaps, their claims are based on circumstantial evidence, such as the plethora of literature relating to academic entrepreneurship in the US compared to the dearth of relevant literature relating to most other countries If so, it is worth noting that while the weight of literature may genuinely reflect a higher incidence of academic entrepreneurship in the US, it may equally reflect the relatively recent interest which European academics have taken in entrepreneurship research in general and their failure to date to address the question of academic entrepreneurship in particular This, in

turn, may be a reflection of the priorities of Europe's more limited sources of research funding. There is little doubt that the media hype which has surrounded many academic spin-off companies in the US has also served to encourage an inflated perception of the incidence of academic entrepreneurship. Bok (1982) cites as examples "Bacteria Tycoons Start a Real Growth Industry" and "The Biology Business. The Bandwagon Begins to Roll". Headlines like these also encourage the perception of academic spin-off companies as successful, multi-million dollar enterprises, when in fact academic spin-off companies have tended to perform less well than industrial spin-offs, as we shall see.

It is evident that European commentators are not alone in their belief that academics and entrepreneurship go hand in hand in the US Some American commentators have felt the need to place the entrepreneurial activities of American academics in a perspective less tinged by hyperbole Following 20 years' experience of academic spin-off companies - both as co-founder, dean of a university college and more recently as innovation centre consultant, Brown (1982) emphasised " .. the overwhelming majority of faculty do not want to be entrepreneurs Furthermore, sufficient barriers exist to block the path and discourage all but a few to take such a drastic step" Brown's comments are particularly significant, given that his assessment is based on experience of a university (Utah) which actively encourages academic entrepreneurship In the light of this perspective, it is less surprising to discover that some American commentators also bemoan the lack of entrepreneurial spirit exhibited by American academics (*eg* Bearn, 1981)

It has been argued that the entrepreneurial image of American academics is based on a fundamental misconception Luria & Luria (1970) concluded that despite its "get up and go" image, academic entrepreneurship is an inherently passive activity. American academics are responding to society as it is, instead of generating evolutionary change.

This view is reminiscent of models of competition proposed by neo-classical economists, in which the entrepreneur is seen as as "a sterile eunuch, a puppet manipulated by the invisible hand ... he does not create, he does not innovate, he merely reacts" (Williams, 1981) Kenney's investigation of the manner in which academic spin-off companies to exploit biotechnology came into being tends to support this view of academic entrepreneurs (Kenney, 1986) He concluded that during the 1970s spin-off companies were nearly always the result of an independent entrepreneur soliciting the co-operation of an academic, often taking 6-12 months to identify the right person. At the University of California (San Francisco) Boyer was approached by Swanson and together they formed Genentech; David and Isaac Blech approached Nowinski at the Fred Hutchinson Cancer Research Centre, leading to the foundation of Genetic Systems, Adams approached Bogorad at Harvard, which resulted in the formation of Advanced Genetic Sciences, to take three examples Once they understood the potential of biotechnology, venture capitalists started to undertake systematic searches for suitable academics, both in the US and Europe. This is how Biogen, the company associated with Harvard Nobel prize-winner Walter Gilbert, came into being According to Kenney, it was not until the early 1980s that entrepreneurial academics began to approach venture capitalists on their own initiative Royston and Birndorf of the University of California were among the first, when they approached Brook Byers of Kleiner, Perkins, looking for backing to set up Hybritech Unfortunately, this is a question which has only recently received attention in the literature We have no way of knowing whether most academic spin-off companies are the result of academic initiative or the initiative of venture capitalists, bankers, large corporations pursuing corporate venturing strategies, or even successful academic entrepreneurs of an earlier generation This is a matter of some importance, given the interpretation which has been placed on the remarks of British industrialists like those from English Electric who believed that " the American don is prepared to launch into

business by himself and to achieve success by his entrepreneurial activities, backed by his scientific knowledge and skills" (Eastwood, 1969) More recently we find the Chairman of the University Grants Committee making similar statements " ... inside most American academics there is an entrepreneur struggling to get out. If an American professor finds something which he thinks can be turned to commercial advantage, he either contacts an industrial company or establishes a new one to exploit the discovery" (Swinnerton-Dyer, 1989)

Inevitably, given the preponderance of American literature, most of our insights into academic entrepreneurship relate to the situation in the US Given that the British government appears bent on emulating the situation which obtains in American universities, doubtless in the hope of stimulating British academics to embrace entrepreneurship as readily as Americans are supposed to, this is not in itself problematical from the perspective of this study. However, as has been indicated, the literature is often based on research in which rigour and scope were wanting and is characterised by large gaps We could be forgiven for concluding that where academic entrepreneurship is concerned, a little knowledge is a dangerous thing.

4.2 Defining "Academic Entrepreneurship"

The traditional perception of the academic entrepreneur was someone who undertook fundraising activities to ensure the continuation of research programmes (Vollmer, 1962, quoted in Webster & Etzkowitz, 1991) The organiser and fund-seeker for the research group did not affect the channels through which the research results were distributed, except to increase the flow of research results, which were usually manifested in a higher incidence of journal articles, papers presented at conferences *etc* (Webster & Etzkowitz, 1991) This is not entirely consonant with the perception of academic entrepreneurs which

has come to be commonplace in the literature, anyway, in the intervening years The term "academic entrepreneurship" has been used extensively in the literature to describe the entrepreneurial (*ie* business-oriented as opposed to merely enterprising) activities of a number of different groups within the university. These range from academic staff employed in university departments or research laboratories/institutes (Shapero, 1966, Susbauer, 1972, Draheim, 1972; Roberts, 1972, Richter, 1986) to technicians (Susbauer, 1972, McQueen & Wallmark, 1982b) and students, both graduates and post-graduates (McQueen & Wallmark, 1982b; O'hEocha & Watson, 1984, Williams, 1985a; Cerych, 1985) In this review and in the fieldwork which follows, the focus will be on academic staff and will only refer to students and technicians if the respective literature also sheds light on business start-up by academic staff [1]. As a group, technicians confront the same problems as any technical entrepreneur They do not, however, confront the very particular, additional problems which face academics who wish to exploit their research discoveries by forming a business For this reason, these two groups are excluded from this study

It is evident that even if we restrict ourselves to the literature relating to the entrepreneurial activities of academic staff, there is no uniformly accepted definition of what constitutes an academic entrepreneur In the pioneering studies conducted during the 1970s, for example, some researchers required academics to have left their university and become a full-time "driving force" in their business (Cooper, 1972b) Others employed a far more loose definition· academic entrepreneurs ranged from full-time academics to ex-academics who had spent ten years in industry before founding their business (Roberts, 1972) In recent European studies, there has been a tendency to employ a more rigorous definition an academic entrepreneur is someone who leaves the university and founds their company directly, without an intermediary period in some pre-start-up activity,

whether this might be "relevant" or not (McQueen & Wallmark, 1982a) For the purposes of this review - and, indeed, the investigation which follows, an academic entrepreneur is someone who attempts to found a new technology-based firm either on a part-time basis, combining this with their academic duties, or on a full-time basis, leaving the university to concentrate on the business. It also includes academics who opt for a combination of part-time and full-time, by taking unpaid leave of absence or using a sabbatical to get the business off the ground, later returning to the university on at least a part-time basis It does not include academics who leave their university and found their businesses some years later, but it does include academics who leave their university and found their business directly

4.3 Are People Born to Be (Academic) Entrepreneurs?

4.3.1 Introduction

Many entrepreneurship researchers have been preoccupied with the question of why it is that some people try their hand at entrepreneurship while others do not One school of thought holds that entrepreneurs are born, rather than "made" - a multi-faceted concept which will be explored in greater detail in the next sub-section It has been claimed that, as a group, entrepreneurs exhibit certain characteristics in significantly greater or lesser measure than the population from which they are drawn Characteristics cited range from gender - they are predominantly male (Manpower Services Commission, 1985), sibling position - they are generally the oldest child or oldest son (Roberts & Peters, 1981; Hisrich & Brush, 1985), to membership of an ethnic or religious minority - a higher than expected proportion has been found to be *eg* Jewish (Litvak & Maule, 1974). However, it has recently been established that in Britain, certainly, the extent of over-representation of ethnic minority group members in self-employment is minimal, relative to their proportions in the population as a whole (Jones & McEvoy, 1986) Moreover, it is also

recognised that this may change over time - that Jews, for example, have moved from a heavy involvement in small businesses to a wider range of occupations, particularly the professions (Curran, 1986)

Entrepreneurs are also said to exhibit in greater measure than the population from which the are drawn a variety of personality traits. These include need for achievement, need for affiliation, need for autonomy and need for power (Maslow, 1954, McGregor, 1960; McClelland, 1961), anxiety or neuroticism (Lynn, 1969), persistence, self-confidence (Cromie & Johns, 1983), resilience, self-reliance (Hornaday & Aboud, 1971) *etc etc.* The explanatory value of such traits - singly or in constellations - has been called into question recently. Chell (1985) argued that there usually appeared to be a very low correlation between the measure (*ie* assessment of the trait) and actual behaviour, moreover, the underlying assumption of trait theory is that the individual is consistent in expressing it - but how consistent are people, in fact? And how far does the impact of various situational factors modify an individual's behaviour? Moreover, how credible is the concept of "personality traits", in any case?

Notwithstanding such arguments, the explanatory power of psychological traits is particularly popular with researchers who observe that entrepreneurship is an iterative process, that is to say, entrepreneurs who fail will pick themselves up and start again, while entrepreneurs who succeed will often sell out and start again

4.3.2 Academic Entrepreneurship as a Function of Inherited Characteristics

Studies of academic entrepreneurs suggest that they tend to exhibit some of these supposedly inherited characteristics Roberts & Wainer (1971), for instance, found that technical entrepreneurs spinning out of American universities frequently had demographic

characteristics which McClelland's work showed to be related to need for achievement. Wainer & Rubin (1969) established that the business success of academic entrepreneurs was directly related with their TAT (thematic apperception tests) scores for achievement motivation However, academic entrepreneurs seem not to have been subjected to personality trait analysis to the same extent as entrepreneurs in general, so we should not attempt to draw definitive conclusions from these isolated findings Moreover, it is not at all clear whether studies reporting such findings to date have elicited data from statistically valid samples which would permit extrapolation to the wider population of academic entrepreneurs

With regard to gender, one must assume by default that academic entrepreneurs studied have been predominantly or even exclusively male, since it proved impossible to locate any studies which referred to female academic entrepreneurs or distinguished samples as composed of different proportions of male and female academic entrepreneurs Studies of academic (as opposed to technical) entrepreneurs have either failed to consider ethnic and/or religious profiles, or have found no correlation (*eg* Roberts & Peters, 1981) The relationship between academic entrepreneurship and sibling position established by Roberts & Peters' (1981) has already been cited

4.4 Are (Academic) Entrepreneurs "Made"?

4.4.1 Introduction

Other theorists have proposed an association between entrepreneurship and certain aspects of the socialisation process, thereby making the first steps on the journey towards the opposing theory - namely that entrepreneurs can be "made". These theorists are concerned with nurture rather than nature, highlighting a reported tendency for entrepreneurs to come from families where there is involvement in small business - whether on the basis of

self-employment or as small business owners (Watkins, 1973, Litvak & Maule, 1974), or to have been exposed to other entrepreneurial role models (Shapero, 1971; Cooper, 1971, Draheim, 1972; Cooper, 1973). The proportion of technical entrepreneurs coming from such families is reported to be particularly high; Roberts (1969), for instance, found that in all the source organisations he studied, those reporting self-employed fathers consistently represented around 50 per cent, while Roberts & Wainer (1971) and Shapero (1971) also found disproportionately high percentages.

Other theorists again have progressed considerably further on the journey towards the opposing theory, proposing, for example, that in some cases entrepreneurship is a response to the organisation in which they previously worked, that some entrepreneurs are "pushed" into entrepreneurship by events happening in or characteristics of the organisation in which they were previously located, rather than "pulled" towards entrepreneurship by their personality traits, or by attributes of the activity of entrepreneurship itself, or the particular manifestation of the entrepreneurial venture in question, or perhaps by events or opportunities to which the entrepreneurial venture might respond - such as capitalising on a particular market opportunity. Another way-station on the journey towards entrepreneurs being made rather than born is occupied by those who claim that entrepreneurs found their first business in their thirties - or their forties, in Europe (Scott, 1980) A number of reasons have been proposed for this - for example, it is not until then that entrepreneurs are sufficiently well established financially to consider taking such a step - or, less positively, by that age people become disenchanted with their career prospects and take their future into their own hands (Cooper, 1971; Liles, 1974, Shapero, 1975; Brockhaus, 1980, Scott, 1980) Yet another way-station on this journey is occupied by those who believe that the incidence of entrepreneurship is variable, depending on the character of the prevailing culture - that the incidence of

entrepreneurship will increase in the context of an "entrepreneurial culture".

At the very end of the journey, of course, we find theorists who believe that entrepreneurship can be taught, in much the same way that, say, brain surgery can be taught (Gibb, 1984) It is not unusual for these theorists to (try to) put their beliefs into practice, by running courses Curran (1986) observed that in 1970 it would have been hard to find a course for the intending or existing small enterprise owner; in the 1980s, in contrast, there was hardly a college, polytechnic or university without at least one course in small business education Curran also observed that research on the content and effectiveness of small business education has been very limited, and that research in the US, where such courses have been established for a longer period, suggests that they should be viewed with scepticism

4.4.2 Academic Entrepreneurship as a Function of the Socialisation Process

Some studies of academic entrepreneurs suggest that they tend to exhibit characteristics which lend support to the view that academic entrepreneurship, like entrepreneurship in general, is associated with particular aspects of the socialisation process Roberts & Wainer (1971) and Susbauer (1972) found, for instance, that a high proportion of academic inventors who decided to entrepreneurially exploit their invention came from families where there had been involvement in small business - whether on the basis of self-employment or as small business owner-managers However, Roberts & Peters (1981) found no such correlation in their study of spin-offs from MIT, specifically Doutriaux & Peterman (1982) reported that only 25 per cent of Canadian academic entrepreneurs studied had self-employed parents and concluded that Litvak & Maule's (1974) findings were not confirmed by their own findings, however, they give no indication of the proportion of the Canadian population as a whole who are self-employed or small business

owner-managers, so this percentage does not necesarily contradict Litvak & Maule's findings. Academic entrepreneurs' prior exposure to other role models is not very well documented.

4.4.3 Academic Entrepreneurship as a Function of an Enterprise Culture

European commentators often attribute the supposedly high incidence of academic entrepreneurship in the US to the positive attitude towards enterprise which has prevailed for much of this century (Sharp, 1985). Although the term "enterprise culture" has become something of a cliche in the hands of politicians and the media, as a concept it has a fairly impeccable pedigree It derives largely from McClelland's empirical work on achievement orientation, though it has been refined considerably over the intervening years McClelland established that business entrepreneurs throughout the world are characterised by a need for achievement (nAch) At any given time, however, countries differ in their achievement orientation; moreover, over time the achievement orientation of individual countries varies [2] (McClelland, 1969) An "enterprise culture" is not a nebulous, meaningless cliche but a form of national ethos which is becoming increasingly quantifiable, as additional indicators are established

Interestingly, very few American observers have attributed the incidence of academic entrepreneurship to the prevailing enterprise culture, perhaps because McClelland believed that education influences the level of achievement orientation, which generates a circular argument Cooper is an exception he found that 25 per cent of the US firms he studied had been "incubated" by universities/teaching hospitals, a significantly higher proportion than that established by earlier studies he had conducted He attributed this to a climate which is more favourable towards entrepreneurs, encouraging founders to emerge from organisations which had not previously served as effective incubators (Cooper, 1986)

Some European observers have come to a similar conclusion For example, McQueen & Wallmark (1982b) note that since patenting and spin-off company formation has become a socially desirable phenomenon in Sweden, there has been a substantial increase in the proportion of academics filing patents and forming companies. However, none of these studies set out expressly to explore this issue and it is unfortunate that their conclusions are based on impressions, not on quantifiable indicators.

In recent years, research into entrepreneurship in general has focussed less on the extent to which a country has a nationally prevailing enterprise culture than on the extent to which specific regions are characterised by an enterprise culture This follows the observation that the rate of new firm formation is not distributed evenly throughout a country It varies from region to region, within regions and between different types of region (*eg* urban/rural). This phenomenon has been observed in the US, the UK and several European countries (Storey & Johnson, 1985). A growing body of literature has implicated a number of factors, including the level of unemployment, the socio-economic profile of the region, the existing industrial structure, the availability of seed and venture capital, *etc.* This literature was reviewed in detail by Whittington (1986), who emphasised that many of these factors interact. He concludes that influences on entrepreneurship operate in a far more complex and localised manner than has generally been suggested. This is almost certain to be true of academic entrepreneurship, too, yet research on this front has so far failed to consider the impact of the regional culture *vis-a-vis* enterprise on the incidence of spin-off company formation by academics

Some entrepreneurship researchers have proposed an approach which is more focussed, however Schell & Davig (1981) highlight the need for research which might, for example, build on the work of Riggs (1964) Riggs argued that elites in the local

community have a high degree of control over the emergence of entrepreneurs Riggs' model was originally developed to explain national levels of entrepreneurship, but according to Schell & Davig, there is substantial evidence that the same forces work at all levels of society, including regions and local communities [3]. Wilken (1979) started to develop Riggs' concept and concluded that in different types of community, the social groups which predominantly generate entrepreneurs will differ. In "fused" communities [4], for example, it is likely to be the mainstream, collective business activities of the majority, Protestant merchant class. Wilken has not specifically considered academic entrepreneurship, but if his model is valid, by analogy academic entrepreneurs are unlikely to flourish in certain types of community This has yet to be demonstrated empirically, however Just as research has yet to explore the impact of the regional enterprise culture (or lack of it) on academic entrepreneurship, it has also failed to relate the university and its academic staff to the community in which they are located Significantly Cooper, responsible for much of the early research into academic entrepreneurship, recently proposed that measures should be established of the extent to which different "places" represent an entrepreneurial environment (Cooper, 1986). In his view, this might involve indicators like knowledge about the entrepreneurial process, sources of assistance, awareness of role models, perceptions of risks and rewards associated with entrepreneurship *etc* Cooper's list could be extended to include the role of elites in the surrounding community, together with other indicators which have been implicated following research into the incidence of entrepreneurship in general Using these measures, we might then be able to establish the extent to which academic entrepreneurs are influenced by the regional/local environment in which they and the university operate

A comprehensive approach to the wider influences on academic entrepreneurship might also need to encompass the impact of specific critical incidents Some observers have

noted in passing that critical incidents at a national level have created entrepreneurial opportunities which have been exploited by academic entrepreneurs Draheim (1972) gave a number of examples, including the introduction of the Medicare and Welfare programmes in the US This led to an injection of private and government spending on health and welfare, facilitating the creation of medical/hospital supply services Sharp (1985) argued that the Vietnam war had a similar effect: because American universities were reluctant to undertake defence research, defence projects were awarded to government research institutes and to a new institution, the independent research-based company, founded by dissenting academics For her, this was the primary stimulus for the so-called "Route 128" phenomenon It is likely that critical incidents at a regional or local level could have a similar impact There are references in the literature which suggest that this is the case· Babbitt (1984) noted the effect which establishing a science park locally had on American academics, Williams (1985b) observed the same phenomenon in the UK.

4.4.4 Academic Entrepreneurship as a Function of the University System

To date American researchers have preferred to focus on academic entrepreneurship as a function of the university system, rather than a function of the prevailing culture. In the 1960s a number of commentators concluded that universities were uniquely well-equipped to incubate new technology-based firms (Deutermann, 1964, Allison, 1965, Shapero, 1972) Typical of this ilk was Lamont (1972a)· "[Universities are] a source of significant research, technical entrepreneurs and the technology which is so vital to economic growth." The idea that universitics were effective incubators of spin-off companies received support from early empirical work in the US. In a large-scale study, Cooper (1972b) established that universities were incubating technical entrepreneurs at a higher rate than government research institutes (1/1950) or large corporations (1/678). The spin-off rate for universities varied from 1/122 to 1/736, depending on the base population

employed (*eg* engineering faculty plus contract researchers versus faculty and researchers in engineering, the physical sciences and business studies). In view of management scientists' conclusions about the kind of environment which is supportive to entrepreneurs, findings like this did not cause undue surprise. According to Forrester (1965), for example· "In today's small business world, the risk to the budding entrepreneur is greater than it need be In general he gets but one chance. There is no opportunity to practice and improve ability if the first undertaking is not a success. [In an ideal situation] the individual grows from initially managing his own time, to managing small projects, to becoming an entrepreneur who matches customer needs to the abilities of the organisation This evolution without discontinuity from individual worker to entrepreneur can stop or be redirected at any point" Forrester suggested that in the corporate world trying to change direction like this would be tantamount to career suicide; it would be unremarkable in the context of a university, however

The idea that the American university system is a particularly good incubator of technical entrepreneurs has attained the status of an article of faith in some quarters In view of the sheer diversity which characterises American universities, we must presume this claim relates to the major research universities. Certainly the ability to incubate technical entrepreneurs has been attributed to a number of idiosyncratic features which characterise these universities as a group. It is believed that these act as what we might call as positively "enabling" features - or, in some instances, negatively "enabling"

Consultancy

Sociologists have identified consultancy as one of these "enabling" features (Burns, 1969, Williams, 1985a, Richter, 1986) Richter sees the progression from consultancy to academic entrepreneurship as a consequence of economic forces intensive consulting

activities lead to incorporation for tax purposes; this in turn leads to expansion from personal consulting to additional entrepreneurial activities Burns saw it as a consequence of developing an interface between academia and industry. for him, consultancy was "an academically deviant practice which provides a channel for breaking through the institutional confines which have grown up around academic research, engineering technology and manufacturing R&D". Whatever the mechanism, there are certainly numerous examples in the American literature of academics who started out as consultants and subsequently became entrepreneurs, either through their own start-up companies or by forming new subsidiaries of the company for whom they were consulting (Kenney, 1986). These should probably not be dismissed as isolated examples: it has been observed that organisations which offer few/no opportunities for consulting are poor incubators of spin-off companies (Cooper, 1972b). Furthermore, a study commissioned by the NSF into factors affecting the formation of university spin-offs found that in universities with a high level of spin-off companies, faculty consulting was particularly extensive (ABT Associates, 1984)

Although consultancy was originally an American concept, first introduced at MIT, it is said to have been uniformly accepted in UK universities for many years, and actively encouraged in a large proportion of them (CBI, 1970) Consultancy is also undertaken in some European universities, most notably those in Germany and Holland (Sharp, 1985) However, in the US the incidence of consultancy is probably considerably higher. A study of 27,000 academics from a cross-section of all disciplines established that around 60 per cent of American academics do consultancy work, a figure which seems to remain fairly constant over time (Patton, 1980) In the US, medium-sized companies are known to employ academic consultants as the most common source of external advice, on both general and specific matters (CBI, 1970) In the UK, in contrast, although engineers and

scientists in industry used external sources of information more frequently than internal sources and regarded them as of higher quality, these were principally written sources (journal articles, trade magazines, science magazines *etc*) rather than person-to-person contacts entailed in consultancy (Angell, Collins *et al*, 1985) The interface between academia and industry seems to be altogether better developed in the US than the UK. It is significant that academics from the UK who visit the US are 3-5 times more likely to give lectures to American companies than they are to UK companies. In fact, one survey established that 38 per cent of academics from the UK had only given lectures to American companies (CBI, 1970). Thus, consultancy may be less "enabling" for British academics than for their American counterparts - or may have been so twenty years ago.

Competitive Research Funding and Lack of Tenure

Where academic entrepreneurship is concerned, many other positively "enabling" features are cited in the literature Price (1968) believed that the American university system bolstered faculty initiative and entrepreneurship in a way which the university system in the UK or Europe did not, because the manner in which research was funded in the US acted as an incentive to entrepreneurial behaviour. In the US funding used to be awarded directly to the individual academic; US academics controlled what happened to research funds which they won and were free to take the grant with them to a rival institution (CBI, 1970) In the UK the bulk of university funding was institution-based and even project-based funding from research councils or private foundations was awarded via the institution In Price's view, this stifled initiative and entrepreneurship, acting as what we might refer to as a "disabling" feature However, in the light of increasing competition for research funding which seems to be decreasing in real terms, there may no longer be such striking differences between US and UK academics when it comes to "entrepreneurial" (*ie* enterprising) activities such as fund-raising, managing personnel within research groups or

departments, publicising the group's activities *etc.* The HoD in a major department may be becoming more and more akin to a CEO in a medium-sized corporation - though Webster & Etzkowitz (1991) remind us to be cautious about such analogies, given that management in a department or a research context may be very different to management in a corporate context.

Fierce competition for tenured academic posts leaves a relatively high proportion of US academics to exist on nine-month contracts [5]. This forces many academics to actively solicit funding on a routine basis. James Bonner, academic founder of Phytogen, believes this is essentially an entrepreneurial activity: "Each academic scientist is an entrepreneur, employing a larger or smaller corps of colleagues, supported by the funds which the scientist can charm out of federal and private sources .. in the form of grants and contracts" (Bonner, 1981) It has also been seen as a similar activity to raising capital for business start-up Etzkowitz (1983) quotes a biologist from the University of Michigan as saying that his experience in grant-writing gave him an edge in writing proposals to the Small Business Administration The experience of managing major research projects of the type described by Bonner is also said to equip American academics with many of the skills which are required when setting up a business The experience makes it easier for them to make the transition from an academic to a business environment [6] (Lamont, 1972a).

Etzkowitz has developed this analogy in recent years, noting that major academic research groups operate as "quasi-firms" within the university, lacking only a direct profit motive to make them a firm in the usual sense of the word When professors move outside of the university to found a firm (in the usual sense of the word), their academic expertise is held to stand them in good stead They negotiate with venture capitalists instead of research agency programme managers, hire employees instead of recruiting students and

post-doctoral researchers *etc etc* (Etzkowitz (1989), detailed in Webster & Etzkowitz (1991)) In much of the American literature, entrepreneurship is portrayed as an activity which is almost an extension of academic duties, rather than a sharp departure from them (Etzkowitz, 1983). It is presented as one of a number of options which an academic might pursue, having been positively "enabled" by idiosyncratic features of the university system.

Other studies highlight features which we might describe as negatively "enabling". An obvious example is the job insecurity inherent in the position of many American academics This is seen as pushing them towards entrepreneurship as a defensive response to a perceived lack of options. Draheim (1972) found that spin-off companies were formed by staff during the period when the Rosemount Aeronautical Laboratory at the University of Minnesota was constantly threatened with closure owing to lack of contract research Similarly, Roberts (1972) observes that the decision to limit the size of MIT's Lincoln Laboratory acted as a strong stimulus to staff to form spin-off companies A study of academic entrepreneurs in Sweden is particularly interesting in the light of these observations There, as academics got older, finally attaining faculty status and job security [7], they were less likely to become entrepreneurs (McQueen & Wallmark, 1982a), despite considerable evidence to suggest that under normal circumstances, they would be more likely to become entrepreneurs as they got older. In Europe, people tend to become entrepreneurs in their forties, rather than their twenties or thirties (Watkins & Watkins, 1986), as these Swedish academic entrepreneurs did In this instance, an idiosyncratic feature of the Swedish university system appears to have a "disabling" effect on academic entrepreneurship.

Means to Autonomy

A number of other threats have been*p1074Xidentified ing American academics toward entrepreneurship as a defensive strategy Richter, a sociologist, believed that the introduction of unionisation, equal rights requirements and health and safety legislation in the 1960s acted in this way Initially experienced by most academics as an intrusion upon American academic life, in the intervening years, unionisation came to represent a collective means to protect academics' professional autonomy against challenges to it In Richter's view, entrepreneurship was the individual corollary to unionisation, giving academics "organisational and financial footings completely separate from the bureaucratic structures of their own universities and completely separate from the funding sources upon which many of them have become dependent" (Richter, 1986) Autonomy was increased by multiple organisational ties, rather than exclusive ties to a single organisation Academic entrepreneurship was a common response to a perceived threat for two reasons in the US society places value on entrepreneurship and academic duties are expressed in sufficiently vague terms that it is seldom overtly proscribed in academics' job descriptions If Richter's analysis is correct, it is likely that the "comfort levels" of American universities have diminished since the 1960s. If academic entrepreneurship has become increasingly prevalent in the intervening years, as Richter claims, this may partly explain why· organisations in which employees experience high "comfort levels" are not good incubators of entrepreneurs [5] Cooper (1972b)

Career Prospects

Irrespective of the recent history of American universities, the "comfort levels" associated with an academic career may diminish over time anyway, due to the perception of increasingly limited career prospects Academic entrepreneurship has been seen as a response to this (Doutriaux & Peterman, 1982, Kenney, 1986, Kulicke & Krupp, 1987),

and if the incidence of academic entrepreneurship is one day proved to be higher in the US than Europe, this may partly explain why. In Europe academics can generally expect to wait much longer before being appointed to a chair, because of the rigidity of the faculty structure (Sharp, 1985), most still have academic goals to achieve during their forties and fifties, even though by their late thirties, they have probably passed their most productive period in scientific terms (Pelz & Andrews, 1966). Academia is said to present north American academics with an increasing lack of challenge as they get older - with the result that entrepreneurship seems an attractive proposition It has been established that many entrepreneurs take up entrepreneurship precisely because they see it as a challenge (Todd, 1977) and there is evidence that Canadian academics became entrepreneurs precisely for that reason (Doutriaux & Peterman, 1982)

It should be stressed that much of this literature is highly speculative in nature. It is difficult to assess the extent to which idiosyncratic features of the American university system actually "enable" academic entrepreneurship, since there is a dearth of rigorous, controlled studies No serious attempt has been made to establish the effect of idiosyncratic features of other countries' university systems in order to make reasonable comparisons For this reason, we should be wary of the numerous claims in the literature about "disabling" features of other countries' university systems. For example, Sharp (1985) commented repeatedly that the rigid and hierarchical nature of the German university system militates against "American-style" academic entrepreneurship, but her claims are not backed up by specific details. This is unfortunate, in view of the fact she went on to imply that since universities in Scandinavia, Holland and Switzerland were modelled on the German system, by analogy these university systems are also likely to inhibit academic entrepreneurship For all we know, this is an unwarranted slur on the German university system, coloured by the conviction that no university system "enables"

academic entrepreneurship like the American system However, Allesch (1987) was more specific about "disabling" features of the German university system. He listed restrictive regulations about part-time activities, the inability to pay lecturers for outside activities, too high a burden of teaching and research, inadequate technical support staffing levels, inflexible staff management systems and insufficiently flexible funding for projects. Bullock (1983) suggested that such features may have an inhibiting affect on the incidence of academic entrepreneurship, but this is a tenuous conclusion to draw without benefit of further research Significantly, though, a recent study of new technology-based firms in West Germany established that 18 per cent had been founded by academics (Kulicke & Krupp, 1987) One wonders whether the percentage for the US would be any higher, for although American academics account for a very large proportion of biotechnology start-ups, it seems unlikely that academic spin-off companies in the United States account for more than 18 per cent of new technology-based firms across all industrial sectors

4.4.5 Academic Entrepreneurship as a Function of Institutional/Departmental Ethos

Whilst idiosyncratic features common to the US university system may positively or negatively "enable" academics to become entrepreneurs, on their own these features do not account for the patterns of academic entrepreneurship observed in American universities. Universities appear to vary widely in the extent to which they act as incubators to technical entrepreneurs. In his study of new technology-based firms in Austin, Texas, Susbauer (1972) found that 68 per cent were academic spin-offs, a similar study of new technology-based firms in Minneapolis/St Paul established that the University of Minnesota had acted as incubator to only 2 per cent of local spin-off companies (Lamont, 1972b) Although these researchers failed to pursue the matter in any detail, clearly these figures owe much to circumstances beyond the control of the university, such as the

availability of venture capital, skilled labour, economic rents, grant-aid, the state of the infrastructure, the extent to which a "critical mass" of technology-based firms has developed locally *etc* Despite this fundamental weakness in the literature, it has generally become accepted that universities do incubate technical entrepreneurs at different rates Much of the early literature was preoccupied with establishing the spin-off rates of individual universities [9]. The resulting figures led some commentators to regard MIT, Stanford and the Universities of Michigan and Texas as exceptions, rather than the norm (Shapero, 1972) In the intervening years, the advent of biotechnology and information technology has necessitated redrawing the map of universities in north America which have incubated significant numbers of technical entrepreneurs There are now clusters of new technology-based firms founded by academics around Carnegie-Mellon, the Universities of Utah and Pennsylvania and around the Ecole Polytechnique in Montreal, for example (Cooper, 1986) Moreover, a study of 57 rural universities identified 1700 academics who had founded new technology-based firms, an average of 30 per university (Buck *et al*, 1984)

Beyond suggesting that there is probably wide variation in the extent to which universities incubate technical entrepreneurs, figures like these are of questionable value The researcher who pioneered studies of academic entrepreneurs has commented on the difficulty involved in tracking down spin-off companies. They exhibit what he refers to as the "iceberg effect" even the head of MIT's Instrumentation Laboratory was unaware of the extent to which his own laboratory staff had spun off companies, despite his well publicised support for them (Roberts, 1972) In situations where academic spin-off companies are proscribed or frowned upon, it is less likely still that they will all be identified Even if they gave an accurate picture, statistics like these are not particularly useful unless they trigger studies to explore the reasons for the wide variation. However,

there has been little systematic study of why particular universities exhibit higher rates of entrepreneurial activity than others. We are obliged to glean information from papers which touch incidentally on this question following relatively unstructured research.

Institutional Ethos

During the 1960s and 1970s few American universities had formally discussed issues such as academic entrepreneurship, let alone formulated detailed policies. There was often nothing concrete which researchers could put their finger on to explain the differences between institutions. For want of quantifiable indicators, some commentators simply attributed the differences to institutional ethos Shapero noted that at MIT in the 1960s "there were professors who felt they had to start a company because they would be left behind if they were not entrepreneurs". At California Institute of Technology, in contrast, academic entrepreneurship was "specifically frowned upon", and Carnegie Institute of Technology, a worthy comparison with MIT, appeared not to have any spin-off companies (quoted in Cooper, 1972b) Some universities were seen as having a "permissive attitude" which was said to encourage academic entrepreneurship and others a negative attitude, which was said to lead to a low level of academic entrepreneurship (Susbauer, 1972, Shapero, 1972, Brown, 1982, Bullock, 1983, Segal, Quince, 1985) - though Bullock was less concerned with attitudes *per se* than with practical manifestations of attitudes which lowered or raised the threshold to commercialisation

Some researchers speculated about the source of this ethos A number of studies identify a person of stature, reputation and prestige in a policy-making position in the university as determining the ethos *vis-a-vis* academic entrepreneurs Shapero (1972) regards Frederick Terman, former vice-president and provost of Stanford and head of the engineering school, as the classic example "so great did his reputation become for encouraging the

founding of new businesses that few left the university to found a new R&D business without his recommendation". McQueen & Wallmark (1982b) also commented on the value of support "from the top", from the principal/president of the university. Certainly, at MIT, support for academic spin-off companies has come "from the top", but it is worth noting that support has often been motivated by concerns other than facilitating academic entrepreneurship Roberts (1972) indicated that MIT encouraged spin-offs in situations where researchers had opted to work on classified research; on one occasion, MIT spun-off an entire laboratory into a company with 99 founders, because the laboratory was involved in a classified Atomic Energy Commission project

Departmental Ethos

Other researchers have seen it as more helpful to consider the different rates at which universities incubate academic spin-off companies on a departmental basis rather than an institution-wide basis The ethos of conventional university departments appears to differ appreciably from that of the newer contract research laboratories and institutes Conventional university departments tend to incubate relatively fewer academic entrepreneurs than contract research laboratories and institutes (Shapero, 1966, Shapero, 1972), though atypically, Lamont (1972b) found a 50 50 split at the University of Michigan Two separate studies by Cooper and Roberts illustrate this particularly well Stanford's school of engineering has incubated relatively few spin-off companies compared to MIT's, yet both universities are known for their support of academic entrepreneurs. The majority of identifiable companies spun-off from MIT were founded by laboratory staff, not departmental staff - and at MIT none of the laboratories are affiliated to academic departments (Roberts, 1972). Stanford has a more traditional, departmental set up, with few full-time staff employed in semi-independent laboratories (Cooper, 1972b). It is believed that contract research laboratories and institutes incubate technical

entrepreneurs at a higher rate because they have a more "applied" ethos [10]. Certainly the earliest known examples of academic entrepreneurs had an applied background From as early as 1811 German university chemists co-founded companies to exploit their research findings [11]. Most of them had been practising pharmacists prior to becoming academics (Etzkowitz, 1983). More recently, it would appear that in conventional departments academics with an applied orientation are more likely to become entrepreneurs. Susbauer (1972) found that under 20 per cent of academic entrepreneurs from departments at the University of Texas at Austin were "blue sky" researchers The majority had a strongly applied orientation and they were often provoked into forming a spin-off company by dissatisfaction with their university's decision not to follow up research with development work which would lead to a product Roberts (1972) also observed that when MIT imposed a policy of non-involvement in production on its Lincoln Laboratory, this acted as a strong stimulus to staff to form spin-off companies It has also been established that academic entrepreneurs have a greater propensity to invent than the average academic Academic entrepreneurs at a Swedish technical university filed an average of 1 4 patents per academic over a 15-year period (McQueen & Wallmark, 1982a), nearly twice the rate established for academics in general at UMIST (Norris, 197?), though the two studies are not directly comparable

This suggests that pure science departments are likely to incubate academic entrepreneurs at a lower rate than applied science departments. Surprisingly, the literature devotes little attention to the relationship between the disciplinary profile of a university and the aggregate incidence of academic entrepreneurship within that university It is unusual to find details of the departments incubating spin-off companies in the early American literature This may be because it was observed early on that universities which incubate academic entrepreneurs are not necessarily strong in science/engineering, the converse did

not appear to obtain, either In both the US and Europe, it was found that there were universities which were strong in these areas - but which were associated with little or no entrepreneurship (Cooper, 1973) The few studies which detail the extent to which different disciplines within a university have generated academic entrepreneurs report quite conflicting findings Whereas Susbauer (1972) found high percentage of new technology-based firms at Austin had spun-off from the physics department, indeed the first ever new technology-based firm in Austin was formed by two physicists in 1939, a study conducted at a Swedish university established that just 9 per cent of spin-off companies originated in the physics department This compared with 44 per cent from electrical engineering, 18 per cent from mechanical engineering, 15 per cent from chemistry and 14 per cent from civil engineering (McQueen & Wallmark, 1982b) The authors are unwilling to attribute the low incidence of academic entrepreneurship in the physics department to the more theoretical nature of physics, citing Einstein's 15 patents as evidence that pure scientists are able to think in applied terms [12] They prefer to try and explain the variation in the numbers of companies spinning out of the engineering departments in terms of influences and conditions conspiring to constrain or encourage academic entrepreneurship. These may be endogenous or exogenous, or a combination of both

The history of the disciplines which are collectively known as biotechnology is of interest in this debate Biotechnology is a classic example of the argument that at any given time, the likelihood of a discipline yielding commercially exploitable discoveries varies Idiosyncratic characteristics of a discipline may also influence the mechanism by which discoveries are exploited In the US an unprecedented proportion of academics working in biotechnology have chosen to exploit their research discoveries by becoming academic entrepreneurs In fact, for many years the commercialisation of biotechnology was almost totally dependent on the entrepreneurial activities of university scientists Kenney (1986)

has described the "pervasive role of professors in managing and directing biotechnology start-ups" as unique in the annals of business history This phenomenon is said to be a consequence of the unparallelled proximity of basic biological research findings to applied biotechnological products and processes. Vannevar Bush's quip that the gap between research discovery and commercial application was "around 20 years" does not necessarily apply to biotechnology, where the gap can be a matter of months, even weeks, rather than years

In the purportedly "enabling" context of the US, biotechnology has been associated with an unusually high incidence of academic entrepreneurship. In a context which is less "enabling" or positively "disabling", this association has not been exhibited In France, for example, most of the new companies founded to exploit biotechnology have been offshoots of large, established companies or of research institutes like the Institut Pasteur (Sharp, 1985) The French government chose to exploit academic research discoveries by establishing four specialist technology transfer centres expressly to identify existing companies to develop research of potential commercial value Sharp concluded, characteristically, that the French government employed this strategy because French academics are not entrepreneurial. We might equally conclude that by employing this strategy the French government has wittingly or unwittingly constrained academics in this and related disciplines from becoming entrepreneurs

Although this example concerns nationally-prevailing constraints which originate outside the university system, there is evidence in the literature that some biologists in the US have been constrained by their university/department from exploiting their research findings by means of dedicated spin-off companies The medical school at Washington University has done this quite consciously and openly by assigning exploitation rights to a

large multi-national company in exchange for generous levels of research funding (Guze, 1983) In other cases, the evidence is more circumstantial Kenney (1986) has identified an east/west divide which is not explicable in terms such as the availability of venture capital On the west coast, the most common method of exploiting discoveries in molecular biology is through start-up companies established by academics with the help of venture capitalists, on the east coast, exclusive deals between university departments and multinational corporations is the most prevalent method There the well-publicised biotechnology companies founded by Baltimore and Sharp from MIT and Ptashne and Gilbert from Harvard represent the exceptions for biotechnology, not the norm. This is surprising, in view of the fact that it was the east coast which generated the "Route 128 phenomenon" through academic spin-offs from electronics and computing departments and laboratories How should we interpret this? Possibly departments exercise a strong influence over the manner in which research discoveries are exploited Possibly the difference is due to a change of institutional ethos during the course of the previous two decades This is an issue which will be discussed in further detail below

The impact of departmental ethos on the incidence of academic entrepreneurship was certainly considered by entrepreneurship researchers in the early 1970s, but not in a very structured way In his study of academic spin-offs from the University of Texas at Austin, Susbauer (1972) identified the attitude of departmental chairmen as critical He reported "We found time after time that the physics department was entrepreneurially very encouraging .. The [departmental] administrators not only encouraged vocally, they also sought capital funds, rented out university facilities in off-peak and idle hours and were generally very reinforcing to technical entrepreneurs, including some people who would probably never have started their own companies without this sort of backing". In contrast, the department of engineering at Austin was very negative towards outside

activities by faculty and had formally forbidden it for over 25 years This is an unusually clear-cut case for this period academic entrepreneurship was formally proscribed in the engineering department - and the head of department was clearly willing to enforce the rules This may be less true in American universities today a report commissioned by Cornell warned that departmental chairmen were likely to strongly resist the idea of enforcing restrictive rules *vis-a-vis* activities like academic entrepreneurship (Peat, Marwick & Mitchell, 1981)

The attitude of department heads/chairmen has received surprisingly little attention in the literature, either in north America or Europe There is very little information available, even on an incidental basis A Swedish study considered whether the attitude of department heads accounted for the wide variation in spin-off rates exhibited by a university's engineering departments The researchers concluded that the number of spin-off companies was more likely to be a function of the personal characteristics and drives of individual department members (McQueen & Wallmark, 1982b) On the other hand, a Canadian study reports that 54 per cent of academic entrepreneurs felt their university had been indifferent to their entrepreneurial efforts and 15 per cent felt that they had actually been undermined by their university Many identified deans of faculty and departmental chairmen as particularly unhelpful they regarded business ventures as beneath the dignity of a professor (Doutriaux & Peterman, 1982) On the basis of these and other isolated examples, we cannot gauge the extent and nature of the influence of department heads on the incidence of academic entrepreneurship. In view of the fact that an academic who becomes an entrepreneur may be less able to shoulder departmental responsibilities, this is an area of more than intellectual interest It represents a gap in the literature which would benefit from further research Furthermore, departmental ethos may be not necessarily be determined by departmental heads/chairmen alone, but by the majority views of members

of the department, or perhaps even by one or two particularly influential members.

It may be wrong, of course, to assume that the prevailing ethos in a department acts as a constraint to academic entrepreneurs. It may take formal regulation to have that effect The literature indicates that departmental hostility is a common reaction to the entrepreneurial activities of fellow academics and that this can have serious consequences, including being passed over for promotion (Etzkowitz, 1983) or being relieved of responsibility for graduate students (Kenney, 1986). It is impossible to tell from existing research whether hostility stifles academics' entrepreneurial inclinations Doutriaux & Peterman (1982) report that 24 per cent of Canadian academic entrepreneurs surveyed experienced hostility from fellow academics Those from pure science departments were considerably more negative, seeing business ventures as self-serving and therefore at odds with the academic mission Hostility does not appear to have acted as a constraint to these particular academics, but there is no way of knowing whether others have been deterred by it Academics from the disciplines which comprise biotechnology do not always appear to have been deterred from their entrepreneurial activities by the prevailing departmental ethos, indeed in many cases they have succeeded in radically altering that ethos. Fox (1981) recounted the reaction of a prominent biologist to academics commercially exploiting their research findings. "It's like ... the movie "The Body Snatchers". You look into [someone's] eyes and you realise it's too late". Fox interpreted this as expression of a sense of powerlessness in the face of change However, in the case of biotechnology, the unusually high proportion of academics pursuing entrepreneurial activities may make this an exceptional reaction Again, this is an area which would benefit from further research

Research into the relationship between the incidence of academic entrepreneurship and conditions specific to individual universities/departments has not progressed significantly

beyond these early observations. This is possibly due to the fact that in the intervening years, many American universities have formulated detailed written policies concerning activities like academic entrepreneurship. The extent to which individual universities facilitate, proscribe or are indifferent to academic entrepreneurship and their reasons for adopting a particular stance are increasingly a matter of public record, following open and often intense discussion between administration and faculty In these universities there is no longer cause for speculation about which individual or group of individuals determines the prevailing institutional ethos, as it is formally expressed Despite the impression given by European commentators like Sharp (1985), we now know that academic entrepreneurship is by no means universally accepted in American universities. Unfortunately, we do not know whether the prevailing attitude is one of practical support, moral encouragement, indifference, restrictive regulation or outright proscription No comprehensive survey of policies towards academic entrepreneurship in America's major research universities appears to have been conducted to date Neither do we know the extent to which universities' policies have been informed by experience It is evident that in some cases, discussion of academic entrepreneurship has been triggered by critical incidents which arose within the university, in other cases, universities appear to have formulated policies based on more theoretical considerations, perhaps motivated by a desire to avoid the crisis management which they have observed in other institutions.

4.4.6 Institutional Constraints on Academic Entrepreneurship

Recent literature gives us some indication of American universities' reasons for closely regulating or proscribing the entrepreneurial activities of faculty members, though it is less helpful on the specifics of those regulations Yet again, this is an area which has not benefitted from comprehensive, structured study. It is clear that universities in the US are often motivated by the need to avoid conflicts of interest, both within the university and in

the university's relations with external organisations and institutions There is little doubt that part-time academic entrepreneurship is sometimes proscribed because of universities' adherence to the legal and moral code underlying the concept of conflict of interest To Richter (1986), this is a direct parallel to a business corporation legislating against the practice of moonlighting Concern about conflict of interest appears to be a peculiarly American phenomenon. In the literature relating to academic entrepreneurship in other countries, it is not an issue Moreover, it is evident that certain activities of academic entrepreneurs which would be construed as a conflict of interest in the US pass as unremarkable in other countries

American universities were first alerted to the issue of conflicts of interest in the early 1960s as a result of a number of reports emanating from prestigious institutions like the Carnegie Foundation and the Brookings Institution. At the 1963 Conference on the Administration of Research delegates were asked to consider the ethics of what then seemed to be a hypothetical situation - in which a university scientist could simultaneously be the senior investigator on a government-sponsored research project, a panellist advising the same government agency on research proposals submitted by colleagues in the same field, a consultant to industry specialising in this field, a major stock-holder or even sole owner of a company operating in the field - and could even require for his academic research equipment of which he is the sole manufacturer (Morse, 1968) Morse outlined the "softly-softly" approach taken by the federal government and academic umbrella organisations to persuade universities to formally adopt recommended policies and procedures to prevent such conflicts of interest, backed up by the threat of Congressional legislation Each institution receiving federal funds was asked to formulate written rules outlining which outside activities were considered proper for faculty to pursue, and faculty's obligation to disclose such activities to a designated official By the

end of 1967, 97 per cent of universities were judged to have complied, following widespread discussion of ethical problems by university administrators and faculty

At the time, considerable attention was paid to the morality of academics absenting themselves from their university to undertake work for government (OECD, 1970). In the intervening years, work in the national or international interest or work on social issues has generally become an accepted activity for American academics. In contrast, work for commercial or personal interests remains a controversial issue, which often shapes the attitude of individual academics and institutions to consultancy, university/industry collaboration and academic entrepreneurship Conflict of interest has generally been invoked where the university's interests are seen as compromised by the private interests of organisations or individuals - like academic entrepreneurs in their capacity as company directors (Etzkowitz, 1983)

Despite the existence of conflict of interest rules, universities differ widely in their willingness or ability to enforce them Less prestigious universities appear less able to limit conflicts of interest The University of California, Yale, Harvard, Columbia and Pennsylvania are known to be relatively strict, for example, and have prohibited certain entrepreneurial activities (Etzkowitz, 1983) Atypically, MIT is seen as "incredibly lax" (Kenney, 1986) It is not entirely clear where the majority of research universities in the US stand in relation to enforcing the rules In 1982 Albert Meyerhoff of the Natural Resources Defence Council testified to Congress that he did not know of a single research university which required faculty to disclose their interests in businesses potentially benefitting from their research - even though that research was supported overwhelmingly with public funds [13] (Wade, 1984) This is probably an exagerration, but it is interesting that a management consultancy report commissioned by Cornell felt obliged to advise

American universities to enforce disclosure policies. The report predicted that "those institutions which have not been enforcing existing regulations will find a substantial resistance not only from those governed by the rules, but perhaps even more so from those charged with enforcement, especially department heads" (Peat, Marwick & Mitchell, 1981).

Universities tightening up lax regulations regarding outside activities in recent years have encountered extreme hostility from entrepreneurial faculty members At Columbia, for example, faculty did not object to sharing their financial rewards with the university, but they were adamant about their right to accept stock and to function as independent entrepreneurs They regarded the regulations as an infringement of their academic freedom (Etzkowitz, 1983) This kind of response has left academic entrepreneurs open to the charge that they fight for their own freedom at the expense of the university which enables them to enjoy that freedom (Morse, 1968, Jarratt, 1985).

In 1981 the House Committee on Science and Technology joined in the debate, pronouncing that whilst innovation should be encouraged, the public interest was not *de facto* served by the commercial opportunism displayed by some academics Committee members asked the AAU to formulate a set of voluntary guidelines, which were scrutinised in the course of Congressional hearings (Gore, 1983) It became clear that neither universities nor industry found it acceptable for faculty to hold equity positions in commercial ventures whose interests coincided with their field of research. This would preclude, for example, the activities some ten years earlier of Herbert Boyer, co-discoverer of the rDNA technique and co-founder of Genentech Boyer commissioned his university laboratory to do research work until such time as he could set up a company laboratory· "Boyer, the officer of Genentech, contracted with Boyer, the professor, to

perform research that would be proprietary, that is patented private property at a public university" (Kenney, 1986) It is interesting to compare the Congressional recommendation with a recommendation published a decade earlier, which urged academic entrepreneurs to carry out more development work in university laboratories "rather than in their own laboratories, at their own expense" (Lamont, 1972). It is perhaps surprising that Boyer's activities had been permitted at all in a public university in many land grant universities it had long been forbidden for faculty to accept equity in companies exploiting university research - in the same way that it was forbidden to do paid consultancy (Kenney, 1986). It is interesting to note that in Canada the practice of academics developing their product/process in their university laboratories does not appear to be an issue: one study found that only 25 per cent had developed their product/ process outside the university (Doutriaux & Peterman, 1982)

There is evidence that institutional attitudes to conflicts of interest and those of academic entrepreneurs have undergone subtle and opposing changes in the intervening years. There has apparently been a distinct hardening of attitudes Etzkowitz (1983) reported that academic entrepreneurs who founded new technology-based firms out of MIT after the second world war - and retained faculty positions - were uneasy about potential conflicts of interest. A great deal of ambiguity prevailed about what was acceptable and several faculty members tried to conceal their business ventures [14]. Roberts' study of part-time academic entrepreneurs at MIT found that if they were forced to make a choice, without exception they would give up their company and stay at MIT (Roberts, 1972). Kenney (1986) claims that entrepreneurs in certain disciplines, notably electrical engineering and computer science, took it for granted that they should not try to combine academic and entrepreneurial roles, even on a part-time basis. Etzkowitz (1983) also comments that academics founding semi-conductor firms in the 1950s and 1960s did not attempt to retain

faculty status at the same time as playing a major corporate role However, studies such as that conducted by Lamont (1972) at the University of Michigan appear to contradict this the majority of academics was found to have opted to combine their academic and their entrepreneurial roles on a part-time basis [15]. Many of the current generation of American academic entrepreneurs clearly operate on a different set of assumptions to their predecessors Some have attempted to combine not just part-time but full-time roles as academics and entrepreneurs. Far from being uneasy about potential conflicts of interest, some have ignored repeated warnings from their university that they are in a conflict of interest situation - until their university obliged them to make a choice Harvard forced Nobel prize-winner Walter Gilbert to take a year's leave of absence to decide whether he wished to be a full-time academic or full-time chief executive of Biogen (Bylinsky, 1980) Prior to this, Gilbert had effectively been running Biogen out of his Harvard office (Etzkowitz, 1983). In 1983, the University of California (Los Angeles) dismissed a professor of geochemistry for persistently using his university laboratory to perform research for his company's commercial and government clients (Sanger, 1983). The University of Wisconsin, the University of California (Davis and Los Angeles) and numerous other American universities have adopted the same stance (Kenney, 1986, Sanger, 1983; Etzkowitz, 1983). At professorial level, American entrepreneurs have seldom gone without a struggle to retain their chairs, but in the end many have chosen in recent years to pursue their business activities rather than retain the intellectual stimulation and legitimation offered by the university (Etzkowitz, 1983)

Despite Meyerhoff's scepticism, American universities often have no option but to curb conflict of interest situations, due to external pressures. One of the best documented examples concerns Ray Valentine of the University of California's (Davies) Agricultural Experiment Station Valentine persuaded the Allied Corporation to contribute $2 5m to

replace diminishing NSF funding in plant productivity and nutrient use One week later, the Allied Corporation bought 20 per cent of the stock of Calgene, a new technology-based firm founded by Valentine in the period between opening negotiations with the Allied Corporation and concluding the deal California Rural Legal Assistance filed a successful request with the state's Fair Political Practices Commission that California's employee disclosure laws should apply to faculty. The University of California offered Valentine three choices dissociating himself from Calgene, becoming a regular faculty member or not working on the Allied contract Valentine chose not to work on the contract, losing the University of California $1m in the process, he resigned his vice-presidency of Calgene in favour of a directorship (Kenney, 1986) Unlike some universities, the University of California did not force Valentine to make a choice between his chair and his entrepreneurial activities

Etzkowitz (1983) reported that whereas conflict of interest has traditionally been seen as a matter of university interests versus external interests, it is increasingly being invoked in cases of concern about the distribution of activities within the university Academics are generally expected to teach undergraduates, supervise graduate students, attract research funding, conduct research and contribute towards the running of the department by sharing the burden of administrative duties, participating in committee work *etc.* For some years faculty members who devote an inordinate amount of time to consultancy activities have been accused of neglecting their academic responsibilities Their treatment of graduate students is a particularly sensitive issue, they stand accused of ignoring their graduate students - though these findings are contested by Patton (1980) and Blumenthal, Gluck *et al* (1987) - and accused of exploiting them [16] Staff who try to combine academic and entrepreneurial roles have incurred the same accusations, usually from departmental colleagues. Faculty members are increasingly polarising into two conflicting groups.

gatekeepers of traditional values and entrepreneurs (Douglas, 1983) In some American universities the gatekeepers of traditional values feel that they have to contend with the university administration as well as entrepreneurial colleagues. Etzkowitz (1983) reported that administrators have been accused of protecting entrepreneurial faculty members from colleagues who resent what they see as neglect of students and departmental duties [17]. There are numerous examples of alleged neglect in the literature Again, there is particular concern that graduate students will be abused. At the University of California (Davies) repeated charges were made that Ray Valentine was exploiting graduate students for the benefit of his company and restricting their freedom to disseminate their research findings (Kenney, 1986). Similar charges have been made more recently in relation to an unspecified Canadian university, the student concerned accused her supervisor of using his supervisees to do research for his company and rejecting the results of experiments she did repeatedly because they indicated that his company was giving its customers misleading product information (Helwig, 1988)

On the basis of existing literature, it is impossible to evaluate whether faculty who combine their academic and entrepreneurial roles do generally neglect their academic responsibilities Similar accusations were levelled at academics who were involved in contract research for industry, yet a major study of those working in biotechnology did not find that they neglected their students or their administrative duties, or published less (Blumenthal, Gluck *et al*, 1987) If anything, these academics were more active than their colleagues This may not be a fair analogy. the lure of working for one's own company may be greater than the lure of working for another company Moreover, the demands made by one's own start-up company are likely to be more diverse and time-consuming than the research requirements of an established company for whom one conducts research. The researcher who pioneered many of the early studies of academic

entrepreneurship was co-founder and president of a consulting company at the same time as retaining his academic position He admitted to constant problems concerning his loyalties and how he spent his time (Roberts, 1972). The president of the National Academy of Sciences felt it necessary to stress the need for academic entrepreneurs to be extremely sensitive to maintaining a balance between their commercial and their academic activities (Press, 1983) Some universities clearly believe that this is an impossible balancing act When negotiating a multi-million dollar contract with Monsanto, Washington University Medical School deliberately incorporated terms which would prevent individual faculty members from commercially exploiting faculty research discoveries To the head of school exclusive licenses were preferable to academic entrepreneurship· "We have serious concerns about the entrepreneurial activities of some faculty members around the country I don't see how you can serve two masters" (Wade, 1984) He was supported by the university, which was anxious was to ensure that faculty did not neglect their academic commitments (Guze, 1983)

Academic commitments extend beyond teaching, research and administrative duties. In the course of their career academics are expected to progress from publishing in their own right to refereeing manuscripts and editing journals, activities which constitute academic leadership The former president of Harvard expressed concern that part-time academic entrepreneurs may exclude themselves from these activities, either through lack of time or because they are no longer considered to be suitable for these positions (Bok, 1982) This in turn leads to concern about the kind of role model which part-time academic entrepreneurs present to graduate students, from whom future generations of academics will be drawn Luria (1973) believed that the entrepreneurial style of academia in the US had introduced a harmful element of competition where none previously existed When researchers published new work openly, fellow scientists used to give them space to

develop their ideas for a few years. Today fellow scientists rush back from conferences to perform the experiments which the speaker has not yet had time to perform. Webster (1988) also commented on the confusion created by fellow academics being competitors, rather than collaborators On the other hand, the tradition of industrial ties in chemistry and solid-state physics may indicate that academic ethos need not be harmed by competition between faculty colleagues associated with different companies (Davis, 1981) Universities may also be concerned about the long-term insidious effect of part-time academic entrepreneurship on university-based science Davis (1981) suggested that in biology, at least, the search for wealth may divert too many academics away from basic research in the next generation. Luria (1973) claimed that academic entrepreneurs were so opportunistic that the content and style of their research often suffers He was not alone in questioning the scientific integrity of academic entrepreneurs Their habit of announcing scientific breakthroughs to the press instead of via academic publications has occasioned considerable comment, especially recently Whereas their announcements were taken at face value initially, there is now concern they may be a ploy to boost stock offerings on Wall Street (Gore, 1983)

It is evident that society perceives academic commitments as extending beyond the confines of the university. There is one particular role which it sees academics as uniquely equipped to play making impartial judgements by virtue of their disinterested approach to science Genetic engineering presented the US with what has been described as implications "so staggering as to frustrate efforts to assess them clearly" (Gore, 1983). It was felt that there had never been so great a need for disinterested experts, for people "watching out from the crow's nest not just for reefs, rocks, but also for new land" (Gore, 1983), yet it is reported that the leading academics who had traditionally assumed this role all had a vested interest in the commercial exploitation of their particular areas of

expertise in genetic engineering, including Nobel prize-winners (Hilts, 1982) This phenomenon led the Supreme Court to discount evidence given by Harvard entrepreneur Walter Gilbert [19] (Wade, 1980a) Cohen, co-inventor of the rDNA technique, had already foreseen this problem in 1973. "The fact that I had already turned over all royalties to Stanford enabled me to speak out in ways which would not have been possible if my motives were being questioned" (Wade, 1980a). This was not an entirely new phenomenon, triggered by the biotechnology revolution, however; Kenney (1986) reported that the State of California had been hard pressed to find academics prepared to testify against the oil industry at the hearings into the Santa Barbara oil spill in 1969 - because most of the relevant experts were under contract to oil companies as consultants. This phenomenon does not yet appear to have created problems in the UK, however The UK Register of Expert Witnesses was established in 1988, initially as a subscriber publication and subsequently as a witness location service, the editor was unaware of any such problems [19]. On the other hand, it may be that the courts in the UK are less attuned to the possibility of a conflict of interest than their US counterparts.

The literature gives the impression that some American universities have been reluctant to proscribe part-time entrepreneurship, despite publicly expressed concern about its affect on the university. In 1981, for example, Donald Kennedy, president of Stanford, testified to Congress. "We are not losing whole people What we are concerned about is what the ultimate landscape will look like in terms of the loss of parts of people" (Kenney, 1986) Their reluctance may be founded on another fear, however Forced by concern over conflict of interest to choose between the academy and the marketplace, American academics are increasingly opting to give up their tenure and leave the university. While this might be in the interests of technology transfer, from the perspective of university administrators, it represents a very serious threat to the viability of their institutions

(Blumenthal, Gluck *et al*, 1987). This is quite contrary to Roberts' blithe assumption some 15 years earlier that academic spin-off companies were particularly beneficial to society, since the exodus of scientists would not spell disaster for the university, as it could for some companies (Roberts, 1972)

4.4.7 Institutional Policies to Support Academic Entrepreneurship

Concern over conflict of interest has not prevented some American universities from being seen as tolerant or even overtly supportive towards academics wishing to exploit their research findings by spinning-off companies (Lamont, 1972, Roberts, 1972, Shapero, 1972, Susbauer, 1972; Brown, 1982) We do not know whether these universities abdicated responsibility for vigilance concerning conflict of interest situations, seeing it as the responsibility of the individual academic, or whether perhaps they managed to regulate the activities of entrepreneurial academics in such a way that conflict of interest situations are avoided The literature fails to properly address the question of <u>how</u> American universities encourage academic entrepreneurship The information available relates to only to individual universities' strategies It is unclear whether encouragement is generally encapsulated in formally supportive policies or whether it operates in an implicit, informal way Nor is it clear whether encouragement is predominantly limited to moral support or whether it extends to practical support of various kinds In the absence of such basic information, it has not been possible to establish whether there is an association between the incidence of academic entrepreneurship and the nature and extent of support available This is a complex issue the university's perceptions of what constitutes support may not coincide with academic entrepreneurs' perceptions of the support they require. A Canadian study reports that only 32 per cent of academic entrepreneurs questioned could cite a helpful university policy, and none of the policies cited were common to other universities Entrepreneurs varied considerably in the kind of

support they required from their university (Doutriaux & Peterman, 1982) The situation is further complicated by the fact that there are almost certainly discrepancies between formal policies, where they exist, and informal practice. One suspects that departments' adherence to institutional policy may vary considerably. The ethos of an individual department or the attitude of an individual departmental head may sometimes conflict with the prevailing institutional ethos. Individual heads of department may not be in sympathy with the university's motives for encouraging/proscribing academic entrepreneurship

The literature contains surprisingly little information on what motivates universities' tolerance/support. Early empirical studies conducted in the US were particularly guilty of failing to explore universities' motives This possibly results from the partisan attitudes of some entrepreneurship researchers they may have regarded universities' reasons as self-evident The "seminal" literature of the early 1970s contains little which is more informative than Lamont's contention that spin-off companies are a source of great pride to their respective universities (Lamont, 1972). Despite his observation that the attitude of department chairmen was critical, Susbauer (1972) did not adequately explore what motivated their support - or lack of it Reading between the lines, it would appear that concern for product development might account for their support Curiously, the role of academic entrepreneurs in transferring technology was not mentioned, despite widespread recognition at this time that the movement of people transferred technology more effectively than the written word (Burns, 1969). Recent literature is not a great deal more enlightening about universities' reasons for being supportive towards academic entrepreneurs Richter (1986) suggests that universities may be motivated by the "considerable benefits" which they confer on the institution they are a source of additional research funding and they often provide the university with equipment, supplies or services below market price Although Richter adds that academic entrepreneurs

prepare students more adequately for a career in business, his perspective is predominantly economic Interestingly, however, American universities which encourage academic entrepreneurship seldom appear to be motivated by the possibility of earning extra revenue from academic spin-off companies Few universities in the US have extended their customary profit-sharing arrangements for patent income to spin-off companies (Davis, 1981), though there are isolated cases, like Utah (Brown, 1982) and Columbia (Etzkowitz, 1983) This is surprising, given the media's interest in putting the spotlight on the number of American academics whose spin-off companies have made them paper or actual millionaires in recent years, a phenomenon which is now occurring in the UK media, too [19].

Once again, there is little indication that universities are motivated by academic entrepreneurs' ability to transfer technology This is surprising, in view of the tacit assumption in much of the peripheral literature that academic spin-off companies transfer leading edge technologies It has certainly been established that universities incubate technical spin-off companies, rather than non-technical spin-offs (Cooper, 1984). Moreover, in certain cases, such as the transfer of space technology in the US, the significant and unique role of entrepreneurs has been well documented [20] (Roberts, 1972) In fact, there is a dearth of comprehensive studies which assess the extent to which academic spin-off companies transfer new, leading-edge technologies, as opposed to relatively low technologies We know that where an academic founds a company some time after leaving the university, the longer the interval inbetween, the lower the level of technology transfer (Roberts, 1972) However, because many researchers have excluded such cases from their definition of what constitutes an academic entrepreneur, we do not know whether this is a common or uncommon phenomenon Moreover, most studies of academic spin-off companies have concentrated on the entrepreneur himself, his business

strategies or the organisation which incubated him, the character of the technology transferred has largely been neglected. We find only passing references in studies such as Susbauer (1972), who comments that academic entrepreneurs from the University of Texas at Austin did not require a much start-up capital, since their products were not very "high tech". It may be that universities are sceptical about the extent to which academic spin-off companies transfer technology Alternatively, some universities may be reluctant to assume technology transfer as a formal, institutional objective

Finally, it is evident that some American universities have actively encouraged academic entrepreneurship for what we might characterise as negative reasons. Several commentators claim that universities have encouraged the practice in the belief that like part-time practice in medicine, it helps retain valuable but restless faculty (Davis, 1981, Richter, 1986, Kenney, 1986)

4.5 Academic Entrepreneurship in the UK

It will be evident from this review that academic entrepreneurship in the UK is not a subject which has excited the attention of academic researchers The number of empirical studies can almost be counted on the fingers of one hand They relate only to individual universities and few of them are recent With the notable exception of "The Cambridge Phenomenon" (Segal, Quince, 1985), they give the impression that British academics rarely exploit research discoveries by spinning-off a company expressly for that purpose Despite establishing that UMIST generated around 60-80 inventions per year in the early 1970s, Norris (197?) was unable to identify a single case of academic entrepreneurship at Manchester, other than a "trivial educational game" and a couple of computer programmes. He attributed this to the fact that "men (*sic*) with entrepreneurial talents and inclinations do not usually become academics". In his view, this was as it should be it

was more appropriate for industry or an organisation like the NRDC to exploit academic inventions, not academics themselves. This appears to have been the prevalent feeling at the time. A study conducted by the CBI found that only 14 per cent of university vice-chancellors thought that the initiative for securing satisfactory application of research findings should lie with the researcher (CBI, 1970) Similar sentiments have been expressed in recent years, too. Comerford (1987) advocated licensing rather than academic entrepreneurship, since it lets academics get on with what they do best

More recently it has been reported that UMIST has been generating four to six new ventures a year (Holdom, 1987) Holdom implied that this figure could be larger, were it not for the number of constraints confronting academics founding new technology-based firms Interestingly, the constraints he listed have little to do with the UK university system or related constraints, or conditions specific to UMIST Only the vesting of IPR in industry, where SERC collaborative and co-operative schemes are concerned, fits into the former category The other constraints are all exogenous, from the negative attitude towards technical entrepreneurship held by a variety of funding and support agencies to the lack of "midwives" to assist in the pregnancy, birth and neonatal life of companies when they can least afford professional help

Academic entrepreneurship does not appear to be an activity which springs to mind in the UK as a means of exploiting university research discoveries In 1980 the Spinks Report on biotechnology in the UK noted that British researchers were forced to spend months manufacturing their own restriction enzymes [21] It concluded that this was a missed opportunity on the part of industry. It is interesting to note that in the US, the demand for restriction enzymes led to an academic from Harvard Medical School establishing a new technology-based firm The company started business touring university microbiology

laboratories, selling restriction enzymes from a bucket, a project which made them the first company in the US to bring an rDNA product to market and which had sales worth some $3m by the mid-1980s [22]. Noticeably, Spinks did not countenance academics founding new technology-based firms to exploit biotechnology discoveries at any point in his Report. This is all the more striking when we consider that, like the US, Britain opted to focus on the "high-technology end" of genetic engineering (Sharp, 1985) Instead, the Spinks Report recommended that the NRDC should lead a study with the UGC, CVCP and the research councils to review existing and potential ways of encouraging academic inventors in the UK and to consider practice overseas. Spinks had in mind awards such as a share of the equity of any company set up (by a third party) to develop their discoveries This recommendation was one of those in the Report which was not acted upon [23].

The subject of academic entrepreneurship in both the UK and Europe is clearly one which could benefit from further research, and it is hoped that this investigation will make a small contribution

CHAPTER 5

5 DEVISING INSTITUTIONAL POLICIES AND PROCEDURES IN RELATION TO IP - AN EXAMINATION OF THE ASSISTANCE AVAILABLE TO UNIVERSITIES

5.1 Introduction

In May 1985, when the Chairman of the SERC, Sir John Kingman, wrote on behalf of the five Research Councils offering each university the opportunity to assume rights and responsibilities for exploiting IP arising out of Research Council-funded projects, none of the Vice-Chancellors and Principals to whom it was addressed should have been surprised by the contents of his letter As we have seen, the Government had first announced its intention to remove the BTG's monopoly in September 1983, amid not inconsiderable publicity [1]. To recap briefly, it was not a novel idea even then, having first been suggested by ACARD two years earlier (ACARD, 1981) Moreover, during 1982 representatives of the Department of Industry (DoI) had visited a number of universities to canvas local opinion about the BTG's effectiveness [2]. The idea was given a further airing in June 1983, when a joint ACARD/ABRC report commissioned by the Prime Minister described the BTG as "inefficient and rapacious, an obstacle to industry-HEI co-operation and a barrier to the exploitation of academic inventions" and recommended the removal of its right of first refusal (ACARD/ABRC, 1983) By May 1985, Vice-Chancellors and Principals had also received a stream of "office notes" from the Committee of Vice-Chancellors and Principals (CVCP), reporting in some detail on both policy and procedural aspects of proposed new arrangements for the exploitation of IP arising out of Research Council-funded projects Indeed, a working party reporting to the CVCP's Advisory Committee on Industry, set up a year earlier, was able to influence at least some of those arrangements [3].

Nonetheless, there is evidence to suggest that many universities found it difficult to respond adequately to Sir John Kingman's letter. Although around half made some kind of

response within four and a half months, as requested, very few of these responses were regarded as acceptable [4], exchanges of correspondence continued until July 1986, when the first batch of universities was finally authorised by the Research Councils The problem was not so much whether to accept the offer, but how to satisfy the Research Councils that the institution's policies and procedures addressed the eleven points which the letter indicated must be satisfactorily addressed, before authorisation could be granted Universities' existing policies and procedures, in so far as they had any, did not always seem to provide a solution to this problem. Perhaps the sentence in Kingman's letter, indicating that the Research Councils had no preconceived model of how universities should operate, made it seem like a daunting task

It was felt that there was both intrinsic and extrinsic value in identifying sources of assistance which universities could draw upon, if they were so minded, to help them formulate appropriate policies and procedures This was not intended to yield an exhaustive list, but rather to identify and characterise the principal sources In the event, it proved impossible to identify much published material of this ilk relating to the UK [5]. As a result, the search for sources of assistance took on the character of fieldwork, rather than a literature review, effectively, it acted as a "prologue" to the main fieldwork It proved necessary to visit organisations connected with universities - and some unconnected, to interview people with responsibility for IP and, where possible, to gain access to relevant files These organisations included the CVCP, the Association of University Teachers (AUT) and the Patent Office Since the University Directors of Industrial Liaison (UDIL) does not have a permanent secretariat, access was gained instead to one university's UDIL files and a UDIL meeting was attended Similarly, access was gained to one university's files to establish the contribution made by the Conference of Registrars & Secretaries (CRS)

This chapter presents the findings of this "prologue" to the main fieldwork It identifies attempts to shape universities' policy and procedures, and other sources of assistance It describes the guidance given by each and the premises upon which that guidance was based, with particular reference to the ownership of IP, the respective roles of the researcher and the university in the exploitation process and incentives to encourage academics to notify their university of potentially exploitable discoveries. It compares, contrasts and assesses the guidance given by each source and concludes by considering the relative influence of each

5.2 Findings

5.2.1 Prior to 1974

Until the mid-1970s, identifying, evaluating, protecting and exploiting IP generated by the academic staff of UK universities was purely a local issue As a result, it was an issue which had received no attention at all in many institutions Some had considered the matter and decided to have no involvement, in others, IP was dealt with on an *ad hoc* basis, while in a few, there were detailed regulations [6] The issue was not examined on a collective basis, either at a policy or a practical/ procedural level, until 1974

5.2.2 From 1974-79

(i) UDIL's 1974 Report

The first organisation to do so was apparently the University Directors of Industrial Liaison (UDIL), founded in 1968 to "promote understanding and collaboration between the universities and industries" by a handful of people who were then working in an industrial liaison capacity in UK universities [7]. As UDIL documentation of the period makes clear, the identification, evaluation, protection and exploitation of IP was not a major activity for ILOs Nonetheless, in 1974 UDIL surveyed current patenting and

exploitation practices and procedures in UK universities The resulting report, based on information from 28 universities, expressed concern at "*the confused situation prevailing*" [9].

Ownership of IP

In UDIL's view, this was due, in part at least, to "*uncertainty over how to interpret the common law relationship between employers and employees*" - *ie* uncertainty over who actually **owned** inventions generated by academics in the course of their work, the UDIL report did not consider other forms of IP Only 7 of the 28 universities surveyed made their claims to rights in inventions explicit in academics' contracts of employment, though another 7 simply assumed ownership of inventions, if they heard about them, one university believed it jointly owned inventions together with the academic inventors, whereas 9 believed inventions were wholly-owned by the inventor, in the other 4, ownership was a matter for negotiation on a case-by-case basis

Exploitation of IP

Another possible explanation for the confusion was "*doubt about the degree of involvement a university should have in the commercial exploitation of inventions*". This seems to have deterred 4 of the 28 universities surveyed from getting involved in any way in protecting staff inventions by patenting them, however, 9 were prepared to give staff advice on patenting procedures, though financial support was by no means guaranteed, whereas 15 were prepared to finance the cost of patent protection, provided those costs were reimbursed from any royalties accruing

Information on the commercial exploitation of inventions is sketchy the survey found that 4 universities automatically referred inventions to the NRDC, an option which was

frequently exercised by other universities, too, though it is clear that IP was sometimes assigned/licensed to industry, instead There is no information on the respective roles of the university and the researcher in the exploitation process beyond a comment that in universities which believed an inventor owned his invention, academics were free to "*proceed privately*" with exploitation

Incentives

UDIL's report showed that the division of royalty income differed enormously from one university to the next Those which asserted ownership tended to retain all the net income bar, perhaps, a bonus or *ex-gratia* merit award to the inventor Those which believed the inventors owned the IP tended not to expect a share in the income, unless they had paid the costs of patenting the invention In others there was a variety of revenue-sharing formulae, some incorporating a sliding scale, some involving payments to the inventor's department, too In many cases, the division of royalty income was seen as a matter for negotiation between the inventor and the university on a case-by-case basis

(ii) The CVCP's 1978 Report

The year after the UDIL report was circulated, the Committee of Vice-Chancellors and Principals (CVCP) established a Working Party to investigate Patents and The Commercial Exploitation of Research Results [9]. It did this as a result of observations made by the Comptroller and Auditor General, rather than interest or concern on the part of the CVCP itself, or individual members. In view of proposed amendments to UK patent law, which culminated in the 1977 Patent Act, it was a timely decision The Working Party circulated its report in draft form in November 1977, the definitive version was published in 1978 (CVCP, 1978)

The CVCP's 1978 report was intended both to shape policy and to offer practical assistance It was principally concerned with issues relating to ownership of IP generated by members of university staff, though it also touched on the respective roles of the university and the inventor(s) in the exploitation process and incentives

Ownership of IP

The 23-page report commenced by outlining salient aspects of the 1977 Patent Act· it defined what constitutes a patentable invention, distinguished inventions made in the course of an employee's duties from other employee inventions, indicated that employers may assert ownership of the first but not the second type of invention, and explained the difference between applying for a patent and owning a patent It then considered the position of universities under the new Act It endorsed the view that, in principle, universities have the same ownership rights over employee inventions as any other employer, provided that academic staff contracts impose an obligation to undertake research and provided that the nature of that research is such that an invention might reasonably be expected to result from carrying out that duty Thus, it was explained, a university would have no rights to an invention made by a Professor of Classics who happened to be an amateur radio enthusiast, even if he made use of university facilities The report warned that in some cases, it might be difficult to determine who more rightly owned an invention the university or the employee

Most of the provisions of the 1977 Patent Act apply only to patented inventions However, the CVCP Working Party saw no reason why universities should distinguish between inventions which are patentable - and duly patented, and those which are not patentable or, for some reason, not patented Thus, the report encouraged universities to make wider claims than those covered by the 1977 Act, though it drew the line where IP protected by

copyright was concerned [10].

The Working Party recognised that there was considerable potential for disputes over the ownership of inventions, patented/patentable or otherwise Whereas disagreements over ownership of patented inventions could be resolved by application to the Comptroller of Patents, non-patented or non-patentable inventions fall outside his jurisdiction. The report conceded that it might be desirable to provide for a suitable form of arbitration, rather than resort to litigation However, the Working Party favoured an alternative strategy

Incentives

It felt "*ownership of an invention is, in fact, less important than ensuring it is properly protected and exploited and that any profits are shared equitably between the inventor(s) and the university*". Accordingly, two pages of the report were dedicated to guidelines regarding procedures and regulations governing employee inventions which universities were recommended to introduce, a significant feature of these guidelines is that they were expressed in such a way as to avoid having to determine whether an invention belongs initially to the university or to the inventor(s) Secondly, the report recommended that universities should enhance the rights which employees have under the Act in the following way

> " *the fairest and most desirable arrangement is for the patent to be vested jointly in the university and the member of staff who is the inventor* "

The CVCP Working Party felt that owning inventions outright would be less of an issue for academic inventors if they were guaranteed to share equitably in the profits Accordingly, although it listed nine criteria to be taken into account [11], the report

recommended that universities should not attempt to finally settle the precise division of the revenue until it was possible to assess what the size of the revenue was likely to be - *ie* universities should not attempt to lay down in advance fixed revenue-sharing formulae Moreover, it urged universities to allow for regular review and subsequent variations of the original arrangements.

Finally, the report recommended that if a university had no interest in participating in developing or exploiting an invention, it should waive/assign its rights in favour of the inventor(s) alone

Exploitation of IP

Whilst the report recommended that universities should partially yield their rights over ownership of IP, curiously it did not appear to recognise the rights which joint ownership of an invention conferred on academic inventors when it came to determining how that invention was exploited The guidelines regarding procedures and regulations governing employee inventions (para 30) stated unequivocally that the university should undertake responsibility for the further development and exploitation of an invention. They added

" *the member of staff shall, as directed by the university, do any one or more of the following*

(a) refer the invention to the NRDC for assessment and, if it thinks fit, exploitation under its auspices,

(b) apply, or join with the university in applying, for patent protection in the UK or elsewhere;

(c) assign into the joint names of himself (sic) and the university any patent granted to himself (sic) alone,

(d) enter into appropriate agreements for protecting the secrecy of the invention unless and until it is patented,

(e) collaborate with the university in the exploitation of the invention "

On the face of it, this would appear to deny academic inventors the rights which joint ownership confers - certainly where exploitation of their invention is concerned However, on the next page (para 32), motivated once again by a desire to pre-empt "*unresolvable disputes*", the report warned universities against attempting to lay down in advance any single method of exploitation The CVCP apparently recognised that some researchers might have strong feelings about the way in which their invention was exploited

(iii) UDIL's Response

As an organisation, UDIL did not respond to the CVCP's 1978 report, although one ILO, unable to attend the September 1978 meeting, wrote drawing members' attention to "*the difficulties of joint patents and of deferring revenue division until after revenue existence*". The Minutes of that meeting do not indicate whether or not this was discussed by delegates and, if so, what conclusions they reached

(iv) AUT Advice to Members, 1978/79

Soon after the CVCP began to take an interest in the ownership and exploitation of inventions made by academics, the Association of University Teachers (AUT) had begun to take an interest in the ownership of such inventions The AUT's interest was triggered by being asked to comment on the Green Paper heralding amendments to UK intellectual property law and culminating in the 1977 Act [12]. Seeing proposals - which subsequently became sections 39-43 of the Act - as ambiguous where academics were concerned, the AUT lobbied via the TUC to have the position of academics made explicit The TUC duly registered one of only three objections to the basic principle that the employer should own

employee inventions [13] Nonetheless, academics were not explicitly excluded from the provisions of sections 39-43, nor were they explicitly included

Ownership of IP

Having seen the position adopted by the CVCP in its 1978 report, the AUT decided to seek legal advice about who, under the terms of the new Act, owned inventions made by its members The advice obtained stated that the onus is on a university to show that an invention was made in the course of normal or specially assigned duties and the circumstances were such that an invention might reasonably be expected to result from carrying out those duties In the view of the AUT's QC, it would be unusual for universities to be able to show this, even if the duty to research is stated explicitly in an academic's contract, because universities may engage in commercial activities only as an ancillary function, not as their primary function The QC supported his interpretation by an excerpt from Chitty on Contracts, which states "*if the employee is not employed specifically to invent but eg . as a professor of chemistry or engineering at a university*" [14], any invention made by that employee belongs to him, not to his employer

The AUT restricted its enquiries to "inventions" and to the question of ownership It did not consider other types of IP, nor did it pay much attention to policies, procedures or practice relating to the exploitation of such inventions At the beginning of the 1978/79 session, the AUT circulated to local associations details of the advice it had received on the question of ownership.

5.2.3 From 1980-85

(i) AUT

Early in 1984, in the wake of the Green Paper on IPR and innovation, the AUT established a working party with responsibility for IPR matters Local associations were notified of its existence in November 1984 [15], when the AUT conducted a survey of patenting practices in UK universities prior to producing a guide to patenting for members A standing working party, this group also assumed responsibility for co-ordinating the AUT's response to the removal of the BTG's right of first refusal and the proposed new arrangements The IPR Working Party recognised that these events threw up a number of issues which the AUT, certainly, had not considered before and which merited "*substantive consideration*" [16]. Accordingly, the AUT tried to ensure that what it saw as relevant issues were considered both by the Research Councils and individual universities when it came to formulating policy In July 1985 the Assistant General Secretary wrote to Sir John Kingman, seeking a meeting to discuss this [17]. The SERC deflected this suggestion by asking for written details of issues which the AUT would like the ESG to consider at the beginning of October [18], a letter was duly despatched at the end of September [19]

The AUT also wrote to local associations in July, alerting them to the existence of the Kingman letter, encouraging them to seek input into their university's reply and to ensure that any policy enunciated in that reply incorporated systematic and explicit arrangements [20]. Recognising that there was little time to get involved in detailed negotiations, the AUT enclosed a statement of five principles which local associations should communicate to their universities as a holding action, if necessary [21]. With the same letter, the AUT sent a document which gave more detailed advice about how local AUT officers should eventually respond to the Kingman letter, though, in its view, IP was less of a priority

than the AUT's response to UGC Circular 12/85 and the Green Paper "A Strategy for Higher Education into the 1990s", also published in May 1985 [22].

Ownership of IP

In its response to the Green Paper on IPR and innovation, submitted via the TUC in 1984, the AUT had once more sought clarification of the law concerning inventions made by its members Confronted by widely differing interpretations of the 1977 Act, the AUT still felt that academics should own the rights to their inventions, commenting *"If such a system works in an industrially sucessful country such as Germany, then there is no reason to believe that it would not work equally well in this country"* [23].

However, the AUT's five principles did not assert that AUT members owned the IP they generated in the course of their work - though they sought to prevent universities from extending their claims beyond those outlined in SERC guidelines of the period They also tried to ensure that universities would commit themselves to deciding within six months whether they wished to be involved in the exploitation of IP - and if not, to assigning their rights to the relevant employee(s)

The more detailed document reminded local officers that where ownership of inventions made by staff in the course of their duties was concerned, the advice given by legal counsel engaged by the AUT conflicted with that obtained by the CVCP. It noted that paragraph 2, sub-section (x) of the Kingman letter *"must, in the light of [Sir Keith] Joseph's remarks, surely be construed as assuming that [universities] will diminish their contingent rights over inventions as yet unmade"* - and reminded local associations that section 42 (2) of the 1977 Patent Act legislated against employees having their contingent rights forcibly diminished However, the document put no pressure on local associations

to contest any claims their university might make to ownership of inventions made by members in the course of their work Indeed, by encouraging local associations to try and ensure their university committed itself to deciding within six months whether it wished to be involved in the exploitation of IP - and if not, to assigning its rights to the relevant employee(s) - it would appear that the AUT was either tacitly giving way on this issue or, more probably, side-stepping it

By this time, the IPR Working Party had also turned its attention to another form of IP, computer software During 1985 the Working Party came to the conclusion that if copyright in computer software was to be regulated, it should be on the same basis as patents - *ie* people who were not specifically employed to write software should own any software they wrote incidentally [24]. The document detailing how local associations should respond to the Kingman letter confined itself to the question of inventions, partly because it had been decided to produce a companion guide to computer software to accompany the one on patents, embodying the above principle Interestingly, at the very time universities should have been drafting their replies to the Kingman letter, the AUT was successful in dissuading one university from continuing to use computer software registration forms which required staff to assign their rights to the software they had written [25].

Exploitation of IP

During the course of 1985, prompted by the terms of the Kingman letter and the DES statement, the AUT came to focus less on the question of who owned IP generated by its members than on its exploitation [26] The AUT felt universities might try, through explicit clauses in their contracts of employment, to control researchers' ability to disseminate their findings - and thereby inhibit the progress of science. However, provided the right to publish was assured, the AUT recognised that the exploitation of IP could bring benefit

both to the economy and its members Indeed, much of the DES statement met with AUT approval. However, having decided not to pursue its members' claims to own the IP they generated, the AUT realised this could put them in a difficult position when it came to assuming responsibility for exploitation In particular, the AUT foresaw problems of motivation, expertise and substitute monopolies, unless policy was framed in such a way as to avoid such pitfalls

The AUT felt that academic inventors had far more motivation to go out into the marketplace than the institution which employed them Whereas the AUT had previously concentrated on safeguarding members against "*ruthless exploitation*" by universities, it now seemed more likely that "*the difficulty would be to persuade universities adequately to exploit inventions*" *since they were not, after all, in the business of manufacturing and had little experience of "selling or leasing IP*" [27]. The AUT suggested that one solution to this problem might be the creation of an inter-university consortium with centralised expertise, funded by a pump-priming grant or a soft loan from Government, this consortium would provide experts who had a capacity to identify with the outlook of university researchers, as well as potential customers Another, complementary solution lay in releasing entrepreneurially-minded staff for upto 2 years, so that they could exploit their discoveries themselves - with right of return to their university post at the end of that time

The AUT recognised that the tensions inherent in the proposed new arrangements could be greater than the tensions between its members and the BTG had been, since a university clearly had the option of "*becoming the agent of commercial exploitation*" itself [28], moreover, a university's decision regarding the exploitation route for any given discovery could be influenced by thoughts of the likely return, as it was also entitled to a share of

any profits. The AUT was anxious to avoid exchanging the BTG's monopoly for a monopoly held by members' own institutions It concluded that a number of safeguards should be established universities should be compelled to seek competent professional advice when evaluating IP generated by their staff and to ensure that staff had access to independent advice, too, they should also set up some form of arbitration procedure to deal with disputes. Indeed, the AUT felt it might be worth making the respective roles of the university and the researcher in the exploitation process explicit in university policies It was the AUT's belief that the success of the Government's new policy would depend on these issues being resolved - and on adequate incentives being provided to encourage its members to become more involved in the exploitation process

Incentives

The AUT was interested in two main incentives career progression and financial advantage. The document sent to local associations in July 1985 noted that "*academic and administrative excellence may be manifested in facilitating the commercial exploitation of research results and to the extent that they are, they should be taken into account in assessing promotion*". The AUT felt that the removal of the BTG's monopoly should lead to potentially greater financial rewards than the BTG had previously offered, though it believed the Government would "*put a ceiling on royalty sharing*" [29]. It foresaw a number of problems, most notably the possibility that some universities would opt out of the new arrangements, leaving the position of those members uncertain For this reason, the AUT felt that there should be national guidelines on royalty-sharing, which would be negotiated with the AUT, rather than reliance on local agreements Above all, however, the AUT was anxious that *ad hominem* or *ad hoc* royalty-sharing arrangements, especially secret ones, should be outlawed, there should be a standard royalty-sharing formula which applied to all discoveries from the outset

Other Issues

Whilst approving in principle of the Government's wish that its members should become more involved in the exploitation process - indeed, entrepreneurially involved, if they wished to, the AUT was concerned about the extent of the obligations, restrictions and performance assessment which universities might now try to impose on academic staff

It recognised the duty which the 1977 Patent Act imposes on all employees, but felt this should not be interpreted in a way which implied expertise which many members clearly did not have In the AUT's view, the existing Research Council formula constituted the limit of what might be expected from an academic It also felt that commercially exploitable research results were generally a "*mere accident*", and that universities should not treat these as a measure of the relative quality and value of individual researchers or Departments

Having read ACARD/ABRC's report (ACARD/ABRC, 1983), which recommended exploiting IP on the basis of know-how agreements rather than patents, the AUT was concerned, too, about potential conflicts between an academic's need to publish and his university's possible interest in enforcing confidentiality in pursuit of "*theoretical commercial gains*" [30]. It sought to address this by two strategies firstly by talks with the SERC to discuss ways of formalising what it saw as the Research Council's moral responsibility to ensure publication of research results and secondly by encouraging local associations to seek the explicit right for researchers to disseminate information within a short period, except in certain, agreed circumstances

(ii) UDIL

During the early 1980s, UDIL's attention was fixed on a somewhat wider horizon than IP· university/industry relations in general In pursuit of this, UDIL was starting to make contact with other organisations, such as the SRC (subsequently the SERC), the DES, the CVCP, the DoI, the NRDC (subsequently the BTG) and the LES It also submitted evidence to Parliamentary Commissions and responded to invitations from Holland, Germany, Sweden and Eire, which saw UDIL as both the prototype and the model for promoting European university/industry relations Indeed, after approaching the EC to discuss the possibility of funding to train technology transfer intermediaries, a UDIL representative became chairman of the EC committee established in 1982 to look into their training needs, as a result, the EC became interested in establishing a European-wide association of technology transfer intermediaries [31] UDIL also applied to the DES for pump-priming grants to enable each UK university to appoint one, if not two, technology transfer intermediaries

Where IP itself was concerned, during this period UDIL devoted most of its attention to "soft" IP, building on ACARD/ABRC's suggestion (ACARD/ABRC, 1983) that an on-line database of academic expertise should be created, this culminated in the launch of the BEST Index in December 1984 The identification, evaluation, protection and commercial exploitation of "hard" IP was a relatively minor concern for much of this period, although UDIL was working behind the scenes to lobby for initiatives such as the BTG's seedcorn fund and the setting up of a company dedicated to marketing university software - indeed, in September 1982, UDIL set up an IPR Working Party to consider this last idea [32].

By that time, UDIL had learned that the BTG's monopoly might be relaxed [33], it duly arranged a meeting with the SERC to discuss what that might mean in practice Curiously,

though, there is no evidence that as an organisation, UDIL did very much more prior to 1985 to prepare for the removal of the BTG's monopoly, either at a policy or a procedural level It was not until April 1985 that UDIL decided to set up a working party to look at the implications of IPR from Research Council-funded projects being "*returned .. to the grant-holder and his university*" [34]. It was two months before the chairman of the working party wrote to UDIL members requesting information on current policy and practice At the same time he enquired about the impact of the Kingman letter on each institution. "*Can you tell me if it has caused a flurry of discussions or any policy changes? Has it catalysed any new initiative?*" The results of this enquiry were reported at UDIL's September 1985 meeting, just a few days before universities were to respond to the Research Councils' offer

UDIL's main contribution to IP matters during this period was therefore purely practical A working party considering the organisation's future role suggested that UDIL should set up in-service courses on managing university IP The first workshop took place in April 1985 and was attended by 90 per cent of ILOs attending UDIL's spring meeting. It was the first of a series of seminars on this general topic

(iii) CRS

There is no evidence that the Conference of Registrars & Secretaries (CRS) took much, if any, interest in IP matters prior to the mid-1980s Following the announcement that the BTG's right of first refusal was to be removed, this changed, however In 1984 the CRS began to feel concerned about who was going to influence the new arrangements governing publicly-funded IP once the BTG's monopoly had been removed CRS clearly viewed both UDIL and UKSPA as potential rivals when it came to representing the views of UK universities A letter written by one Registrar to fellow members contained the

phrases "*BTG is looking for somebody to consult over a new policy they wish to adopt in regard to patents and licensing ... Other university bodies are already seeking to represent universities on some of these issues . If we wish to keep abreast of, or even control, what is going on, it is clearly important that we move fairly quickly*" [35].

The CRS duly established a Forum on University Industrial/Commercial Activities, which first met in September 1984 The Forum identified a number of pressing needs, most of which related to members' lack of information and representation It was at this meeting, for instance, that CRS members learned of the existence of the LES and its role in providing experienced and specialised personnel to help conduct license negotiations and/or train previously inexperienced personnel The CRS seems to have felt particularly ignorant about university companies and science parks It was decided to press the CVCP to seek detailed information on university companies, with especial regard to IPR, equity arrangements, university representation on company boards, specialist legal advice, letting space in UGC-funded buildings to private companies, difficulties of individuals working both for the university and a university company *etc*

It was also decided to cultivate links with UDIL, an organisation which "*could be seen by some outside bodies as representing universities in industrial matters, although the seniority, responsibilities and contact with university central authorities of the various ILOs is very variable*" [36]. Six months later, the Deputy Chairman of UDIL attended a meeting of the Forum, at which he emphasised that UDIL sought to avoid creating the impression that it represented universities in its relations with industry, but that despite its best efforts, outsiders sometimes persisted in this belief This does not appear to have had a calming affect on the Forum, which decided to ask the CVCP to "*monitor carefully the burgeoning activities of UDIL*"; the Forum also decided to ask UDIL to inform the CRS

"*on each occasion it intended to establish a new working party or other initiative*" [37]. Within a month or so, the Forum had achieved its objective the CVCP set up an *ad hoc* group to monitor universities' relations with UDIL [38] and UDIL was asked to place the Forum on its circulation list The Forum then turned its attention to UKSPA, attempting to gain some measure of influence over UKSPA's activities [39] It also tried to persuade the National Audit Office to "*establish a certain degree of tolerance*" in its relations with universities, given that both were operating under new circumstances and conditions [40]. Prior to this, the Forum had attempted to establish a line of communication with the BTG by getting itself invited to a meeting between the CVCP and the BTG in November 1984 [41]. In September 1985, in response to recommendations from the Forum, the CRS asked the CVCP to gather data on revenue-sharing arrangements in UK universities, its objective was to encourage universities to adopt a more uniform approach, so that they could "*respond more effectively to pressure from the AUT*" [42].

Although the CRS' Forum devoted most of 1984/85 to manoeuvring itself into a position of influence, it does not appear that it had any views of its own on subjects such as the ownership of IP and the respective roles of the researcher and the university in the exploitation process - though it seems to have exhibited a certain degree of concern about the financial incentives which universities were being urged to create In the main, the Forum devoted much of its energy during this period to persuading other organisations to gather data and make recommendations on its behalf

(iv) CVCP

The CVCP had been interested in university/industry relations considerably longer than the CRS [43] Prior to the CRS establishing its Forum, the CVCP had established an Advisory Committee on Industry (ACI) [44] The ACI turned its attention to a wide range

of topics, many of which were relevant to the exploitation of IP. In 1984 it established a working party which responded to a request from the DES for comments on arrangements for the exploitation of Research Council-funded inventions which it was proposed to introduce following the removal of the BTG's monopoly. CVCP members were duly notified of both the proposals and the working party's comments in June 1984 [45]. This was followed in September 1984 by a report on likely aspects of the new arrangements, following comments from a wide range of organisations The report stated that the Prime Minister, whose approval for the new arrangements was required, favoured an exploitation system "*which involves the minimum of central control and bureaucracy and gives the greatest possible entrepreneurial freedom to the researcher*" [46].

This same working party reviewed many of the topics considered by the ACI in a paper circulated to Vice-Chancellors and Principals at the end of June 1985 [47]. Although this paper focussed on university/industry relations in general, sections of it incorporated background information highly relevant to the exploitation of research discoveries [48] The paper also considered the various mechanisms by which research discoveries could be exploited, placing considerable emphasis on start-up companies located on science parks, particularly companies founded by universities or members of their staff It concluded by considering the kinds of policies and procedures which universities might adopt in order to ensure that academic research discoveries were properly exploited - matters which were currently taxing universities trying to respond to the Kingman letter In particular, it reiterated the need to encourage entrepreneurial attitudes among academic staff, given that fewer than 5 per cent were reputed to be interested in starting their own businesses It also drew attention to the implications for university management, emphasising that universities would need to adopt "*[an] unobtrusive management accountancy style . [a] laid-back style of management*", in which individual freedom of activity was facilitated without

excessive formal controls and monitoring procedures

In February 1985, partly in response to approaches from UDIL and the CRS, the CVCP established another working party to look into the issues surrounding industrial liaison This group spent some time considering the role of science parks and university companies; it concluded by deciding to commission a survey The results of this survey were not circulated until June 1987 [49]. However, in the meantime the CVCP circulated a paper on the legal and taxation implications of universities establishing limited liability companies for commercial or trading purposes [50]

Much of the information and guidance which universities might have drawn upon when formulating their policies and procedures was scattered in documents which dealt with wider concerns than IP. When the Kingman letter arrived, the CVCP's 1978 report remained its only comprehensive attempt to provide assistance on the exploitation of "hard" IP (*ie* tangible IP patentable inventions, computer software, books, musical compositions and so on, which are copyrightable, registered designs, unregistered design rights, and know-how - see chapter 7 for further details) - and parts of it were by then out of keeping with the Government's latest approach The CVCP recognised this, perhaps rather belatedly, and in the third week of May 1985 it established an advisory group [51] Judging from the 4-page note given to members of the advisory group [52], apart from identifying redundant aspects of the 1978 report, the CVCP was interested in providing practical assistance relating to the process of identifying, evaluating, protecting and commercialising IP, which its 1978 report had not considered - such as marketing and negotiation techniques, sources of development finance *etc*

It was also interested in illuminating unresolved issues These included, for example a definition of what should now be deemed to constitute "IP", how to protect academics' rights when they generated IP protectable by copyright or secrecy - apparently a reference to ownership of types of IP not considered by the CVCP's 1978 report, what - from the academic's perspective - constituted a fair share of the profits, how to resolve the sometimes conflicting demands of protecting and publishing discoveries The CVCP was interested, too, in how to resolve tensions between the wishes of the Government, the Research Councils and the DES regarding the respective roles of the researcher and the university in the exploitation process. The Research Councils apparently wished the rights and responsibilities for exploitation to rest firmly with the institution in receipt of the grant, however, the Government was encouraging universities to give researchers the fullest opportunity and scope to assume responsibility for exploiting their discoveries The position of the DES, on whose behalf the Secretary of State had issued his statement of 14 May, was that universities should give researchers the right of first refusal to exploit their discoveries "*within the framework of the university's agreed arrangements*". These three bodies also seemed to differ about another aspect of the exploitation process - should universities/researchers be given complete freedom to negotiate whatever they saw fit, in pursuit of exploitating discoveries, or should they be constrained to avoid wide variations in practice The CVCP perceived the DES to be in favour of "*hard but fair bargains with companies*" but against "wide variations in practice," a view similar to the UGC's some 7 years earlier [53].

The advisory group had less than a month in which to make its initial recommendations and a further 2-3 weeks in which to finalise its report In the event, the time-scale was academic, since the group met only once and made no recommendations It was wound up once the SERC established the Exploitation Scrutiny Group (ESG) on behalf of all five

Research Councils [54]; the CVCP assumed the ESG would provide appropriate guidance

(v) ESG

The ESG was established by the SERC in June/July 1985, with representation from the other four Research Councils, the UGC, the DES, the DTI, the Treasury - and the CVCP, representing the universities themselves [55]. According to the Kingman letter, its function was to scrutinise universities' responses to the Kingman letter and to develop and refine criteria for satisfactory arrangements Some of the issues raised by the CVCP were apparently examined by the ESG [56] However, the ESG has adopted what might be described as a minimalist approach to publicising its thoughts and actions Moreover, it invariably communicates via the SERC or the CVCP, rather than directly, indeed, it is unclear sometimes whether the Research Councils are communicating on their own behalf or the ESG's

(vi) SERC

The SERC's principle guidance during this period was contained in the Kingman letter itself This document did not provide a clear definition of the kind of IP which universities were offered the rights to and responsibilities for exploiting Paragraphs 1 and 2 referred to "*inventions*", note (i) to "*discoveries and know-how*" and note (iii) to "*intellectual property*" It is not clear whether the Kingman letter regarded "*discoveries and know-how*" and "*intellectual property*" as synonymous with inventions, as defined by the 1977 Patent Act, whether it was consciously but imprecisely widening the types of IP which it expected universities to assume the rights and responsibilities for exploiting, or whether the BTG's right of first refusal applied to all forms of IP, in any case In the BTG's view, although the NRDC was originally given the right of first refusal over "*inventions*" [57], rights which the BTG inherited, the term was not intended to be interpreted in the narrow

sense subsequently employed in the 1977 Patent Act; rather, it was intended to be a catch-all phrase which included designs and, later, copyright in computer software [58] This would seem to coincide with the SERC's usual view of the types of IP which it required principle investigators to look out for [59].

Nor did the Kingman letter state explicitly who the SERC felt owned IP generated by academics - either prior to the removal of the BTG's monopoly or subsequently. In the BTG's view, it belonged to the universities, the BTG invariably asked universities to assign to it their rights [60]. Since the letter offered *universities*, not researchers, the chance to assume "*rights and responsibilities for exploitation*", we may perhaps assume the SERC felt that universities - or certainly those which accepted its offer - owned the IPR. On the other hand, note (v) referred to "*safeguards, and reversal of rights*" and note (x) to "*consequences for terms and conditions of employment, including the waiver of rights of ownership under the Patents Act 1977*" The AUT certainly interpreted to mean that universities were expected as a matter of policy to yield their rights in IP generated by staff in the course of their work It could equally be interpreted to mean that researchers should be obliged by their terms and conditions of employment to waive their rights, although it is likely that this would contravene the provisions of the Act

Apropos the respective roles of the researcher and the university in the exploitation process, the Kingman letter simply stated that certain responsibilities, including identifying, assessing, protecting and "*securing exploitation*" of IP, should be "*explicitly allocated*". *Apropos* incentives, the letter called for royalty-sharing on a basis which achieves a balance between creating an incentive and reward for the researcher and due return to the university on the public monies involved, it gives no indication of what constituted "*a balance*".

(vii) DES

As noted by the CVCP, the guidance given by the SERC in the Kingman letter differed in key respects from the guidance given by the Department of Education and Science (DES) in the shape of Sir Keith Joseph's statement, issued on the same day in May 1985 This document [61] was no more precise than the Kingman letter when it came to defining the kind of IP under discussion The title of the statement was "The Exploitation of Research Council Funded Inventions". However, the body of the statement refers to "*scientific and technological discoveries*", "*findings and ideas*" and "*potentially exploitable results*", as well as "*inventions*"

Where ownership of IP is concerned, the DES statement appears to be less ambiguous than the Kingman letter Paragraph 6 contains the sentence "*Where a researcher nevertheless chooses not to take on the rights and responsibilities for the exploitation of his or her discoveries, these would revert to the university*". This strongly suggests the DES felt that universities had the right to IP generated by their staff in the course of their duties, but that it expected universities to yield all those rights as a matter of policy - with the proviso that they would revert to the university where researchers chose not to exercise those rights and responsibilities

The most noticeable difference between the guidance provided by the SERC and the DES concerns the respective roles of the researcher and the university in the exploitation process Where the Kingman letter leaves it to universities to resolve this question, the DES states unambiguously that although the rights and responsibilities for exploitation would be granted in the first instance to *institutions* in receipt of a grant, *researchers* should inherit the BTG's right of first refusal

"I envisage that the opportunity to exploit would thus in the first place rest with the researcher ..."

provided he or she took "*active steps*" to exploit their discoveries in ways which were consistent both with the Government's policy aims and the framework of the University's agreed arrangements As outlined in chapter 1, the DES expected universities to give researchers "*the fullest opportunity and scope .. to assume responsibility for exploiting their own findings and ideas*", to actively "*encourage researchers to exploit discoveries themselves*" and "*to provide guidance and help for those who wish to do so*" The DES recognised that by giving researchers greater scope and opportunity to exploit their discoveries themselves, there was a possibility that in some cases, exploitation might be "*less than optimal*", it felt this was a risk worth incurring in view of benefits to be gained from researchers and universities having increased responsibility and incentive

Where incentives are concerned, the DES echoed the Kingman letter in stating that universities should share in the royalty income from IP because public funds were involved. However, it introduced the idea that the share allocated to researchers should be commensurate with the responsibility for exploitation which they had assumed

(viii) Patent Office

Until the late 1980s the Patent Office was purely a regulatory authority, it simply accepted applications for patents/registered designs/trade marks, processed them, granted them - where appropriate, and arbitrated in disputes By the early 1980s, there was considerable dissatisfaction with this *modus operandi*, as evidenced by the sections of the 1984 Green Paper on IPR and innovation [62] which made various proposals regarding the future of the Patent Office In the end, the Patent Office became an Executive Agency within the DTI, charged with assuming a more proactive role, from 1989 it was empowered to spend upto

5 per cent of its annual budget on marketing its services [63].

Some years before these changes were formalised, the Patent Office established a publicity section which, in July 1985, targetted the industrial liaison officers of UK universities ILOs in 57 institutions were offered the chance to take advantage of the Patent Office's new lecturing service or its films/videos, which could be purchased or hired or even simply borrowed [64].

5.2.4 1986-1990

(i) ESG

The ESG has continued to adopt what might be termed a minimalist approach to publicising its thoughts, decisions and actions Some information has been provided directly through the Secretary of the ESG [65], making presentations and answering questions at meetings of the Conference of University Administrators In the main, however, the ESG has continued its practice of communicating through the CVCP or the SERC, rather than directly

(ii) SERC

Indeed, on occasion, the chain of communication has been even more convoluted In July 1986, for example, the SERC drew up on behalf of the ESG a set of guidelines relating to the exploitation of IP, prepared "*in the light of universities' replies*" to the Kingman letter, they were circulated by the CVCP These guidelines [66] confirmed the ESG's view that there probably were no ideal arrangements for technology transfer and that individual universities' arrangements might vary considerably, given differences in local circumstances The document says nothing at all about the ownership of IP generated by academics, however, it deals with the various stages of the exploitation process in turn and

the various exploitation routes

Exploitation of IP

The guidelines indicated that the initiative for identification, evaluation and protection should rest with researchers, but that universities should not rely entirely on researchers showing such initiative Accordingly, they should "*establish whatever machinery they consider appropriate to ensure opportunities for exploitation are not missed*" - ie fail-safe mechanisms

The guidelines reminded universities that when it came to exploitation

> "*.. it is seen as essential for successful exploitation that the inventor should have the opportunity to be closely involved in pursuing the exploitation process and in liaising with any agency exploiting the invention*"

Moreover,

> "*.. in some cases, this could be a University company in which the inventor plays a key role In other cases, it could be open to the individual alone to pursue the exploitation within the limitations of time that the University considers appropriate and where the University does not wish to become involved*".

The guidelines added that even if a university does wish to become involved ...

> " *. such arrangements should centre on a partnership in which the University provides the institutional backing whilst providing the fullest scope for direct involvement and assistance of the inventor in the exploitation of the invention*".

Universities were also reminded to avoid exclusive, monopoly or quasi-monopoly exploitation arrangements

Incentives

Where incentives were concerned, the guidelines pressed universities to establish fixed royalty-sharing formulae which gave most of the early income to the inventor(s) but the bulk of the overall income to the university

The document also urged universities to "*resolve and codify*" all these issues so that the issue of individual responsibility and accountability is clear, universities should evaluate their procedures and change them, if necessary, to comply with these policy recommendations.

In September 1986 the SERC followed this with a letter to Registrars/Secretaries outlining the new research grant conditions which applied to universities authorised to assume the rights to and responsibilities for exploiting IP arising out of Research Council-funded projects The letter stated unequivocally that universities must follow the procedures which they described to the ESG in their response to the Kingman letter, they must therefore ensure that principal investigators and everybody else associated with a research project (staff and students) are aware of and accept these procedures [67]

The letter added that the SERC expected authorised universities to make such IP available on preferential terms to institutions eligible to receive research grants from the SERC. Preferential terms included the provision of unsupported software, subject to a confidentiality undertaking, and/or provision of supported software, products or processes excluding any element of royalty attributable to the value of the research funding by the Research Council.

(iii) CVCP

Since late 1985 the CVCP has tried to communicate to members at least some of the ESG's thoughts, decisions and actions This has taken the form of position papers, factual progress reports or a combination of both In November 1985, for example, the CVCP reported that the ESG had taken note of the CVCP's 1978 position regarding the ownership of IP, and that accordingly it, too, was less concerned about who owned IP than about "*individual researchers/inventors [being] given adequate scope, encouragement and incentive to pursue the exploitation of their inventions themselves, if they so wish, in accordance with the Government's statement [of] 14 May, 1985*" At the same time, the CVCP reported, the ESG decided that a list of venture capital organisations should be circulated to universities [68] In February 1986, to take another example, the CVCP reminded universities that the ESG attached particular importance to Sir Keith Joseph's statement regarding individual researchers having "*the fullest opportunity and scope for exploiting their own ideas, should they wish to do so, with the backing of their institutions*"; at the same time, the CVCP warned universities against setting up alternative monopolies to the BTG [69].

In 1990, the CVCP representative of the ESG spoke on behalf of the Secretary of the ESG at a meeting of the Conference of University Administrators Administrators were reminded of the Government's objectives in removing the BTG's monopoly, as outlined in Sir Keith Joseph's statement in May 1985 - particularly the role which researchers were expected to play in the exploitation process They were asked to submit to the ESG reports which showed how their institutions were making progress towards those objectives, including information on the involvement of researchers They were also asked to consider whether they needed to change their policy or procedures - and if so, to notify the ESG accordingly [70]

The CVCP has occasionally used these ESG-inspired position papers and progress reports to draw members' attention to sources of practical assistance, such as Barclay's Bank pamphlets on starting high technology companies and a forum organised by the British Venture Capital Association at a meeting of the British Association [71].

There have also been items relating to IP in documents dealing primarily with other subjects In July 1987, for instance, the CVCP circulated to members the second statement of the joint CVCP/UGC working party on performance indicators in universities [72] One of the performance indicators due to be published later that year was "*analysis of copyrights/patents/publications*". The statement indicated that at that point, further work remained to be done on this particular indicator, in fact, this was still being worked upon four years later, in 1991 [73]. In the meantime, the ESG's own deliberations have led to the conclusion that using any quantitative measure of patents as a performance indicator may be very misleading, for two reasons firstly, because the purpose of much university research is not primarily to produce commercially exploitable research results and secondly because patents are not the only route for exploitation [74] It is not clear whether the ESG has transmitted these conclusions to universities, directly or indirectly.

In June 1987 the CVCP finally circulated the findings and recommendations of the survey of university-based companies and science parks, which it had commissioned in 1985 [75] The CVCP was not willing to make a copy available, nor was the author, despite the fact that he prepared a more anonymous, public version of it, as well as a detailed, private copy for the CVCP, this may be because it was considered in some quarters to be an inadequate response to the problem, as outlined [76]

During this same period, the CVCP has become involved on its own account in a number initiatives concerned with the exploitation of IP generated within universities Early in 1986, for example, the CVCP set up a committee to plan universities' participation in Techmart, held in November of that year. At the same time, the CVCP lent its support to a series of University Technology Transfer Forums, a UDIL-inspired initiative (see section (iv) below) The CVCP has also sought to ensure that members have been given opportunity to comment on the initiatives of other organisations, where they seek to shape universities' policies, procedures or practice *vis-a-vis* IP. Examples include UDIL's 1988 report on the management of university IP (also detailed in section (iv) below), indeed, Vice-Chancellors and Principals were asked whether they would like the CVCP to adopt the report's recommendations and conclusions as the basis of a code of practice - or at least a note of guidance for universities [77]. Similarly, the CVCP sought members' comments on a report on IPR in collaborative R&D ventures with HEIs, produced in 1989 by an inter-departmental Government working party chaired by the Comptroller General of Patents, Designs & Trade Marks [78]. At the same time, the CVCP indicated its own view: in principle, universities should seek to retain ownership of any IP their staff generate in the course of collaborative research, subject to the negotiation of non-exclusive exploitation rights for the industrial partner and a share of the resulting revenue

(iv) UDIL

During this period, UDIL has continued to provide practical assistance to its members, providing, for example, workshops on topics such as the strategic use of IP [79]. Indeed, members have been encouraged to give the management of IP considerably more prominence than UDIL's original constitution envisaged In 1986 a working party set up to consider the role and function of both UDIL as an organisation and individual IL

offices concluded that one of UDIL's express functions should henceforth be "*to give help and guidance to UDIL members on the exploitation of IPR, research discoveries and inventions*". Correspondingly, one function of individual IL offices should be ...

"*.. to facilitate the beneficial transfer of new technology and the protection, marketing and exploitation of university IP*".

Accordingly, an ILO should be prepared .

". *to advise and assist with patenting, copyrighting and the other forms of protection of university IP, discoveries and inventions and help with the commercial exploitation of these by way of sale, licensing and royalty agreements*".

Moreover, technology might be transferred "*directly or through joint ventures involving third parties*" [80].

Later the same year, UDIL's Working Party on IPR presented the first draft of a paper focussing on the management and commercial exploitation of university IP [81] Another draft was presented to members in September 1987, the final version was circulated during 1988 [82], after being reviewed by the CVCP and the SERC The report employed the WIPO's definition of IP, namely.

". *the rights relating to literary, artistic and scientific works, performances of performances of performing artists, phonograms and broadcasts; inventions in all fields of human endeavour; scientific discoveries, industrial designs, trade marks, service marks and commercial names and designations, and all other rights resulting from intellectual activity in the industrial, scientific, literary and artistic fields*".

This is the most specific - and the most all-embracing definition of IP employed to date The report indicated its contents related to everything included in that definition, with particular reference to "*the technology of patents and know-how, plant breeders' rights, and copyright in written work, music designs and drawings, software and films and*

videotapes". It also covered every category of research except that carried out by university-owned companies and academic staff acting privately as consultants for third parties

Ownership of IP

UDIL's report reproduced section 39 of the 1977 Patent Act. It also summarised the recommendations of the CVCP's 1978 report in an appendix, without comment However, the section on ownership of IP as between the university and the inventor stated

> "*Most universities have ensured that, as advised by the CVCP in 1977, contracts of academic staff impose an obligation to undertake research, and the nature of university research is such that an invention may reasonably be expected to result from the carrying out of his duties, so that any invention made by a member of the academic staff in the course of his research will belong to the University by virtue of section 39 of the 1977 Act* "

UDIL appears to have decided that the circumstances of research are invariably such that an invention might reasonably be expected to result from carrying out that duty It makes no distinction between inventions which are patentable - and duly patented, and those which are not patentable or, for some reason, not patented The report admits to no doubt about a university's right to inventions made by academic staff in the course of their duties, provided their contract of employment imposes an obligation to do research Moreover, it makes no reference to the CVCP's recommendation that patents should be jointly vested in the university and the inventor

Where material covered by copyright is concerned, the report notes that for individual authors, copyright in a work extends for the author's life plus 50 years, whereas for institutions it extends for 75 years from the date of publication There is no discussion of ownership of copyright, as between the university and the author, nor a discussion of the

ownership of designs Given that the report stated it was intended to cover every type of IP described in the WIPO definition, especially "*the technology of patents and know-how; plant breeders' rights, and copyright in written work, music designs and drawings, software and films and videotapes*", the implication is that a university owns the rights to all such IP However, no justification for this claim is cited, nor does the report recommend whether universities should assert such claims explicitly in their terms and conditions of employment

The report did, however, urge each university to insist on retaining ownership of IP arising from industrially/commercially sponsored research projects and to make this explicit in research contracts - "*to enable it to control its proper exploitation*" It did not pronounce on the relative merits of subsequently retaining ownership of that IP and granting licenses to use it as opposed to assigning ownership.

Exploitation of IP

UDIL's 1988 report referred several times to "*research staff on the one hand*" and "*exploitation staff on the other*", the implication is that these are necessarily two quite separate groups Where the identification of IP with commercial development potential is concerned, the report recommended that the exploitation staff should "*assist*". However, the report argued for a professional approach to the next stages of the exploitation process there should be "*an integrated and professionally managed approach to the evaluation of IP*" This applies to the protection and exploitation of IP, too, apparently, the report indicates that patent specifications should be drawn by chartered patent agents, license/assignation negotiations should be conducted by staff "*experienced in such practices*"; legal documents should be drafted by solicitors *etc*

The report also argued that the choice of exploitation route should be determined after taking into account the nature of the innovation, the ownership of rights, the possibility of protecting them, the capital required for developing it for the commercial market, as well as its competitive life and market potential The wishes of the researcher were not mentioned, since UDIL did not countenance joint ownership of academic inventions, possibly it saw no need for such considerations With regard to companies started "*to accommodate entrepreneurial inventors enthusiastic to be involved in the exploitation of their inventions*", the report referred readers to the CVCP's 1987 paper (see [75]), but remarked "*It is unlikely that a University will wish to divert its energies into setting up a company to market a new product unless the business plan shows that it is capable of making about £100,000 in annual profits within four or five years*". This remark is apparently directed at wholly-owned university companies or joint ventures with another party The report made no mention of independent academic spin-off companies It added that the success or failure of start-up companies depended more on the motivation and management ability of those concerned than on the merit of the product This was, perhaps, an implicit warning against allowing academics to manage companies started to exploit their research discoveries

Incentives

Where incentives are concerned, UDIL's 1988 report restricted itself to the financial rewards which academics should receive if their *inventions* are successfully exploited, there was mention neither of non-financial rewards nor of rewards for other forms of successfully exploited IP. It is not clear whether this was simply a careless choice of phraseology or whether UDIL was adhering closely to IP law, which requires employers to reward employees for *inventions* successfully exploited but says nothing about rewarding other types of IP successfully exploited Certainly, much of the justification

which followed this assertion cited the 1977 Patent Act.

In UDIL's view, the share of the revenue which academics received should be "*negotiated in each case*", though "*normally within an accepted formula*", which should be codified in a written document. The terms of the 1977 Patent Act provided the rationale for this view, which differs from both the AUT's and the ESG's, but coincides with the CVCP's view, as expressed in its 1978 report As both these reports noted, the Patent Act lays down special criteria which must be taken into account when determining the size of the reward UDIL's 1988 report reminded members that these criteria "*must have priority if they result in a greater share for an inventor than would be arrived at by any University formula*", in other words, there may well be a case for re-assessing the academic's share in the light of the revenue which their invention yields

This report subsequently became volume 1 of a two-volume publication Volume 2 gathered together examples of codes of practice, confidentiality agreements, research contracts, license and assignation agreements and revenue-sharing formulae which were in use in universities and which were offered as "*worthy of imitation*", it was circulated in 1989 [83]

During this period, UDIL has also tried evaluate the role of various technology transfer agencies and brokers [84]. UDIL itself devised a new technology transfer mechanism in the shape of University Technology Transfer Forums (*sic*), which it sponsored from 1986-88 in conjunction with the CBI, the DTI, the Royal Society, the CVCP and the CIHE

(v) Patent Office

The Patent Office's new, more proactive role has manifested itself in several ways which could be of assistance to universities - to ILOs and researchers, in particular The first is the "Patent Roadshow", designed to increase awareness of both the different ways in which exploitable ideas can be protected and the unparalleled information resource which the Patent Office provides Between September 1989 and September 1990 the Patent Office held 33 "Patent Roadshows", starting in the north-west, moving then to the south-west, Wales, Yorkshire and Northern Ireland The north-east, east Midlands and Scotland were due to be covered during the following year. The event is hosted by a local organisation recommended by the regional DTI office In several cases, universities and polytechnics were offered the opportunity to act as host, their costs covered by nominal fees paid by the audience, in one or two cases, HEIs accepted this offer [86] The "Patent Roadshow" is intended to attract a diverse audience, ranging from lone inventors and academics to business people and patent lawyers.

A second initiative has focussed more closely on the needs of universities and polytechnics. In June 1990 the Patent Office ran a pilot course on protecting IP, aimed specifically at ILOs and administrators responsible for IP and publicised both directly and indirectly, via UDIL Late in 1990 it started the process of delivering the course locally in different regions and began to consider running a similar course on licensing protected IP

(vi) Miscellaneous

Between 1986 and 1990 several other agencies tried to put together "best practice guides" to help universities formulate policy, procedures and practice *vis-a-vis* the exploitation of IP, among other things In 1987, for instance, the DTI commissioned Peat Marwick to produce a guide, funded by what it described as the "miscellaneous links programme" of

its activities in relation to HEIs [87]. Scheduled to be completed by mid-1988, the project transpired to be more complex than either the DTI or Peat Marwick had realised In the end, it was decided to scrap the single, omnibus text in favour of a series of short, easily assimilable booklets The first of these appeared in late 1989, but had little or nothing to say on the subject of IP [88].

In December 1987 the National Audit Office (NAO) launched a "value for money" investigation of university collaboration with industry. Focussing on the role played by industrial liaison offices, science parks and university companies, the NAO's report was intended to cover the exploitation of IP, too The NAO's findings were scheduled to be presented to Parliament in 1989 and published in the form of a "best practice guide" In the event, the NAO was side-tracked by other, more urgent priorities at the beginning of 1989, having produced only a draft report [89]. Returning to the subject at the end of 1990, the NAO recognised that things were changing so fast, it would need to gather more recent data, it was left to the CRS' Forum on University/Industry Activities and the CVCP's Academic Advisory Committee to recommend, in the course of 1991-92, whether this was worth doing

5.3 Discussion

(i) Definitions of IP

The passing of time seems to have had a particularly noticeable affect on definitions of IP over which universities were deemed to have - or not have - rights. Prior to 1985, most documents dealt exclusively with *inventions* - patented or unpatented, patentable or unpatentable There is little doubt that in early sources of assistance, like UDIL's 1974 report, the word "invention" was used in a fairly narrow and specific sense, equivalent to or close to the sense in which it was subsequently employed in the 1977 Patent Act This

is not surprising, given that computer software only came into being as a separate, exploitable commodity in 1969 [90] and its commercial potential had not yet been perceived In the period immediately after 1977, most sources of assistance focussed on inventions, using the word in the specific, narrow sense employed by the 1977 Patent Act. This doubtless reflects the significance of the 1977 Patent Act for employer-employee relations, though the CVCP, for instance, was not unaware of other forms of "hard" IP which might be generated by academics, its focus on inventions in the 1978 report was motivated by uncertainty about the possible affect of the Whitford Report [91] on copyright, particularly copyright in computer software However, the AUT's initial focus on inventions was occasioned by the fact that its first guidance was produced in response to the 1977 Patent Act - and the CVCP's 1978 report Similarly, it first started to exhibit interest in copyright in computer software following the passing of the Copyright (Computer Software) Amendment Act in 1984

Section 5 2 3 (vi) has already considered why, in the lead-up to and the aftermath of the removal of the BTG's monopoly, the CVCP entitled all its notes to members "Exploitation of Inventions" and why the text of these notes referred invariably to "*inventions*" or "*patents*", too - whereas the Kingman letter and Sir Keith Joseph's statement referred variously to "*inventions*", "*scientific and technological discoveries*", "*discoveries and know-how*", "*findings and ideas*", "*potentially exploitable results*" and "*IP*". It has already been observed that the Guidelines for Arrangements for Exploitation which the SERC produced in July 1986 referred variously to "*discoveries and know-how*", "*inventions*" and "*results*", whereas the SERC usually employed a far more specific and all-embracing definition of IP. This appeared during the 1980s in its rules relating to research grants, principal investigators in receipt of research grants were asked to ensure notification of

" *any device, material, product or process, computer software or other result which it is*

considered might have commercial significance, whether patentable or not" [91] This definition probably covers every type of IP, with "*other results which it is considered might have commercial significance*", employed as a catch-all phrase to include *designs* and *know-how*. It is not clear why the SERC employed such woolly terminology in the Kingman letter or in its 1986 Guidelines What is clear, though, is that this terminology did not provide the calibre of assistance which should have been provided for universities trying to formulate appropriate policies and procedures

It is surprising is that UDIL did not consider at least one other form of IP sooner than it did, namely computer software. There were no objective constraints on it doing so, once computer software became a separate commodity, the 1956 Copyright Act was generally interpreted in a way which made computer software comparable to "*literary works*" - *ie* it was covered by copyright, rather than patent Later this was confirmed explicitly by the Copyright (Computer Software) Amendment Act of 1984 However, UDIL's internal documentation apparently made no reference to software until 1981/82. There were references to "*IP*" - but UDIL does not appear to have offered a formal definition of "*IP*" until it published its 1988 report. UDIL's failure to get to grips with this was probably due in part, at least, to uncertainty about the extent to which members should try to influence universities' IP policies. The 1974 report documented UDIL's reluctance to make recommendations which would amount to a Code of Practice - "*the decision on which procedures to adopt being very much an internal matter*" There is evidence that this uncertainty prevailed well into the 1980s [92]

It is curious, though, that until UDIL included the WIPO's all-encompassing definition of IP in its 1988 report, none of the organisations seeking to provide guidance for universities devised a definition of IP which was as wide or precise as that normally

employed by the SERC. Indeed, with the possible exception of the CVCP in 1978, they do not even seem to have thought of doing so, if they had, they, too, could have used the WIPO definition, which dates from the time of the organisation's foundation in 1967. The reason for this lacuna may be that prior to 1988, most sources of guidance had been produced in response to a variety of highly specific triggers; UDIL's 1988 report was the first attempt to stand back and consider the management of IP as a totality.

(ii) Ownership of IP

Whereas the passing of time has led to increasingly wide and precise definitions of what constitutes IP, it has not led to a correspondingly neat resolution of the question of who owns the different forms of IP generated by academics

In its 1974 report, UDIL was not prepared to adopt a position *vis-a-vis* who owned *inventions* made by academic staff members The report simply noted that Edinburgh University had obtained legal advice suggesting that unless an employee was specifically employed to invent, then institutions could be erroneous in asserting or assuming ownership of resulting inventions. UDIL did not pay detailed attention to this question again until 1986/88, probably for the same reason that it did not get around to defining IP until then.

As we have seen, the CVCP and the AUT considered this question at the end of the 1970s, triggered by the 1977 Patent Act. The Act's failure to make explicit the position of academic inventors led to both sides obtaining legal advice which supported their interpretation However, whereas the AUT's response was to continue claiming rights in inventions for its members, lateral thinking on the part of the CVCP led to a recommendation which was designed to avoid disputes. Universities were asked, as a

matter of policy, to voluntarily yield part of their rights by vesting patents jointly in the name of the university and the inventors. The CVCP failed, however, to make explicit recommendations on the ownership of inventions which were not patentable or, for some reason, not patented Since the CVCP's recommendations are far from mandatory, and at that time it was not usual to follow-up its reports, we have no way of knowing whether this was adopted by many universities as a solution to the problem

In any case, it was not clear whether the Government, the Research Councils or the DES would accept this as a model for dealing with the ownership of "*inventions*" which might arise following the removal of the BTG's monopoly Documents circulated at this time, purporting to assist universities formulate their policies and procedures, left a lot to be desired. Wittingly or unwittingly, the Kingman letter was ambiguous on the question of who owned "*inventions*", "*discoveries and know-how*" and "*intellectual property*" generated by academic staff in the course of Research Council-funded projects Sir Keith Joseph's statement appeared to suggest that universities owned all the rights to "*findings and ideas*", "*inventions*", "*scientific and technological discoveries*" and "*potentially exploitable results*" arising from Research Council-funded projects, however, it also appeared to say that universities should conditionally yield all those rights to researchers who wished to actively exploit such discoveries The CVCP tried to resolve this confusion by persuading the ESG to accept the view expounded in its 1978 report - *viz* that ownership of inventions is less important than their exploitation. However, the office note in question [93] was not sent until November 1985 - by which time universities were supposed to have formulated their polices and procedures and responded to the Kingman letter. In fact, by that time, only 38 institutions had replied to the Kingman letter and some of those were still fine-tuning their policies and procedures [94] For some reason, though, the note did not explicitly remind universities that joint ownership of was one

possible way of side-stepping this problem

It is striking that none of the guidance produced by the CVCP, the Research Councils, the ESG or the DES dealt with the ownership of *copyright* We know that the CVCP deliberately restricted itself to considering inventions in its 1978 report, but this does not explain the absence of guidance in this respect during the years which followed Of course, given the woolliness of the terminology employed in the guidance produced by all these bodies, perhaps we should not be surprised that none of them dealt with the ownership of *copyright* It is the AUT which can claim the distinction of being the first organisation to try to provide guidance for members on this subject - and in particular, guidance on the ownership copyright in computer software The AUT's IPR Working Party started to consider the question in 1984 [95], a process which continued during 1985 Curiously, though, no evidence could be found that any documentation on this was ever sent to the local associations.

In the end, it was left to UDIL to provide guidance on the ownership of copyright, particularly copyright in computer software UDIL could have given this guidance some six years earlier than it eventually did, having set up a working party to look into the exploitation of computer software in 1982 However, UDIL chose to make no comment on the ownership of computer software - perhaps for the same reasons that it was reluctant to provide a definition of the types of IP over which universities could/should assert ownership It was not until 1986 that UDIL's working party on IPR started to consider such matters, culminating in its 1988 report Perhaps UDIL was encouraged by the fact that the CVCP was beginning to take it more seriously and to develop procedures for discussing and circulating reports which UDIL produced, seeking comments from universities, making amendments and even giving amended reports the CVCP's

As we have seen, UDIL's 1988 report was unique in stating explicitly that all inventions generated by academics in the course of their research belong to their university - and their university alone. It supported this claim by an interpretation of the terms of the 1977 Patent Act which may or may not be tenable UDIL's 1988 report also implied that universities also own the rights to every other type of IP covered by the WIPO definition However, it cited no support for such extensive claims - though it could have done so A succession of Copyright Acts dating back to 1911 [96] had effectively given employers the same rights over IP protected/protectable by copyright as IP protected/protectable by patent [97] As indicated above, this was confirmed by the Copyright, Designs and Patent Act of 1988. Curiously, though, UDIL's report did not cite the newly-passed Act to justify implicit claims that the university was the first owner of the copyright in works created by employees Nor did it mention the new design right [98] created by this Act, which conferred on employers first ownership of unregistered designs created by employees It did cite the Trade Marks Act of 1938 and the Trade Marks (Amendment) Act of 1984, but seems to have wrongly asserted that universities could not apply for registration of a trade mark in respect of goods [99]

UDIL's 1988 report made no reference to the fact that the terms of the 1977 Patent Act allowed employers to wholly or partially yield their rights in inventions made by their employees. It did not mention the idea of universities wholly relinquishing those rights in favour of researchers who wished to exploit their IP themselves, as outlined in the DES statement. Nor did it mention the idea of partially relinquishing those rights to allow joint ownership of patents, as recommended by the CVCP. Indeed, it made no mention of assigning the university's rights to the inventor where a university has no interest in

pursuing the exploitation of an invention. Equally, there was no indication that the new design right operated on much the same basis as patents where first and subsequent ownership is concerned, or that first ownership of copyright may be subject to a contrary agreement [100].

UDIL's report was not circulated until 1988, by which time a total of 51 universities/university colleges/hospital medical schools had already formulated their polices and procedures and been authorised by the Research Councils [101].

(iii) Exploitation of IP

With the passing of time, the concept of universities arranging the exploitation of IP generated by members of staff has become more acceptable than it was in the early 1970s, if we may judge by UDIL's 1974 report Moreover, where there was once a tacit assumption that if universities had to do this, they should do so indirectly - by assigning IP to the NRDC/BTG or a company, the concept of universities directly exploiting IP - via companies which they wholly or partly own, has become increasingly prevalent This can be detected in the changing character of the guidance produced over the years by university-related organisations.

The CVCP's 1978 report, for instance, recognised the importance of inventions being exploited - indeed, it regarded this as more important than squabbling over who owned them However, it omitted altogether to discuss the various direct and indirect ways in which those inventions might be exploited (though judging by the regulations which it urged universities to adopt, the CVCP probably assumed universities would generally dispose of them by offering them to the NRDC, or possibly a company). In 1985, however, the CVCP decided to remedy this omission, as outlined in section 5 2 3 (iv)

Although that particular effort was aborted, the CVCP had already commissioned research into science parks and university companies and duly circulated the findings to members.

The passing of time has also seen a significant change in the approach which universities have been urged to adopt towards the respective roles of the university and the researcher in the exploitation process - though this change is by no means unanimous. UDIL's 1974 report did not really consider the respective roles of the university and the researcher The CVCP's 1978 report did, tacitly, by recommending regulations which specified that researchers should act "*as directed by the university*". As we have seen, the list of actions included referring the invention to the NRDC for assessment and, if it thought fit, exploitation under its auspices, or collaborating with the university in the exploitation of the invention - presumably as it saw fit It did not occur to the CVCP that joint ownership of patents conferred equal rights when it came to making decisons about the exploitation process The concept of the researcher directing the exploitation process was apparently even further from the CVCP's mind The warning not to lay down in advance any single method of exploitation suggests the CVCP recognised that some researchers might have strong feelings about the way in which their invention was exploited However, this smacks of a tactic to pre-empt tantrums It certainly falls considerably short of the concept of giving them, as a matter of policy, the freedom to exploit/have their invention exploited as they saw fit

It was not until the lead-up to the removal of the BTG's monopoly that researchers started to be cast in a less subservient or dependent role in the exploitation process - in some quarters, at least It is clear that this idea originated in Government - or rather, the Prime Minister herself, gained acceptance within the DES, but did not entirely find favour with the Research Councils, as indicated above Thus, the Kingman letter left it to universities

to allocate responsibility for the different stages of the exploitation process, whereas the DES statement advised universities to give researchers the first right of refusal as a matter of policy If we are to believe the CVCP's reports on the thinking of the ESG, as time went by the Government/DES view gradually prevailed. Certainly, the office note sent to Vice-Chancellors and Principals in November 1985 stated "*Whether or not ownership is vested in the institution as employer or the individual as inventor, the group is concerned that individual researchers/inventors are given adequate scope, encouragement and incentive to pursue the exploitation of the invention themselves, if they so wish, in accordance with the Government's statement of 14 May, 1985*" [102] This was followed in February 1986 by another note which reminded Vice-Chancellors and Principals of the particular importance which the ESG attached to Sir Keith Joseph's statement regarding individual researchers having "*the fullest opportunity and scope for exploiting their own ideas, should they wish to do so, with the backing of their institutions*" [103]

It is questionable how much help these notes provided even for those universities which had not yet responded to the Kingman letter or were still fine-tuning their policies and procedures In July 1986 the Research Councils drew up a set of guidelines which was also distributed by the CVCP The guidelines did not seem to support the role for the researcher which had been advocated by the ESG Although the Research Councils expected the researcher to take the initiative when it came to identifying, assessing and protecting their invention (para 2), securing its exploitation seemed to be another matter altogether The guidelines indicated that unless a university had no interest at all in it, an invention should be exploited by "*a partnership in which the university provides the institutional backing whilst providing the fullest scope for direct involvement and assistance of the inventor ...*" [104] This has a definite ring of subservience about it, from the researcher's perspective It certainly falls short of the initiative which researchers were

not simply allowed but expected to show when it came to identifying, evaluating and protecting their inventions

Local AUT officers were given little encouragement to secure a commitment from their university that it accepted the new enterprising and even entrepreneurial role for their members which the DES statement advocated. Given that the Minutes of IPR Working Party meetings in 1985 show that it welcomed the idea of AUT members being given the freedom to exploit/arrange the exploitation of their IP as they saw fit, this is strange. The Working Party clearly believed that researchers were far more motivated than their universities to ensure their inventions were exploited - and in many cases, probably no less capable The AUT's response to the ESG proposed that researchers who wished to entrepreneurially exploit their discoveries should be given leave of absence for two years, with the right of return to their university post, in order to facilitate this Curiously, though, this approbation was not really communicated to local associations in the guidance produced to help them shape policies and procedures introduced by their university following the removal of the BTG's monopoly Nor did the guidance include practical suggestions such as negotiating temporary leave of absence in order to devote time to exploiting IP. The short section dealing with the roles of the researcher and the university is one of the weakest in the whole document, it was relatively brief and, unusually, badly written It made only a passing reference to members obtaining independent advice concerning their "*business interests*". One can only assume that the AUT Council was less enthusiastic than the IPR Working Party about the new role advocated for its members

UDIL's 1988 report did not explicitly discuss the respective roles of the researcher and the university in the exploitation process It is not clear whether this was an oversight or a deliberate omission, motivated perhaps by unhappiness at the idea that researchers should

assume responsibility for the exploitation process, if they chose. The document produced by the working party examining the role and function of both the organisation and individual members used language which suggested a *supportive*, rather than a *directive* role The ILO's function was to "*facilitate*" technology transfer ... to "*advise and assist*" with patenting, licensing and joint ventures However, it is not clear exactly who was primarily intended to benefit from this advice and assistance individual researchers with IP to exploit or "*the university*". Reading between the lines of the 1988 report, it is hard not to conclude that it was the university, and that the researcher's wishes were of little or no consequence to UDIL. Perhaps it is immaterial, since, as we have seen, a total of 51 universities/university colleges/hospital medical schools had already formulated their polices and procedures and been authorised by the Research Councils (see [101]) by the time this report was circulated.

(iv) Incentives

The passing of time has also seen considerable changes in the rewards which universities have been recommended to give academics whose inventions are successfully commercialised Judging by UDIL's 1974 report, which noted that academics in some universities received no financial reward, or at best a small *ex-gratia* payment, there has been a move towards considerably more generous financial rewards and, in some cases, non-financial rewards, too.

There is little doubt that the terms of the 1977 Patent Act triggered the move towards increased financial rewards - for inventions, at least. The CVCP's 1978 report devoted several paragraphs to the terms of the Act and, in the light of those terms, recommended that universities should not attempt to settle the precise division of revenue until it was possible to assess what the size of the revenue was likely to be Moreover, it urged

universities to regularly review the situation and amend any agreements accordingly. This is a view which the CVCP still holds today and which is shared by UDIL. The DES' view, as expressed in Sir Keith Joseph's statement, is not dissimilar, except that it advocated financial rewards which were commensurate with the level of responsibility which academics assumed for the exploitation of their inventions, not just commensurate with the income which they generated.

These are not views which found favour with the AUT, the Research Councils or the ESG, all of which urged universities to adopt fixed royalty-sharing formulae, laid down in advance and uniformly applicable to every situation and every researcher The Research Councils and the ESG favoured formulae incorporating a sliding scale giving most of the net income to the researcher when the total was small, with the university taking a progressively larger share as the income increased In its guidance to local associations in July 1985 [105], the AUT cited actual revenue-sharing arrangements from two universities, which it regarded as offering an acceptable financial reward One arrangement incorporated a sliding scale with six income bands, the other a sliding scale with just two income bands The SERC's July 1986 guidelines [106] cited a "typical" revenue-sharing formula incorporating a sliding scale with three income bands, universities were given advance warning of this in an office note from the CVCP in February 1986, by which time quite a few had already formulated their policies and procedures and registered them with the ESG.

Interestingly, given the attitude of the CRS' Forum on University/Industry Activities (see section 5 2 3 (iii)), at lower income levels, the SERC's formula was upto 20 per cent more generous to inventors than one of the formulae commended by the AUT and 6 per cent more generous than the other. At higher income levels, one of the formulae

commended by the AUT was just 1 per cent more generous than the SERC's - though it was calculated on the gross rather than the net income, but the other was 36 per cent less generous [107]. Irrespective of differences in the method of calculating the reward, it is evident that every organisation producing guidance has recommended universities to reward academics in a manner [108] and at a level which far outstrips what they would receive if they worked for industry [109].

There have been considerably fewer recommendations regarding a complementary, non-financial reward, or rather, a reward in which the financial aspect may be of secondary importance, namely career progression Neither UDIL's 1974 report nor the CVCP's 1978 report considered this Nor, however, did the CVCP's later documentation, nor the Kingman letter, nor the SERC guidelines - nor even the DES statement [110], despite the fact that the Green Paper on the future of higher education, published the same month, had flagged the idea of including collaboration with industry in the criteria for promotion In fact, the AUT was alone in broadly supporting this view by suggesting that "*academic and administrative excellence may be manifested in facilitating the commercial exploitation of research results and to the extent that they are, they should be taken into account in assessing promotion*".

(v) Relative Influence

As we have seen, the examples of guidance for universities considered in this chapter exhibit a noticeable lack of concensus in relation to key issues like the ownership of IP and the respective roles of the university and the researcher in the exploitation process This is not entirely a function of different ideas reflecting different times, the guidance which universities received during the mid-1980s exhibits a similar lack of concensus This makes it imperative to consider the potential influence of each source of assistance

relative to the other sources In doing this, it may be wrong to treat the earlier material as redundant, universities which acted upon the earlier guidance could, by the time the Kingman letter arrived, have had in place long-standing policies and procedures which they saw no need to change substantially.

UDIL's 1974 report had the distinction of being the first such example of guidance Interestingly, it flagged many of the issues which universities were asked to address 11 years later, in the Kingman letter. However, it is doubtful whether the report was read at the time by anyone but fellow members of UDIL; it is extremely unlikely that it was read by university officers of sufficient seniority to influence policy and for reasons which will be discussed below, it is certain that organisations like the CVCP and the AUT did not see a copy at the time By the early 1980s, UDIL had declared reports from the 1970s to be invalid

The CVCP's 1978 report had quite a different character It was the first document to consider and recommend policies and procedures which universities might adopt to handle inventions generated by academics Moreover, for several years it was the only such document, since the AUT had restricted its advice to the question of who owned such inventions The CVCP's report was not only widely circulated, it was circulated at the most senior level of each university - to people who had the power to shape policy, rather than just implement it

The Kingman letter and Sir Keith's Joseph's statement were undoubtedly major documents - in the sense that the policies and procedures which they were designed to trigger were occasioned by a major change in the way discoveries arising out of Research Council-funded research were to be exploited Like the CVCP's 1978 report, they were also

addressed to Vice-Chancellors and Principals However, it is questionable how much guidance each provided when it came to formulating those policies and procedures in any detail In so far as it was less ambiguous, Sir Keith Joseph's statement may have been more helpful in this respect On the other hand, since the Kingman letter was the document which universities were obliged to respond to if they wished to assume the rights to and responsibilities for exploitation, it is possible that this had greater influence than the DES statement Possibly, neither of the two documents - which were sent together - was particularly helpful They certainly failed to concur on several key points, reflecting tensions between the views of the Government and the Research Councils which the CVCP noted and tried, without immediate success, to resolve.

The CVCP's decision to wind up the advisory group which it set up in the third week of May 1985 meant that during this crucial period, its ability to influence universities' policies and procedures was more indirect than direct - by means of its response to proposals made by the DES and the Research Councils and its membership of the ESG The CVCP's attempts during late 1985 and early 1986 to assist members by relaying the thoughts, decisions and actions of the ESG was doubtless helpful to those institutions which did not immediately respond to the Kingman letter - and those which took some time to fine-tune their policies and procedures. For those which sent in a full and adequate response within the time-scale given or shortly afterwards, much of this interpretive information may well have come too late, however

As we have seen, the AUT failed to have the position of academics clarified with regard to those provisions of the 1977 Patent Act dealing with ownership of employee inventions. This had significant consequences for its ability to influence universities' responses to the Kingman letter. It meant that, at national executive level, the AUT was powerless to

influence the resulting policies and procedures unless proposals were made to nationally amend members' terms and conditions of employment in this respect - or, unless it was invited to participate in the debate It received no such invitation, however, it did not occur to the CVCP to involve the AUT and no attempts were made to nationally amend academics' terms and conditions of employment. The union's request for a discussion with Sir John Kingman was deflected by the SERC. It is clear that at the level of the national executive, the AUT was able to achieve few, if any, of its objectives

As a result, the AUT could only try to influence individual universities' IP policies and procedures, this was the objective of the guidance which it circulated in 1978/79 to local associations, a tactic which it repeated in 1985. Equally, however, local associations were powerless to influence their university's IP policy and procedures unless their university proposed to amend local terms and conditions of employment - or, unless they were able to participate in the debate

UDIL's role during this period is rather enigmatic, unless one looks behind the scenes In 1985/86 UDIL seems to have made a belated and surprisingly low-key response to a major new opportunity, apparently missing the chance to influence universities' IP policies and procedures. There are at least two possible explanations for this - and either or both of them may be correct The first has to do with UDIL's view of itself In 1979 UDIL's Secretary described the organisation as "*a sort of peripatetic Gentlemen's Club ... largely unrecognised as a group*" [111] It was not until the end of 1981 that UDIL even considered becoming a formal, trade association It became one in 1982, but was nonetheless unsure about its future role and function - indeed, it had set up a working party to deliberate on this [112]. The working party did not submit a draft report until 1986 [113] and it was some months before the final report was authorised In the meantime, presumably, UDIL

continued to have doubts about whether it should influence policy-making in universities

The second possible explanation has to do with UDIL's relations with other organisations Despite the fact that, during the late 1970s and early 1980s, UDIL had successfully been making contact with UK Government Departments and their subsidiary agencies, giving evidence to Parliamentary commissions, responding to invitations from foreign governments, stimulating initiatives in the EC *etc*, UDIL did not make contact with UK university-related organisations until relatively late on

UDIL had identified the benefits to be gained from contact with the CVCP as far back as 1981, when it considered the possibility of the two organisations jointly publicising collaborative university/industry activities [114]. However, the relationship between the two did not immediately flourish in 1984 a former Vice Chancellor of Brunel University, then the ILO of Cambridge, felt it necessary to write to the Secretary General of the CVCP suggesting "occasional meetings" between the UDIL and the CVCP to avoid "*a complete tower of Babel*" occurring where the exploitation of university skills and resources was concerned [115] When these meetings started, UDIL's Chairman felt that discussions at a very high level were not always matched by action on the ground [116]. Indeed, in March 1985 UDIL's Chairman wrote to the Secretary General of the CVCP asking "*who is going to state the policy of universities towards industrial liaison and who is going to have responsibility for implementing that policy?*" [117]

In the meantime, the CRS had evinced a sudden interest in IP matters and - in a knee-jerk reaction - decided that UDIL was promoting itself as the mouthpiece of universities where IP policy and procedures were concerned It is evident that this was not UDIL's attitude - despite having received a "star rating" from the Technical Change Centre's report on

technology transfer between academia and industry. However, CRS' fears may partly explain a subsequent change in the relationship between UDIL and the CVCP. during the course of 1985, the CVCP began to constrain UDIL's freedom to pronounce on this and other subjects. Moreover, the CVCP persuaded UDIL to "*recast*" some of its papers to reflect the CVCP's concerns [118]. In the intervening years, UDIL has submitted drafts of its reports to the CVCP for comment before finalising them, including its 1988 report [119].

It would seem, therefore, that UDIL's 1988 report has the *imprimatur* of the CVCP - despite discrepancies between the report's attitude to the ownership and exploitation of IP and those of the ESG, as outlined by the CVCP Wittingly or unwittingly, UDIL's 1988 report could be said to perpetuate earlier tensions between the views of the Government, the DES and the ESG and those of the Research Councils On the other hand, it may have come too late to influence the policies and procedures of many universities

CHAPTER 6

6 DETERMINING THE RESEARCH DESIGN AND THE MANNER IN WHICH TO IMPLEMENT IT

6.1 Introduction

As chapter 1 revealed, this study has two primary aims.

* to generate a body of data about the way(s) in which selected UK universities handled the exploitation of IP between 1970 and 1990,
* to assess - in relation to those same universities - the extent to which current policy and practice regarding the exploitation of IP accommodate the government's wishes, as outlined in the letter from the Chairman of the SERC and the statement issued by the Secretary of State for Education on 14 May, 1985

It also has a secondary aim:

* to begin to develop theory

6.2 Theoretical Approach

In the social sciences, "theory" has come to be an ambiguous term, used to denote anything from *grande theorie* (such as Weber's theory of bureaucracy or Durkheim's theory of suicide) to minor working hypotheses It is worth noting, therefore, that it is obviously not the aim of this study to begin to develop *grande theorie*. Nor does it aim to start developing what is sometimes referred to as "formal" theory - *ie* theory developed for a particular conceptual area of enquiry (for instance, socialisation or organisational decision-making) At best, this study aims to begin to develop "substantive" theory - *ie* theory developed for an empirical area of enquiry (such as race relations in the inner city or, in this particular case, the exploitation of IP in UK universities) In practice, of course, it is possible that the investigation will develop no more than a few minor working hypotheses

Essentially, the social sciences offer investigators two contrasting approaches to developing theory where none exists to date One is the logico-deductive approach, whereby theory is generated in the armchair - from what Glaser & Strauss (1967) characterise as "*a priori* assumptions and a touch of common sense peppered with a few theoretical speculations made by the erudite" and, in a less charitable frame of mind, as "happenstance, fantasy, dream life or conjecture" In this approach, armchair theory is broken down into a number of armchair hypotheses which are then tested against the data elicited. The other, less common today despite having yielded both Weber's and Durkheim's *grandes theories*, is the grounded approach Here, the investigator sets out with no *a priori* assumptions, while he or she may begin to develop and test hypotheses in the process of collecting data, theory is developed only after the data has been systematically collected and analysed. The investigator is not asked to adopt a completely *tabula rasa* approach to data collection, initially, data collection is likely to be guided by structures/processes which are commonly held to characterise the situation under investigation Thus, for example, in a grounded study of hospitals one might begin by investigating doctors, nurses, wards, admission procedures and so on, however, one would be alert to the possibility of other, previously unsuspected structures and processes being uncovered

The choice between these two approaches is often dictated by the investigator's personal inclination or training, in this particular study, however, the choice was made on more objective grounds It was felt that in a field so neglected to date, the logico-deductive approach would oblige one to pluck theory and hypotheses from the air, for, as chapters 2-4 revealed, there is very little literature relating to the exploitation of IP generated in UK universities, either prior to or after 1985 It is pertinent to this discussion to note that the research problem itself did not emerge from scrutiny of the literature, nor did it

emerge from consideration of existing theories As the Prologue to chapter 1 indicates, recognition of the need for research in this area emerged from the investigator's own observations and experience over a number of years - *ie.* by grounded means (The events of 14 May, 1985 merely indicated that others perceived there to be a problem, too They also served to provide a topical focus for the study, had the investigator been successful in her efforts to research UK universities' management of the exploitation of IP some years earlier, the boundaries of the study would have been the same but the focus might have differed somewhat) In this situation, the logico-deductive approach could easily lead to an entirely "negative" result - *ie.* a theory quite unable to explain or predict the way in which universities handle the exploitation of IP The grounded approach was felt to be far more likely to yield a "positive" result - *ie.* working hypotheses and possibly the beginnings of a substantive theory to explain or predict the way in which universities handle the exploitation of IP. The grounded approach seemed to offer other advantages, too As Glaser & Strauss (1967) observed, a grounded approach to developing theory tends to generate categories, hypotheses and theory readily understood by both social scientists and laymen (*eg* policy-makers, policy-implementers). This was seen as advantageous in a study where the findings could well have extrinsic as well as intrinsic value. Moreover, the grounded approach gives the investigator considerable freedom when it comes to choosing a research design, theory may be developed from either quantitative data or qualitative data - or, indeed, both

6.3 Research Design

Over the past few decades, social scientists have developed a more diverse range of research designs than are currently available to scientists, who still rely on observation/manipulation and observation of natural phenomena to obtain their data Social scientists may also choose to obtain their data by means of observation (direct observation

or participant observation) or manipulation and observation of their subjects (experiments/quasi-experiments), though this latter approach has attracted criticism in recent years on account of the inherent artificiality of manipulating human subjects in a tightly controlled context. Alternatively, social scientists may opt to obtain their data by means of histories, analysis of archival material, surveys, case studies - or even a combination of such research designs The choice is not - or should not be - determined by the investigator's personal preferences, but, as Yin (1989) observed, by objective factors such as the extent to which the investigator has control over the behavioural events in question, the type of research questions which the investigator wishes to pose and whether he or she intends to focus on contemporary or historical phenomena

Taking objective factors such as these into account, it became clear that a research design based purely on direct or participant observation or a quasi-experiment/a series of quasi-experiments was not an option for this investigation; this study is concerned, after all, with policy and practice over a 20-year period, not simply with the present day. Conversely, a research design based on histories alone was ruled out, for the opposite reason There were additional reasons for ruling out an experimental research design, most notably the fact that even if a meaningful quasi-experiment/series of quasi-experiments could be designed which did not attract criticism on grounds of artificiality, it was seen as highly unlikely that the investigator could exert the kind of control over variables which is a prerequisite of good experiments A research design based purely on analysis of archival material was not seen as an option for this study either, since it was felt that universities might not have archived relevant material - and even if they have, that material might be sufficiently ambiguous and/or insufficiently comprehensive as to require to be interpreted/complemented by eliciting additional data from relevant informants In other words, in order to provide data of sufficient depth, breadth and accuracy, it would

probably be necessary to complement a research design based on analysis of archival material by another research design - perhaps some kind of survey. Effectively, this left only two options, if a single research design was to be employed survey(s) or case studies

Upon consideration, it was felt that several factors militated against a research design based purely on survey(s) Firstly, no matter how well they are designed and administered, there is no doubt that surveys are more appropriate for questions starting "who . .?", "what .. ?", "where .. ?" and "when . ?" than for questions starting "how ?" and "why ...?". In other words, they are most effective when it comes to eliciting data relating to frequencies or incidence than they are at eliciting data relating to process(es) Although it is undoubtedly concerned with establishing answers to questions starting "who ?", "what ?", "where . ?" and "when ?", this investigation is not primarily interested in frequencies or incidence, rather, it is concerned to establish the process(es) underlying decisions, policies, implementation strategies *etc.*

Secondly, surveys are an appropriate research design for investigators interested in frequencies or incidence because they are administered to a statistically representative sample of the population, thus permitting generalisation from the sample to the population It was felt that this characteristic of surveys would have presented a fundamental problem, had this study in fact been interested in frequencies or incidence - namely, what constitutes a statistically representative sample of the population of UK universities? There is a tendency in the English language to employ the word "university" as if it denoted an individual member of a set of uniform, homogeneous institutions This tendency is exhibited even in official documents like the 1963 Report of the Robbins Committee (Robbins, 1963) which recommended that over and above competence in the chosen

subject, a university should ensure "the transmission of a common culture and common standard of citizenship". As Harvey *et al* (1988) pointed out, this was probably a tall order Although in some respects universities are currently more uniform than at any time in their history [1] they are nonetheless extremely diverse institutions Some of that diversity stems from endogenous differences, some from exogenous circumstances Located in widely disparate geographical areas, some rural, some urban, some metropolitan, they were founded hundreds of years apart to serve appreciably different purposes, as indicated by the terms of their Charters Some have become large by UK - though not European or North American - standards, some remain very small [2] Some have remained autonomous, monolithic institutions, whereas others have adopted a federal structure, joining together a number of semi-autonomous colleges As Page & Yates remind us (1975), some have traditionally been run on republican principles, while others have advocated a hierarchical system of government, others again have gone through periods during which they were committed to increasing democratisation In recent years, admittedly, the recommendations of the Jarratt Report (CVCP, 1985) have had a similar impact on the administration/management/governance of just about every UK university, but the exact manifestation of that impact has varied somewhat from one institution to the next UK universities have not been treated uniformly by the University Grants Committee (UGC) since it was founded, either This was particularly noticeable during the 1980s The financial cuts imposed by the government in the early and mid-1980s were not applied on the basis of equal misery, some universities were allowed to significantly increase their student numbers, whereas others had significant cuts imposed on them, likewise, some universities suffered a significant reduction in the level of their recurrent Treasury grant, whereas others did not. Some universities were forced to undergo one or more periods of major restructuring, while others were able to retain their existing structure For historical as well as more contemporary reasons, then, there is no such thing as a "representative"

UK university Nor would it be easy to identify a "representative" sample of UK universities, given the many and diverse factors which it could be argued should be taken into account, it would probably be less contentious to survey the entire population of UK universities - and only marginally more demanding in resource terms than surveying a sample which would inevitably be sizeable in order to accommodate those many and diverse factors.

Thirdly, as Guba & Lincoln (1983) point out, in a research design based on survey(s), it is necessary to determine that design at the outset, before data collection commences, the design should not be altered once the investigator has started to implement it, for any alteration could confound the variables and render a meaningful interpretation of findings impossible It was felt that in an exploratory study such as this, employing a research design which had to be determined at the outset could run the unnecessary risk of inhibiting the investigator from asking questions of categories of informants who transpire to be relevant but who were misguidedly excluded or not even anticipated at the outset Indeed, it could even inhibit the investigator from asking the right questions of any category of informants, for it is only at the end of a survey that it is possible to identify questions which were relevant - possibly even crucial, but which were not incorporated in the survey.

Upon further consideration, it quickly became apparent that employing a research design based purely on case studies had none of the disadvantages outlined and many other advantages As Yin (1989) pointed out, a research design based on one or more case studies is particularly appropriate in a study to be conducted in a "real-life" context over which the investigator has little or no control. Case studies are also eminently suitable for investigations which focus on contemporary, as opposed to historical phenomena - *ie*

studies which are concerned with the present and immediate past, as opposed to the "dead" past. Furthermore, since case studies may be based on a qualitative approach to data collection as well as/instead of a quantitative approach, they are as capable of answering questions beginning "how .. ?" and "why .. ?" as they are questions beginning "who ...?", "what ...?", "where .. ?" and "when . ?". In other words, case studies are likely to be a strong contender in a study concerned with uncovering process(es) - even complex processes, for, as Yin observed, they are used extensively in investigations of complex organisational/social/political phenomena. A further, major advantage of case studies is that they do not require the investigator to fix the research design at the outset. If it transpires during the data collection process that individual informants or even categories of informants have been misguidedly excluded from the data collection process for one reason or another, belatedly including them poses no problems for the research design This was felt to be a particularly valuable feature in what is, after all, an exploratory study It should be noted, however, that this investigator does not subscribe to the view that case studies are appropriate in the exploratory phase of research into a new area, to be replaced by surveys/histories in the descriptive phase and perhaps even experiments in the explanatory or causal phase of researching a particular field There are numerous well-regarded examples of descriptive and explanatory case studies [3] and in any case, such neat taxonomies rarely reflect reality; the boundaries between the different types of enquiry are often blurred and there may be a considerable degree of overlap.

It was felt that research designs based on case studies offer several advantages in the context of this study, over and above those listed so far. Perhaps the most interesting is their ability to incorporate evidence from a wide variety of sources - *eg* from interviews and observations (gained through direct or participant observation), from documents, archival records and even physical artefacts For reasons already outlined, it was felt that

in this study, little or no evidence was likely to be gleaned from direct or participant observation. However, the combined evidence from documents (*eg*. letters, memoranda, agendas, minutes and other written reports of events, newspaper cuttings *etc*), records (*eg* diaries, calendars, lists and other individual/organisational records) and systematic interviews was seen as likely to generate data of the depth, breadth, accuracy and character required

Consideration was given to several potential disadvantages of employing a research design based on case studies For instance, although some commentators dismiss case studies as an easy option, compared, say, to undertaking a major survey, others have remarked upon the difficulties faced by case study investigators, especially those who choose to collect their data by means of systematic interviews In that situation, characteristics of the interviewer (*eg* personality, appearance, gender, tone of voice or perhaps interviewing style/technique) may impinge on the data-collection process, a problem which does not occur with surveys unless they are administered in person. Yin (1989) perceived additional difficulties, pointing out that whereas the data-collection phase of a survey or an experiment is a routine, more or less mechanical process, the data-collection phase in case studies is seldom routine - particularly where data elicited through interviews is concerned It is liable to make great demands on the investigator's intellect because there is - or should be - a continuous interaction between the theory being investigated (or generated) and the data being collected In Yin's view, even in exploratory studies the case study investigator needs to have a particularly firm grasp of the issues being studied - in order to be able to interpret answers to questions whilst in the process of collecting data and to ask impromptu questions which clarify/amplify those answers, a process which he characterises as intellectually and emotionally exhausting Moreover, the case study investigator must be highly flexible and adaptable, seeing unanticipated "situations" (*eg*

facts, opinions, issues, theories, informants *etc*) as opportunities rather than threats In opting for a research design based on case studies for this investigation, these difficulties were neither dismissed nor diminished. However, it was felt that the investigator's lengthy and successful experience of interviewing informants of widely differing status in highly diverse contexts [4] should equip her to handle such difficulties

Whilst the commentators cited to date have reservations about the difficulties entailed in collecting case study data, others express concern about the quality of the data collected A common criticism of case studies is that they allow equivocal evidence - or, even worse, biased interviews - to influence a study's findings As Rosenthal (1966) and Sudman & Bradburn (1982) note, the same criticism can be made with regard to other research designs, including experiments and surveys (in particular the design of questionnaires). This observation does not diminish the possible validity of this criticism in relation to case studies, of course However, just as good survey research must satisfy criteria like reliability, internal and external validity *etc*, good case study research takes into account the fact that documents, records, interviews *etc* may exhibit unintentional or even intentional bias It is incumbent upon case study investigators to be aware of this and to take steps to reduce bias to a minimum by using multiple sources of evidence, by developing converging lines of enquiry - a technique akin to triangulation Upon consideration, it was felt that there was no reason why these techniques should not be employed in the context of this particular investigation.

Another common criticism of case studies is that they do not usually provide a basis for generalisation - in the manner that surveys allow one to generalise from the sample to the population There were two main reasons for dismissing this criticism, one specific to this particular investigation, one more general Firstly, as indicated, this study is not especially

interested in frequencies or incidence; moreover, it is doubtful whether one could really construct a representative sample of UK universities Secondly, this criticism misses the point of most research designs based on case studies. As Yin (1989) observed, the goal of case studies is not to enumerate frequencies (statistical generalisation) but to create, expand and generalise theories (analytical generalisation) Much like experiments, case studies generalise to theoretical propositions, rather than populations/universes. This was felt to be entirely in keeping with the aims and objectives of this study.

So far, the discussion has centred on the advantages and disadvantages of single research designs Mention has been made, in passing, of the possibility of overcoming the disadvantages of certain research designs by employing them in conjunction with other research designs which complement them - for instance, complementing the shortcomings of a research design based on archival records by means of some kind of survey. Consideration was given to the value of combining various research designs However, it was concluded that a research design based on case studies alone offered such flexibility that there was little justification for introducing the additional complexity of incorporating more than one research design in what is, after all, an exploratory study

6.4 Deciding How to Implement the Chosen Research Design

6.4.1 Determining the Number of Cases to be Studied

It is not uncommon to find proponents of research designs based on case studies arguing that it is feasible to base one's investigations into a given area on a single case study, many back up their argument by citing landmark studies based on a single case, such as Selznick's (1949) classic study of public organisations, or Lynd & Lynd's (1929) famous "Middletown", a revealing and influential case study of one small midwestern city. This was not thought to be a useful way to approach this particular study, however, in view of

the fact that the major strategy for developing grounded theory is comparative analysis Whilst a single case may provide the opportunity to compare subsidiary, embedded units of analysis (perhaps policy-makers, policy-implementers, academics with IP to exploit *etc*), it does not offer the opportunity for comparison at the level of the primary unit of analysis (*ie* the university).

There is a difference, of course, between recognising that more than one case study is required and knowing how many are needed in the context of a particular investigation - and there is no "correct" answer. The selection of case studies is not governed by rules in the way that minimum sample sizes in surveys are determined by criteria such as stratification factors, probability and other statistical prerequisites The number of cases to be studied may be a matter of personal inclination, instinct and/or more objective factors such as overall availability or accessibility of suitable cases, time, resources *etc* The number of cases to be studied in the context of this investigation was determined objectively, on the basis of the following reasoning

6.4.2 Selection Criteria

This study aims to generate a body of data about the way(s) in which UK universities have handled and currently handle the exploitation of IP and to begin to develop theory which might explain or predict those empirical findings Whereas research designs based on experiments and surveys are bound to try to control as many variables as possible, those based on case studies are not constrained in this way, indeed, one of the strengths of case studies is their ability to accommodate uncontrollable, possibly idiosyncratic differences between cases - differences which could transpire to be highly relevant to the development of theory. It was felt, therefore, that the most rewarding approach would probably be to select cases (universities) which differ in terms of certain "objective" criteria

Section 6 3 touched on a number of objective criteria which combine to differentiate one UK university from the next Broadly these can be characterised as

* university type;
* the severity of the cuts imposed by the UGC in 1981,
* university size;
* the results of the 1986 and 1989 research assessment exercises,
* geographic location

It is worth digressing briefly to examine these criteria in more detail.

University Type

Although the foundation dates of the UK's universities range from the late 12th century to 1976 (see **Figure 2**, Appendix D), it is customary to divide them into four types ancient, civic, technological and a category which is variously referred to as "plate-glass" (Beloff, 1968) or "Robbins" - although as Sanderson (1972) points out, strictly speaking, only Stirling University was founded as a direct result of the Robbins report

Essentially, these categories describe the period and/or the manner in which the universities concerned came to be founded However, these categories often give an indication of an institution's wealth, relative to other UK universities generally speaking, older institutions tend to be wealthier in their own right This is because although they were endowed with varying degrees of generosity, some post-war universities have no endowments at all With good financial management, the passing of time has often enabled initial endowments to grow considerably (Oxford and Cambridge stand out from the rest in this respect - or certainly their colleges do, it is said to be possible to walk from Oxford to London on land owned by one college, St John's).

In addition to indicating the period/manner in which a university came to be founded and its probable wealth, relative to universities in other categories, it is often argued that this categorisation says something about the ethos of an institution "Ethos" is, of course, a nebulous, probably unquantifiable phenomenon which may be more subjective than objective. Nonetheless, ethos could conceivably affect the way in which a university chooses to handle the exploitation of IP.

The Severity of the Cuts

In July 1981 - just three months before the start of the 1981/82 session - the UGC announced that it planned, with immediate effect, to reduce both the level of the recurrent Treasury grant received by most UK universities and to adjust the number of home students which each institution was permitted to admit These changes were not applied across the board on an "equal misery" basis Several institutions were confronted with the prospect of their recurrent Treasury grant being reduced by >30 per cent within two sessions Indeed, Salford was faced with a reduction of 44 per cent, significantly higher than the average reduction of 17 per cent [5], whereas London Business School was granted an increase of 11 per cent, for reasons which will shortly become clear Similarly, several institutions were required to reduce the number of home students they had in 1979/80 by around 20 per cent within two or three sessions Here, too, Salford suffered more than most, being required to reduce its home student numbers by 30 per cent, whereas eight universities were allowed to maintain the *status quo* and Manchester and London Business Schools were asked to increase their home student numbers by 42 per cent and 70 per cent respectively.

In 1983, towards the end of this first revenue-cutting exercise, the government announced that if universities wished to create an infrastructure to support industrial liaison and

technology transfer activities, this would be seen as a proper use of their UGC funding However, some universities were in the process of confronting considerable financial difficulties at this time - which was, it should be noted, just a couple of years before the BTG's monopoly was removed and universities were offered the opportunity to assume rights over and responsibility for the exploitation of IP arising out of Research Council-funded projects. It is conceivable that the proportion of the recurrent grant expended on industrial liaison and technology transfer (if any) could be influenced by an objective factor such as the relative severity of the cuts (Of course, expenditure could also be influenced by subjective factors, such as the importance attached to industrial liaison and technology transfer, relative to other university activities)

University Size

For reasons which have partly to do with each university's idiosyncratic history and partly to do with control exercised by the UGC during the 20th century over departments established, student numbers *etc*, UK universities vary tremendously in size - whichever way we choose to measure it If we measure it in terms of student FTEs, in 1984/85 - the session during which the Kingman letter and the DES statement arrived, the largest monolithic university, Manchester, had nearly 11,300 students, whereas the smallest, Stirling, had just under 2,700 If we measure it in terms of full-time academic staff, Manchester mantains its position as the largest monolithic university, with a staff of nearly 1,700 in 1984/85, whereas Keele was the smallest, with a staff of just under 300 [6]

It was felt that size could conceivably have an impact on the way a university approaches the question of handling the exploitation of IP. Larger universities could feel that their more numerous academic staff are likely to generate enough potentially exploitable IP to justify expending resources on the provision of some kind of infrastructure to handle its

exploitation Conversely, smaller universities could feel they cannot justify expending scarce resources in this manner Moreover, if industrial liaison and technology transfer activities are funded by a mechanism such as top-slicing, clearly this will net larger universities more funds to play with than smaller universities

Research Assessment Exercise Results

In 1985 the UGC embarked upon its first attempt to assess each university's research performance, as evidenced by publications, research grant and contract income *etc.* Broadly, this was achieved by rating each university's output in the majority of subject areas These were then aggregated to give one figure for the natural sciences, engineering and technology, another for the social sciences and a third for the humanities; this allowed universities to be ranked accordingly. These three figures were aggregated in turn to permit an overall ranking of UK universities The various results of this "research selectivity exercise" were published in May 1986

If there is a relationship between the supposed quality of research and its potential for commercial exploitation, we have no evidence of it, since this does not appear to have been researched. Indeed, as we have seen, we do not even know whether certain disciplines are more likely to generate potentially exploitable IP than others - in general or at certain times in their life-cycle, irrespective of the quality of the associated research. There is another reason altogether for considering universities' ratings in natural science, engineering and technology subjects The term "research selectivity exercise" faithfully reflects the fact that it was intended to have more than a purely intrinsic value. One of its purposes was to increase the discretionary "JR" (judgemental research) element of the recurrent annual Treasury grant for those universities which performed well in the research selectivity exercise and to reduce the discretionary element in those which did

not Another purpose was to encourage organisations which fund research - in particular, the Research Councils - to channel their funds to departments which were highly rated, in preference to those which were not. Indeed, at one point, it appeared that not only individual departments but whole institutions were likely to be rated according to their aggregate research performance [7].

It was felt that the prospect of being type-cast in this way - with the resulting implications for obtaining research funding - could conceivably influence a university's approach to formulating a policy to guide the identification, evaluation, protection and exploitation of IP.

Geographic Location

Geographic location is potentially relevant to this study, given that its interest extends to more entrepreneurial ways of exploiting IP. With the possible exception of high technology firms, whose founders may be lured to greenfield sites, it is known that entrepreneurs generally start their businesses close to home, rather than moving to a new area (Storey & Johnson, 1985, Kent, Sexton, Vesper (eds), 1982, Johannisson, 1984) However, it has been observed by many researchers that the rate of new firm formation is not distributed evenly throughout a country It varies from region to region, and also within regions, between different types of areas (metropolitan/urban/rural) This phenomenon has been observed in the UK, the US and many European countries (Storey & Johnson, 1985). Storey identified six broad factors which influence the degree of entrepreneurship in a region and used these to construct an index of regional entrepreneurship in Britain He assessed the south-east of England to be the most conducive to entrepreneurship, followed by the south-west, the north of England and Wales he saw as the least conducive, and Scotland fared little better.

Other Objective Criteria

It was recognised that other objective criteria could conceivably influence a university's policy and practice in relation to the identification, evaluation, protection and exploitation of IP - perhaps the spread of subjects within the science base, the size of the science base relative to other disciplines within the university, the extent to which researchers in the science base succeeded in attracting research grant and contract income, the pattern of sponsorship and whether or not the university had been authorised by the Research Councils *etc*

It was seen as impractical, however, to select cases which took *a priori* account of very many objective criteria, given the constraints imposed by time and resources on the number of cases which might realistically be studied. For this reason, the decision was taken to select cases which differed in terms of the five selection criteria already discussed in detail. These particular criteria were chosen primarily because information relating to them was readily accessible from published sources; there was no need to approach close to 40 institutions individually to acquire the necessary details.

It must be remembered that the research design chosen for this study did not involve a survey, there was no need, therefore, to think in terms of a sample stratified in terms of these five criteria It was necessary only to select cases for study which differed somewhat in terms of some or all of these criteria In order to permit this kind of differentiation, it was felt that some eight or nine cases should suffice

It should be noted, finally, that the selection criteria did not take account of whether or not universities had been authorised by the Research Councils to assume the rights and responsibilities *vis-a-vis* the exploitation of IP which had previously been enjoyed by the

BTG. This was because at the time the selection was made, the CVCP was not prepared to make this information available It was, therefore, perfectly possible that the universities selected had not been authorised by the Research Councils, that they were continuing to use the BTG as an innovation broker. This possibility was not regarded as problematical in the sense that if the opportunity arose for contrasting situations to be investigated, this did not conflict with the aims of the study [8].

6.4.3 Universities Selected for Study

Exclusions

Certain universities were excluded from the pool of candidates for selection. Given that this investigation is exploratory, the decision was taken to focus on monolithic universities alone, rather than include the federal universities; this excluded Oxford, Cambridge and the Universities of London and Wales The Open University was also excluded because, although certain departments have an international research reputation, this particular university was established to teach, not to carry out research, unlike most UK universities, the Open University has raised all its research funding separately or squeezed it out of teaching budgets For similar reasons, the private University of Buckingham was excluded, too. It was decided to not to include institutions with a strong bias in favour of certain disciplines, either - like UMIST, which offers only science and technology disciplines. Finally, the decision was taken to exclude universities whose technology transfer activities - voluntary or involuntary - have already been well publicised, albeit with varying accuracy; this excluded Cambridge, Salford and Warwick

Candidates for Selection

Figure 1 lists by type the candidates from which the participating universities were selected, with one exception [9], universities were typed in accordance with generally

accepted views **Figure 2** gives some indication of the scale of the cuts experienced by the candidate universities during the early 1980s, it shows which suffered an above average cut in their recurrent grant and/or an above average reduction in home student numbers in the early 1980s, which came close to the average in either respect and which had a below average cut in their grant and/or reduction in home student numbers imposed upon them **Figure 3** categorises by size the candidates from which the participating universities were selected In this study, small universities were defined as those with $<4,500$ student FTEs and large universities as those with $>7,500$ student FTEs, medium-sized universities included all those with student FTEs numbering between 4,500 and 7,499 [9]. Published accounts [10] were used to determine the candidate universities' performance in the first research assessment exercise

Geographic location should be self-evident.

Care was taken to ensure that some of the universities selected were ancient, some were civics, some were former CATs and some were so-called plate-glass universities Likewise, some were small, some medium-sized and some large Some were treated relatively leniently by the UGC in the 1981 cuts, whereas others were treated relatively harshly In some of the universities selected for participation a preponderance of science and technology subjects were rated highly, in some, these subjects were rated as fairly average and some, most science and technology subjects were not rated highly The universities selected were widely dispersed on the British mainland [11].

This process led to the following nine universities (cases) being selected for participation in this investigation

"Ancient"	"Civic"	Ex-CATs	"Plate-glass"
Durham	**Bristol**	**City**	**Kent**
Glasgow	**Hull**	**Strathclyde**	**York**
	Liverpool		

Figures 4a-4b and **5a-5b** detail the sizes of the nine universities selected in terms of student and staff FTEs. **Figure 6a-6b** record the ratings awarded to the nine in the natural sciences, engineering and technology in the two research assessment exercises

A list of substitute universities was also drawn up, in case any of the selected universities declined to participate in the study.

6.4.4 Obtaining Institutional Agreement to Participate

Given the potentially sensitive nature of the subject matter, it was decided to obtain - from the highest appropriate authority in each of the nine universities - formal, written permission to include the institution in the study Furthermore, the decision was taken to ask each of the nine universities to confirm in writing that the institution could be openly named in the resulting analysis, it was felt that employing a device such as "university A", "university B" *etc* when reporting findings would be confusing, especially where nine universities are involved

6.4.5 Multiple Sources of Evidence

When gauging how best to implement the chosen research design, considerable attention was paid to the need to elicit evidence from multiple sources It was decided that although the bulk of the data would probably be elicited by means of systematic interviewing, the fieldwork schedule should allocate enough time to allow for systematic searches for

relevant histories, documents and records. Examples which sprang to mind at the outset of the study included items intended for public consumption, such as official and/or unofficial histories of the universities concerned (*ie.* "biographies" of the institution), annual reports, research compendia, university calendars, prospectuses, university newsletters, mission statements, policy statements *etc.* It was recognised that items intended for internal consumption, such as letters, memoranda, agendas, minutes, proposals, progress reports, evaluations *etc*, would be harder to identify and access, moreover, such items were liable to be more prevalent and/or accessible in some universities than others It was also recognised that data elicited from histories, documents and records do not necessarily represent "the objective truth", if there is such a thing, histories, documents and records tend to be created for their own, idiosyncratic purposes However, it was felt that the resulting data could be employed to corroborate, augment or even contradict evidence from other sources.

6.4.6 Converging Lines of Enquiry

In view of the need to develop converging lines of enquiry, it was decided to formally adopt a multi-dimensional approach to eliciting data through systematic interviews In the same way that someone embarking on a grounded study of hospitals might begin to by investigating structures/processes commonly held to characterise hospitals (doctors, nurses, wards *etc*), it was felt that this study should commence by eliciting data from faculties, schools and departments, as well as relevant divisions of the administration. It might then progress to eliciting data from less formal groupings (*eg* academics with IP to exploit, entrepreneurial academics), and from appropriate individuals, identifying them in much the same way that a "snowball" sample identifies its respondents In other words, it was decided to employ not only a multiple-case design, but also one which uses embedded units of analysis, rather than a holistic design

It was felt that this approach offered two advantages. Firstly, it would allow information elicited from, say, the administration to be corroborated, augmented or contradicted. Secondly, it would permit comparison of the attitudes of representatives of these different structures, which are potentially different interest groups.

6.4.7 Interview Technique

Considerable thought was devoted to the most appropriate way to interview informants from these various structures/groups. At one extreme, interviewers may choose to operate in a relatively unstructured fashion, guided by no more than a brief checklist of key areas to cover. This reduces the danger of the interviewer inadvertently constraining informants from providing information which they see as relevant, but which the interviewer may not recognise has relevance On the other hand, interviewers who opt for this approach risk losing their grip on the course of the discussion, to the extent that they may not cover the key areas indicated on their checklist Alternatively, interviewers may choose to conduct their interviews using semi-structured questionnaires, this ensures that the resulting discussion is considerably more focussed, yet it should give informants some freedom to digress or expand upon an area where they see fit. At the other extreme, interviewers may choose to conduct their interviews using highly structured questionnaires, more reminiscent of a survey which they are administering in person This has the advantage of ensuring that not only key areas but the minutiae of those key areas are covered in the discussion. However, this approach often constrains informants from volunteering information which is extraneous to the questionnaire - but possibly not extraneous to the investigation.

The use of semi-structured questionnaires seems, on the face of it, to present a useful compromise. However, it was felt that this might not be the best approach in a study such

as this, where the minutiae of a situation might well be of considerable interest - particularly in relation to assessing the extent to which current policy and practice accommodate the government's wishes, as outlined in Sir John Kingman's letter and Sir Keith Joseph's statement of 14 May, 1985. This consideration led inexorably to two decisions being taken. Firstly, given that comparative analysis is the major strategy for developing grounded theory, it was decided to begin the data collection process by using highly structured questionnaires, but to administer them in a highly flexible manner. It was recognised that this would entail becoming so familiar with the questionnaires prior to administering them that if individual informants happened to raise an issue or introduce a topic out of sequence, the flow of the discussion need not be interrupted. (It was also seen as essential not to constrain informants from volunteering information extraneous to the questionnaire - but possibly not the investigation) Secondly, it was decided to tape-record every interview, but to encourage HoDs, Deans/Heads of School to speak openly by guaranteeing them anonymity [13] It was recognised that this decision entailed some degree of risk - risk that some informants would feel inhibited from speaking openly, irrespective of guarantees of anonymity This was felt to be a risk worth taking, particularly since the questionnaires were regarded as the initial data collection tool, to be followed where necessary by less structured follow-up interviews.

6.4.8 Operationalising the Aims of the Investigation

Before devising the questionnaires, it was clearly essential to operationalise the one remaining aim of the investigation which had not already been operationalised. (It was felt that the decision to conduct a grounded rather than a logico-deductive investigation had effectively operationalised the secondary aim of the investigation, while the considerations detailed in sub-sections 6 4 5 to 6.4 7 and those which will be detailed in sub-sections 6 4 9 address the question of operationalising one of the primary aims of the

investigation - *viz.* generating a body of data about the ways in which the selected UK universities handled the exploitation of IP between 1970 and 1990)

It was decided that operationalisation of the aim relating to the assessment of the extent to which current policy and practice regarding the exploitation of IP accommodated the government's wishes could only be achieved once the government's wishes had been clearly identified. Accordingly, some time was spent examining the documentation which was sent to UK universities on 14 May, 1985.

The letter sent by the Chairman of the SERC, Sir John Kingman, effectively offered UK universities the opportunity to assume for themselves certain rights and responsibilities previously granted to the BTG. Those rights and responsibilities related to IP arising out of research conducted at/under the direction of staff of the university concerned and funded by Research Council grants or contracts, normal postgraduate training awards, normal research fellowships and SERC Teaching Company Schemes Universities which were minded to accept this offer were asked to detail the arrangements they had made or proposed to make for exercising those rights and discharging the related responsibilities. The letter indicated that these arrangements were not expected to conform to any preconceived model, however, they were expected to address certain, specified matters The list which followed included:

* identification of discoveries and know-how that might be exploitable,
* assessment of potential for exploitation,
* protection of intellectual property, relationship to publication;
* securing of exploitation, sources of finance (including development work), marketing, negotiation *etc*,

* respective roles of the researcher and the university, safeguards, and reversal, of rights, incentives for the researcher;
* royalty sharing; a balance would be needed between incentive and reward for the researcher and due return (to the university) on the public monies involved;
* providing, or buying, expertise;
* consequences for terms and conditions of employment, including waiver of rights of ownership under the Patents Act 1977,
* accountability, making the guidance and arrangements known to staff and students, and more widely, monitoring the working and effectiveness of the university's arrangements

The letter, reproduced in full in Appendix A, added that universities' arrangements should explicitly allocate responsibility for each of these matters.

As a stand-alone document, parts of this section of Sir John Kingman's letter could be characterised as enigmatic, even cryptic However, it was accompanied by a copy of the Department of Education and Science's (DES) press release, also dated 14 May. In this 5-page document, reproduced in full in Appendix A, the Secretary of State decoded Sir John Kingman's shorthand by putting it into context He declared that the government's objective in ending the BTG's right of first refusal had been .

".. *to strengthen and improve exploitation, through freer competition between exploiting agencies in the public and private sectors* . " (para 3)

More specifically, the government had ended the BTG's right of first refusal ...

"... *with the aim of enlarging opportunities for exploitation, especially for scientists who want to exploit their own work* . " (para 2)

The press release - effectively the text of a written answer to a question posed in the House of Commons by a conservative MP - indicated that the new arrangements governing the exploitation of intellectual property would apply to universities, local authority institutions of higher education and the Research Councils' own research establishments. However, this particular document focussed on the arrangements which would apply specifically to universities.

Where Sir John Kingman's shorthand raised issues but often gave little or no indication of how they could or should be resolved, the Secretary of State, Sir Keith Joseph, used this statement to propound the government's wishes in relation to certain issues. His main theme concerned the respective roles of the researcher and the university in the exploitation process, and related issues. He expressed the government's ultimate wishes regarding the respective roles of the researcher and the university in the following way:

> ". . *I hope that universities will seek to give the fullest opportunity and scope for researchers themselves, where they wish to do so, to assume responsibility for exploiting their own findings and ideas, with commensurate share in the benefits ...*" (para 6)
>
> " . *I envisage that the opportunity to exploit would thus in the first place rest with the researcher, on the understanding that he or she would take active steps to exploit the ideas* . " (para. 6)
>
> "... *I hope that universities will encourage researchers to exploit discoveries themselves and will provide guidance and help for those who wish to do so ...*" (para 6)

Due to complexities arising out of this proposition and careless phraseology, the DES statement was less transparent with regard to the legal and procedural implications of the government's wishes It required close attention to deduce exactly how the government

wished related issues raised in Sir John Kingman's letter to be resolved.

The proposition that universities should give researchers themselves the fullest opportunity and scope to assume responsibility for exploiting their own findings and ideas was a complex one because, in the same document, the Secretary of State indicated that the Research Councils wished the rights and responsibilities for exploitation to rest with the institution in receipt of grant, where it wished to assume them (para 5). He reinforced this by remarking that once arrangements were agreed and in place, the Research Councils would thereafter regard the university as fully responsible (para. 9) What the DES statement intended to convey by this apparent paradox, but failed to spell out as clearly as it might have done, was that universities which assumed those rights and responsibilities were effectively expected to hold them in trust and to routinely delegate them to researchers who wished, in turn, to assume them This interpretation is confirmed by the final sentence of para. 6

> ". *Where a researcher nevertheless chooses not to take on the rights and responsibilities for the exploitation of his or her discoveries, these would revert to the university ...*"

In the light of this sentence, it is clear that the DES intended the ambiguous note in Sir John Kingman's letter concerning "*consequences for terms and conditions of employment, including the waiver of rights of ownership under the Patent Act 1977*" to be interpreted in one way only. universities should routinely waive their rights of ownership conferred by the 1977 Patent Act - and presumably other Acts dealing with the ownership of IP - in favour of the researcher(s) who created the IP

The government's wishes regarding the role of the researcher in the exploitation process were sufficiently strong that the DES statement made no provision for universities to

withhold those rights and responsibilities from individual researchers on the grounds that they might not exploit their discoveries as effectively as the university. Indeed, the Secretary of State remarked:

". . *In seeking to give individual researchers greater scope and opportunity to exploit their inventions, there is a possibility that in particular instances exploitation will be less than optimal. But the Government believes that it is right to incur this risk to secure the gains that will come from giving researchers [..] more responsibility and more incentive* ..." (para. 13)

However, in another section of the DES statement it was implied that rights should only be waived ...

" .. *on the understanding that [the researcher] would take active steps to exploit [their] ideas, in ways consistent with the Government's policy aims and within the framework of the university's agreed arrangements* . " (para 6)

In other words, universities should conditionally waive their rights in such IP This doubtless explains the cryptic note in Sir John Kingman's letter concerning "safeguards, and reversal, of rights".

Provided researchers complied with these conditions, the DES statement indicated they should be free to exercise their newly-acquired rights as they saw fit, it did not view the transfer of such rights as a cosmetic exercise Paragraph 7 stated

" . *Whether the discovery is exploited by the university or by the researcher, it would be open to them to retain the rights themselves, to set up a limited company for the purpose, or to negotiate terms for transfer of the rights and responsibilities for exploitation to intermediaries such as private sector organisations or to the British Technology Group Or they may choose to enter into direct agreements with industrial and commercial companies for the exploitation of individual discoveries, seeking such*

professional or other services as they need, or conclude agreements with the private sector intermediaries to undertake this on their behalf."

Use of the word "*them*" in the first sentence of paragraph 7 is unfortunate, given the resulting ambiguity A similar ambiguity attaches to the first sentence of paragraph 10, which stated that it would be for "*the university or the researcher*" to negotiate the exploitation terms However, the only logical interpretation is that it is open to whichever of these two parties has assumed responsibility for exploiting the discovery to retain the rights themselves *etc etc* - and to negotiate the exploitation terms.

The DES statement recognised that academics who decide to assume responsibility for the exploitation of their discoveries might find that their dual role as academics and IP exploiters, possibly even entrepreneurs, made conflicting demands upon them Like Sir John Kingman's letter, which referred simply to "*protection of intellectual property, relationship to publication*", the DES statement made no attempt to influence the way in which individual academics or their universities resolved this problem, observing:

"There is a nice balance to be struck between the free flow of information on which the health of science so critically depends and the need to protect new inventions if they are to be fully exploited to the benefit of the UK ..." (para 13)

The statement also recognised that a balance was required "*between the freedom and motivation of the researcher to pursue exploitation [and] the efficient use of negotiating and other commercial skills*" in order to secure the best terms (para 13) It did not specify who could or should provide those skills which individual academics lacked However, it expressed the hope that universities themselves would provide "*guidance and help*" (para 6) and that they would use their share of royalties and receipts "*to strengthen and improve their research capability, its further exploitation, and related infrastructure*" (para 10). It added that where a university chose to establish "*such necessary*

infrastructure", the government would regard related expenditure as a proper use of the institution's resources

Sir Keith Joseph's statement contributed nothing substantial in relation to the other issues raised in Sir John Kingman's letter - *ie.* identification of discoveries and know-how; annual reporting, making the university's arrangements known to staff and students; accountability; monitoring the working and effectiveness of those arrangements. On the subject of royalty-sharing, it observed simply that researchers who assumed responsibility for exploiting their own findings and ideas should have a "*commensurate share in the benefits*".

In the light of this critical analysis of the relevant documents, it was felt that the one remaining aim could most simply be operationalised by setting the following three objectives.

i) establishing whether the selected universities gave the fullest opportunity and scope to academics to assume responsibility for the commercial exploitation of their research discoveries,

ii) establishing the extent to which the selected universities encouraged academics to assume responsibility for the commercial exploitation of their research discoveries,

iii) establishing the extent to which the selected universities provided guidance and help to academics wishing to assume responsibility for the commercial exploitation of their research discoveries

It was also felt that the investigation should focus primarily on the commercial exploitation of "hard" IP - that is to say, products, processes, copyright *etc*, rather than "soft" IP - that is to say, expertise, because the BTG's right of first refusal had not extended to the

exploitation of "soft" IP.

6.4.9 Devising the Questionnaires

Following this approach, four separate, highly structured questionnaires were devised. The first (Questionnaire A) was intended to ascertain current policy *vis-a-vis* the identification, evaluation, protection and exploitation of IP - and policy over the preceding 20 years, in so far as there was any. The majority of the questions attempted to elicit factual aspects of policy, some attempted to uncover the policy formulation process; a few were attitudinal in nature. The second (Questionnaire B) was designed to elicit information relating to the implementation of current policy Again, the majority of questions attempted to elicit factual aspects of policy implementation but some tried to uncover the underlying processes and others were attitudinal in nature. The third (Questionnaire C) was aimed at heads of department and deans (where appropriate) and was intended to ascertain their awareness and experience of current IP policy and practice and their attitude to it. The fourth (Questionnaire D) was targetted on academics with IP to exploit who chose to do so entrepreneurially, it was designed to ascertain their awareness and experience of current IP policy and practice and their attitude to it.

Since this study is not concerned with testing hypotheses, it is pertinent to consider what dictated the choice of questions in each questionnaire. Whether or not they are concerned with formally testing hypotheses, many studies commence by drawing up certain tentative propositions, in order to indicate the kind of data to be collected and to avoid trying to collect "everything". Given the exploratory character of this study, however, no such propositions were drawn up Instead, the rationale and direction of data collection was guided by the literature review and by common sense

Where Questionnaires A and B were concerned, some questions were designed to uncover factual aspects of policy and practice during the 1970s and early 1980s - if, indeed there was any policy, many more were designed to uncover factual aspects of policy and practice since 1985 - and the policy formulation process These questions were essentially guided by common sense, whereas the attitudinal questions in Questionnaires A and B tended to be informed by issues which came to light in the course of the literature review. The questions contained in Questionnaire C were largely driven by the key questions contained in Questionnaires A and B, as a cursory glance will confirm Where Questionnaire D was concerned, most of the questions were also informed by common sense, though some were informed by issues which came to light in the course of the literature review.

6.4.10 Piloting the Questionnaires

Since Questionnaires A-C incorporated 299, 203 and 223 questions respectively [14], it was felt that they should be piloted, in case their length - or rather, the length of time taken to administer them - proved unworkable This was also seen as an excellent opportunity to test the wording of questions, to weed out ambiguities and value-laden phraseology.

6.4.11 Fieldwork Schedule

It was recognised that implementing the chosen research design in the manner outlined would entail an extremely heavy fieldwork schedule, involving lengthy and repeated visits to each university Furthermore, it was understood that in order to ensure that as much as possible of the information elicited was corroborated, augmented or contradicted, much effort would need to be put into data preparation between each trip Indeed, it would probably be necessary to begin to informally analyse the resulting data between each trip. Accordingly, the research timetable allocated a full year to the fieldwork and as much data

preparation and informal analysis as was felt to be necessary.

6.4.12 Data Preparation

Given that the decision was taken to tape-record all interviews, it was recognised that a large part of the data preparation was likely to consist of tape transcription. Moreover, this process was likely to be complicated by the need to edit the resulting transcripts, in order to maintain informants' anonymity.

Where data in the form of histories, documents, records *etc* were concerned, it was envisaged that data preparation would entail logging and roughly categorising the data collected, so that information relating to different topics and issues could be readily accessed.

6.4.13 Timetable

Since it had taken a year to research and write the literature review, to start researching sources of assistance which universities could draw on, if they were so minded, to devise the first drafts of the questionnaires and to contact the universities selected for study, it was intended that all the fieldwork should be completed within the academic year 1989-90 Moreover, a good proportion of the data preparation should be done within this timescale

6.5 Evaluating the Chosen Research Design and Its Manner of Implementation

6.5.1 The Chosen Research Design

There is not a great deal to say about the choice of research design beyond the fact that the flexibility which it offered was absolutely vital to the integrity of the investigation. It is inconceivable that an alternative research design, such as a survey, could have yielded the insights into processes, attitudes and critical events which this research design based

on case studies yielded. The ability to incorporate data from widely differing and even unexpected sources, the ability to return and gather additional data as new areas of interest were revealed, the ability to incorporate apparently conflicting data were invaluable Moreover, as we shall see, the ability to change the manner in which the research design was implemented was also extremely valuable.

Before moving onto evaluating the chosen manner of implementation, it is worth noting, however, that Yin's comments concerning the demands made on the investigator's intellect were highly pertinent to this study Case studies are certainly not an easy option, for despite years of experience of interviewing informants with a view to eliciting novel, complex scientific information, the need to maintain a firm grasp of the issues being investigated, the need to interpret the information being communicated and to ask impromptu questions to clarify or amplify it was found to be utterly exhausting both intellectually and emotionally

6.5.2 The Chosen Manner of Implementation

Obtaining Institutional Agreement to Participate Revisited

In each university the highest appropriate authority was identified through preliminary calls to industrial liaison officers and/or local union representatives. In each case, the person identified was first approached by telephone in order to capitalise on the investigator's lengthy experience of soliciting co-operation by telephone [14]. This also allowed the person concerned to ask questions and advance objections - which could then hopefully be overcome at once This initial approach was followed by a letter outlining the background to the study, its objectives and its proposed *modus operandi* Each letter varied a little, to take account of local circumstances, see Appendix B for a copy of a typical letter

Contrary to the expectations of advisors, the nine participating universities initially selected all agreed to participate in the study. In all but one case, it was possible to elicit formal permission in writing, together with confirmation that the institution's name could be openly used in the analysis In most cases, permission was granted at a very senior level - either by the vice-chancellor/principal or by the registrar/secretary In the one university which omitted to send formal permission in writing, the registrar gave permission verbally, but never got around to committing this to paper.

Piloting the Structured Questionnaires

All four questionnaires were piloted on respondents from Hull This particular university was chosen on purely pragmatic grounds it was the only university which felt able to make informants available within the required timescale

Judging on the basis of this pilot exercise, Questionnaires A and B appeared to provide a workable means of eliciting the initial data They took between three and four and a half hours to administer, depending on the loquacity of informants These particular informants were members of/attached to the administration and if this length of time presented them with a problem, it was not obvious. Accordingly, Questionnaires A and B were retained in their original format for the rest of the investigation. In the light of administering them to informants in the remaining eight universities, this proved on the whole to have been a reasonable judgement In two universities minor difficulties were experienced, in so far as it was necessary to break off the interview and return either later the same day or later the same week, in the latter case, this meant that the administration of Questionnaire B also had to be staggered, since the information from Questionnaire A was incomplete at the time scheduled for Questionnaire B. In a third university - one of those where the same informant was nominated to respond to both Questionnaires A and B - one section of

Questionnaire B had to be sent later by post and was completed in writing, like a postal questionnaire In several universities, time limitations led to it being necessary to prioritise questions towards the end of these two Questionnaires - omitting some in order to be sure to elicit the answers to others In most cases, it was possible to fill in the resulting gaps either in the course of a return visit or later, during the analysis stage, by telephone

Questionnaire C also took between three and four and a half hours to administer, but it soon became clear that few heads of department (HoDs) and deans/heads of school felt able to devote this much time to the investigation. Indeed, one pilot interview had to be broken off half way through and proved impossible to complete for several months. Since Questionnaire C was piloted during the summer recess, it became obvious that this problem was likely to be exacerbated once term started. Accordingly, the number of questions in Questionnaire C was reduced by two thirds to a maximum of 136, in the expectation that this would reduce the time to administer it to about one and a half hours In the main, this reduction entailed removing what were recognised, in the light of piloting Questionnaire C, to have been somewhat repetitive questions However, some new questions which suggested themselves in the course of piloting the Questionnaire were also included In the event, the time actually taken to administer the revised version of Questionnaire C varied from just over one hour to two and a half hours - depending, again, on the loquacity of individual informants Here, too, it was sometimes necessary to prioritise questions towards the end of this Questionnaire; again, it was usually possible to fill in the resulting gaps either in the course of a return visit or later, during the analysis stage, by telephone.

Questionnaire D did not appear to pose any problems and was retained in its original format.

Since the research design for this study is based on case studies, not a survey, the fact that Questionnaire C was modified for use in the remaining eight universities was not felt to present a problem. Accordingly, the data elicited at Hull was not treated differently to the data elicited from the other eight universities. That is to say, no distinction was made between the pilot study and those participating in what a survey would regard as the main study

Identifying Suitable Informants

Suitable informants were identified by a process akin to "snowball" sampling in survey research The informant(s) nominated by the university to respond to Questionnaire A identified suitable informant(s) to respond to Questionnaire B - and often Questionnaires C and D, too Interviewee(s) responding to Questionnaire B also identified suitable candidates to respond to Questionnaires C and D - and so on Interviewees also tended to suggest informants who could provide corroborative, complementary or peripheral information relating to the questionnaire which they themselves were answering, moreover, it was not unusual to find interviewees suggesting informants who might provide a different perspective or even contradict the information which they were giving.

Selecting Actual Informants

In relation to Questionnaires A and B it was usually possible - indeed, necessary - to follow up every informant suggested In relation to Questionnaire C this would not have been feasible, particularly in the larger universities where there are >80 departments and, in the case of Glasgow, close to 150. Clearly, a strategy was required to reduce the number of informants to manageable proportions Accordingly, it was decided to focus exclusively on faculties, schools and departments within the natural sciences, engineering and technology Owing to the constraints imposed by time and resources, the number of

candidate informants was still too large, however. Thereafter, therefore, selection was made on a fairly intuitive basis, taking into account a variety of factors.

Some of these factors related to the study as a whole, rather than individual cases For instance, every effort was made to interview informants from as wide a range of disciplines as feasible, but with some duplication. Thus if, say, the HoD of a department belonging to UGC cost centre 22 (Electrical/Electronic Engineering) was interviewed in one university, an effort would be made to interview his counterpart in at least one other university, but not in all of them It was felt that this might yield interesting comparisons/contrasts in cross-case analysis It should be emphasised, however, that this was not done with the intention of "matching" HoDs in the manner of survey research.

Other factors related to individual cases (universities) For instance, the selection of informants took into account the status of the interviewee who suggested them Care was taken to select some informants who were suggested by their own peer group, rather than those suggested by the centre alone There were two reasons for this firstly, to avoid relying solely on information provided by informants who were "approved" by the centre, secondly, to foil possible attempts by the centre to attribute quotations/attitudes/criticisms to specific individuals. This strategy was particularly beneficial in relation to Questionnaire D, where it led to opportunities to interview academics exploiting their IP illicitly, without the knowledge of the centre, and provided valuable insights into the attitude of individual academics to institutional policy and practice Care was also taken to randomly select from lists of academic staff members some informants who were not suggested by anybody.

Finally, the selection of informants was inevitably dictated by purely pragmatic considerations, such as whether or not a candidate informant's schedule enabled them to be in the proximity of the university during the period timetabled for the investigator to visit.

Obtaining the Agreement of Individual Informants

All candidate informants identified were first approached by telephone in order to capitalise on the investigator's lengthy experience of soliciting co-operation by telephone This also allowed them to ask questions and advance objections - which could then hopefully be overcome at once. Requests for advance notice of the questions were routinely refused, in order to elicit spontaneous responses reflecting the respondent's own attitude, rather than a concensus; this also prevented informants from "doing their homework" where questions designed to gauge their awareness of policy and practice were concerned This initial approach was then followed by a letter outlining the background to the study, its objectives and proposed *modus operandi*, the letter also guaranteed anonymity to HoDs, Deans/Heads of School and entrepreneurial academics who agreed to participate. This proved to be an effective way of soliciting agreement to participate in the study, for only one informant refused - and in this particular case, it was not possible to get beyond his secretary.

Guarding the Anonymity of Informants

In isolated cases, the information provided by individual informants was clearly so distinctive and readily identifiable by other members of their university that the investigator faced two choices either to treat the data as inadmissable or to ask the informant concerned whether he would allow the data to be included, notwithstanding the risk of identification In every case, the informants concerned readily gave their

permission - on tape - for the data to be included

Evaluating the Chosen Interview Technique

Questionnaires A-D were printed for operational use on A4 paper with only 4-5 questions per page, to allow space for field notes to be taken during the course of the interview (noting, *eg* body language, supplementary questions to be asked *etc*) As a result, the bound copies of Questionnaires A and B were close to a centimetre thick, while Questionnaire C was close to half a centimetre thick It was recognised that the very sight of these questionnaires could deter some informants, quite apart from the highly structured nature of the questions they contained In the event, this did not appear to present a problem On the whole, informants seemed to be pleased to have an opportunity to discuss IP policy and practice, both in general and specifically in relation to their own institutions. Many volunteered the information at the end of the interview that they had thoroughly enjoyed the discussion, that it had opened their eyes to aspects of principles and practice which they had not previously grasped, and that it had given them much food for thought. One actually took the trouble to get in touch with the investigator much later to discuss IP-related events which had happened in the intervening months

Informants did not appear to feel constrained by the highly structured nature of the questionnaires, either; indeed, it was often necessary to give them considerable time to pursue a given topic/issue to its natural end before bringing them back to the "next" question. (With practice, incidentally, it became increasingly easy to administer the questionnaires out of sequence, if informants introduced a topic/issue on their own initiative, ahead of the questionnaire's logical, chronological sequence)

It was not really feasible in the context of this study to try to devise an objective measure of the effect which tape-recording the interviews had on the extent to which informants were prepared to disclose information - and on the amount of detail they were prepared to give. It certainly appeared that most informants were prepared to disclose information relating to sensitive or controversial topics/issues, but that some felt they should not reveal names, whereas others did so freely. Indeed, there were several instances where, at the end of the interview, informants made comments - on tape - like "I don't believe all these things you've got me to tell you" Three interviewees responding to Questionnaire C adopted the strategy of asking the investigator to turn off the tape-recorder when particularly sensitive or controversial subjects were being discussed, they then went into detail off the record, presumably to ensure that the investigator understood the point they wished to make without it being attributable to them. This suggests that these particular informants did not feel that the guarantee of anonymity extended to them offered sufficient protection.

Evaluating Questionnaires A-D

Questionnaires A-D were not intended to fulfil the function of survey questionnaires - *ie.* a trade-off between sufficient brevity as to obtain a reasonable response rate and asking questions which the investigator feels at the outset of the study to be necessary. They were simply intended to start the data collection process - and to ensure that this process involved the same sorts of information being elicited for every university.

Despite their length, Questionnaires A and B did not prove to be adequate to the task of eliciting the minutiae of policy and practice required In the course of the data collection process it became clear that many more questions would need to be posed than had been anticipated at the outset if the study was to achieve its aim of assessing the extent to which

current IP policy and practice accommodate the government's wishes, as outlined in Sir John Kingman's letter and Sir Keith Joseph's statement of 14 May, 1985 This is because the "algorithm" of the exploitation process - that is to say, the individual steps which could be entailed in that process - had not been thought out in sufficient clarity when devising the questionnaires Since the research design did not entail a survey, this did not present undue problems, however. A research design based on case studies was chosen precisely to overcome difficulties of this nature, and its manner of implementation - involving repeat visits to each university - allowed the relevant questions to be asked at subsequent encounters with informants.

Questionnaire C was more successful in this respect, despite having been reduced in length by about half. It seldom proved necessary to return to HoDs, Heads of School/Deans to ask supplementary questions

Questionnaire D was never intended to be more than a very basic starting point and given its relative brevity, asking supplementary questions at the time of the interview posed no difficulty whatsoever However, later, when transcribing the resulting tapes, a series of additional questions suggested themselves and this presented more of a problem Chronologically, Questionnaire D tended to be administered last, during the final visit to a university - or even, in the case of academic entrepreneurs who had left their university - in a separate visit made some time after the final visit to the university which previously employed them As a result, these additional questions had to be posed to each informant by telephone In every case but one, it proved possible to elicit the information required in this manner However, it was not possible to record these conversations and it was therefore necessary to rely on brief, handwritten notes taken during the telephone conversations

Data Preparation

The decision to tape-record and transcribe interviews with informants caused the greatest problem with regard to the manner in which it was decided to implement the chosen research design -but not the problem anticipated at the outset There were two main problems technical resources and time.

When deciding how best to implement the chosen research design, it appeared that dedicated tape-transcribing equipment would be available, thus permitting every tape to be transcribed in full. In the event, it was not possible to gain access to this equipment for several months after the data preparation process had begun As a result, transcription had to be done using the tape-recorder on which the interviews had been recorded, a process which was so laborious and time-consuming that the decision was taken not to fully transcribe the tapes recorded in connection with Questionnaires A and B, but to make a spontaneous judgement about what to transcribe and what to omit Transcription was recorded by hand in the spaces left underneath each question in Questionnaires A and B. Where appropriate the information elicited was not transcribed word for word but summarised This technique was also used for Questionnaire C where the pilot interviews recorded at Hull were concerned By the time interviews using the revised version of Questionnaire C came to be transcribed, access had been gained to dedicated tape-transcribing equipment, with the result that these interviews were transcribed straight onto word processor disk, *verbatim* All the recordings made in connection with Questionnaire D were also transcribed in this manner

Having the correct equipment rendered the transcription process considerably less laborious and time-consuming It was, nonetheless, an extremely time-consuming process, which could not be contracted out to typists owing to a lack of funding, the sensitivity of

much of the information and the need to edit out references to individuals, universities, companies *etc* and replace them with phrases like [Dr. X], [this University] and [company X]. Furthermore, in order to facilitate the analysis, during the transcription process markers were placed in the text to locate the numbered questions contained in the questionnaires, these were then indexed. Instances of certain topics/issues being discussed were also indexed As a result, the tape-recording to tape-transcription time ratio was in the order of 1.7 [16] (*ie*. one C90 tape took approximately one and a half hours to record but about ten to eleven hours to transcribe). In hard copy, Questionnaire C alone yielded single-spaced documents which were at least 32 pages long - and in some cases 48 pages long.

This might not have presented an insuperable problem had the decision not been taken to do nine case studies, a decision which had already been partially implemented It became clear that a choice would have to be made between various coping strategies These ranged from jettisoning around half of the case studies - notwithstanding the data already elicited, to significantly reducing the number of informants for Questionnaires C and D or reducing the level of detail sought - *ie* the number of questions posed. It was recognised that each option entailed considerable disadvantages and in the end a compromise decision was taken, based on the following rationale.

Firstly, it was felt that the level of detail sought was central to the investigation, particularly in relation to assessing the extent to which current IP policy and practice accommodate the government's wishes, as outlined in Sir John Kingman's letter and Sir Keith Joseph's statement of 14 May, 1985. Moreover, since the literature review revealed a singular lack of detail concerning the decision-making process underlying the choice of individual steps entailed in the exploitation process in UK universities, this information

had intrinsic as well as extrinsic value. Secondly, it was felt that data already elicited should not be jettisoned Although it did not appear to be particularly difficult to solicit the co-operation of the participating universities, the investigator clearly had no knowledge of discussions which went on behind the scenes It was not seen as justifiable to run the risk of offending universities and individual informants who had devoted considerable time and effort to the study - thereby possibly creating difficulties for future researchers

Given that this is an exploratory study, it was felt that the best solution was to make use of the data elicited from all nine universities in relation to Questionnaires A and B - but to reduce to four the number of universities in which data relating to Questionnaires C and D would be elicited Clearly, this would have a not inconsiderable effect on the resulting case studies, in so far as only four would adhere to the multi-dimensional approach proposed with a view to creating as many converging lines of enquiry as possible. However, it was felt that this was preferable, given that where possible converging lines of enquiry had in any case been pursued in the context of Questionnaires A and B, nor did this solution rule out using multiple sources of evidence Moreover, there was nothing to prevent Questionnaires C and D being administered in the other five universities in the course of a future study

Choosing this particular strategy nonetheless led to interviews being recorded on a total of 143 C90 tapes - *ie.* over 200 hours of interviews were recorded

Selecting the Four Universities

It was decided that rather than select the four universities randomly, it would be more interesting to select them in the light of a preliminary, informal analysis of the extent to which current policy and practice in each of the nine participating universities

accommodated the government's wishes, as outlined in Sir John Kingman's letter and Sir Keith Joseph's statement of 14 May, 1985 In other words, if a preliminary, informal analysis suggested significant differences in policy and practice among the nine, it would be most interesting to select four which were widely dispersed along the length of the relevant spectrum.

In the event, initial drafts of the nine case studies did suggest significant differences in current policy and practice, particularly where allowing researchers to assume the rights and responsibilities previously enjoyed by the BTG was concerned These differences led to **Hull, Liverpool, Strathclyde** and **York** being selected for participation in the second and third stages of the study - *ie.* the administration of Questionnaires C and D

Presenting the Findings

This solution inevitably had an effect on the manner in which the analysis was conducted and the findings were presented Originally it was intended to integrate all the data obtained from Questionnaires A-D together with data elicited in the course of supplementary interviews and from histories, documents and records, producing a comprehensive case study report for each university These would have been followed by a cross-case analysis which took all these data into account This, in turn, would have been followed by an assessment of the extent to which current policy and practice in each of the nine participating universities accommodated the government's wishes

This major modification to the manner in which the research design was implemented meant that the case study reports had to be analysed in discrete stages (*ie.* taking into account the various embedded units of analysis) and presented in the same fashion In other words, each case was analysed initially on the basis of multiple sources of data

elicited in relation to the subjects explored in Questionnaires A and B alone. These findings were then written up in a case study report for each of the nine universities This was followed by a cross-case assessment of the extent to which current policy and practice in each of the nine participating universities accommodated the government's wishes, taking only these data into account. Only then were the multiple sources of data elicited in relation to the subjects explored in Questionnaire C appended to the case study reports for the four universities concerned The data were then subjected to a more formal case-by-case and cross-case analysis. Finally, the data elicited in relation to the subjects explored in Questionnaire D were treated in the same manner, except that no data were appended to the four case study reports, for the reasons outlined in chapter 1.

It is recognised that this makes the presentation of the findings less "tidy" than they might have been, however, on the plus side it provides a better framework in which to report findings specific to the various embedded units of analysis.

6.6 Analytical Technique

Qualitative research is frequently criticised on the grounds that it is not clear how the investigator(s) proceeded from the raw data to the study's conclusions In other words, the analytical system employed is not transparent, provoking questions regarding the rigour of the study and concern that other investigators, confronted with the same data, might not reach the same conclusions In order to avoid such charges in relation to this study, the investigator devoted considerable time and energy to establishing exactly how reputable qualitative researchers set about analysing their data. The approach employed by the Qualitative Research Unit of Social and Community Planning Research (City University) was found to be especially helpful as a pointer to devising the analytical system for this study; practitioners there are well versed in the characteristics required in an analytical

system (*eg.* the ability to focus on issues - the range, recurrence and centrality of issues, the ability to classify and create typologies, the ability to demonstrate associations *etc*). Moreover, the method employed by the Qualitative Research Unit overcomes many of the criticisms levelled at qualitative research in that it is:

* systematic (it is always applied in the same way);
* comprehensive (it is always applied to all the material selected for analysis);
* dynamic and open to change (new issues/themes or categories can emerge from the data),
* grounded/generative (issues, themes, categories and patterns emerge from the data),
* enables easy retrieval (the links back to the original data are transparent),
* accessible to others (can be demonstrated to other investigators)

Furthermore, it allows within-case and cross-case analysis, which is vital if the investigator wishes to undertake both case study and thematic analysis.

Accordingly, analysis of the data elicited in this study proceeded in stages, as practised at the Qualitative Research Unit - *viz.* familiarisation with the transcripts of taped interviews, identification of important/recurrent themes or issues, indexing of such themes or issues, charting each theme or issue for each case, identifying categories and their dimensions, searching for replication, patterns and relationships - and finally, interpretation Appendix C contains examples of the first stage of the analysis, *viz* a transcript of two complete taped interviews (one with a Dean/Head of Department, one with an academic entrepreneur), with questions in the relevant Questionnaire and issues of interest indexed The emergence of categories and their dimensionality is made as transparent as possible in the text and the accompanying **Figures**, as is the search for replication, patterns and relationships Categories which are replicated and which encompass a relatively high

proportion of reasons/grounds/attitudes *etc* are characterised as "robust" categories, while those which are not replicated and/or which encompass a low proportion of reasons/grounds/attitudes *etc* are characterised as "weak". Usually, "weak" categories will be those which are case-specific - *ie.* which are not replicated In this context, "robust" categories are seen as those which are of most interest for the purposes of formulating hypotheses, developing theory *etc.* However, this does not mean that the so-called "weak" categories are not of interest; they may be of considerable interest, particularly if they are case-specific, since they may indicate that exceptional circumstances/attitudes *etc* prevail in specific cases, with regard to specific issues - or perhaps even globally. Moreover, these "weak" categories may indicate a more reflective consideration of a given issue than the "robust" categories, which may, in some instances, state the obvious. It is also worth noting that the categories proposed are not "absolute" - in the sense that they represent the one correct interpretation of the data - along the lines of the one, true God. The categories proposed reflect the investigator's perceptions, analysis and interpretations and in many instances it will be shown that there are alternative ways of looking at the data. The data is made as accessible as possible to the reader, so that the reader may judge for him/herself whether there are other, more insightful ways of looking at the data In some instances, it may be possible to identify hierarchies of categories, which, when unpacked, reveal increasingly specific ways of looking at a given issue

Finally, it is worth noting Yin's observation (Yin, 1989) that it is not uncommon to encounter investigations which purport to be based on a case study design - but where the appropriate analysis of the embedded units is conducted across cases - *ie.* where the data from all the cases is pooled at the outset The results of this analysis may be augmented by discussion of individual cases as a context for the pooled data, but in such studies, no formal attempt is made to relate the within-case data to individual case contexts and no

replication logic is applied across cases. In this type of study, the primary conclusions relate to the pooled, embedded units, and the individual cases are of peripheral importance In the true case study, in contrast, the individual case is the major interest. Thus, analysis of the embedded units is the main focus of attention and should be conducted first within each case, and the results interpreted at the single case level Single-case patterns and interpretations/explanations may then be compared across cases, following the replication mode for holistic, multiple-case designs Finally, the conclusions drawn for the multiple cases become the conclusions for the whole study.

Given that this investigation is concerned with nine cases, it was felt that this approach posed certain difficulties, particularly as the analysis of each case was driven not so much by internally-occurring criteria as externally-imposed criteria It was evident that presenting the analysis of each case separately would lead to extremely lengthy and somewhat repetitious chapters. However, the investigator took heart from Yin's observation that it is permissible to present only the cross-case analysis, provided that the original analysis was done on a case-by-case basis Accordingly, this was the analytical and presentation technique adopted for chapters 7-9 inclusive A good proportion of the case-by-case data is, in any case, presented in narrative (as opposed to analytical) form in Appendix F. In chapters 10-11, however, since only four cases were involved, the investigator has taken the risk of presenting the case-by-case analyses as well as the cross-case analysis It is acknowledged that these chapters are, therefore, relatively long - and, occasionally, a little repetitious However, the material was felt to be sufficiently interesting to offset these disadvantages.

CHAPTER 7

7 DO THE NINE PARTICIPATING UNIVERSITIES GIVE THE FULLEST OPPORTUNITY AND SCOPE TO ACADEMICS TO ASSUME RESPONSIBILITY FOR EXPLOITING THEIR FINDINGS AND IDEAS?

7.1 Introduction

As chapter 6 indicated, Sir Keith Joseph's statement of 14 May, 1985 expressed the Government's wish that UK universities should give.

> " . *the fullest opportunity and scope to researchers themselves to assume responsibility for exploiting their own findings and ideas* "

This document provided some clues as to what the Government had in mind However, its relatively vague phraseology presented a problem when it came to trying to establish objectively whether the nine universities do, in fact, give members of their academic staff opportunity and scope to assume responsibility for exploiting their own findings and ideas - and if so, whether what they offer amounts to the fullest opportunity and scope or whether it falls short in some way. It was therefore necessary to define - for the purposes of this study, at least - what constitutes "*fullest opportunity and scope*", what is meant by "*assume responsibility for exploiting*" and what is meant by "*findings and ideas*".

As indicated in chapter 5, there is little doubt that the term "inventions", when used in connection with the BTG's monopoly, should not be interpreted in the exclusive manner defined by the 1977 Patent Act, for its own purposes "Inventions" should clearly be given a far more encompassing definition The various phrases employed by the DES, of which "*findings and ideas*" is just one, are not very helpful, however For the purposes of this study, it was necessary to define IP far more rigorously

IP comes in a number of forms, as evidenced by the variety of ways in which it can be protected (see **Appendix H** for details). It can be divided into two broad groups - tangible and intangible Tangible IP includes patentable inventions, computer software, books,

musical compositions and so on, which are copyrightable, registered designs, unregistered design rights; trade marks and service marks It also includes what - for the purposes of this study - we shall call "know-how", that is to say, tangible IP which cannot be protected in any of these ways, or which the owner of the IP chooses not to protect in any of these ways The term "know-how" is sometimes used to denote intangible IP; in order that there should be no confusion, for the purposes of this study we shall refer to such intangible IP as expertise, that is to say, the kind of background knowledge which any academic might be expected to have in order to be appointed in that discipline, or in a specific area of that discipline. These two broad groups of IP will be referred to in the course of this study as "hard" and "soft" IP respectively For the purposes of this study, therefore, *"findings and ideas"* has been defined as "hard" or tangible IP. Where appropriate, the analysis will further distinguish between inventions, computer software and other forms of "hard" IP. However, where appropriate, this study will mention the treatment of "soft" IP *en passant*

The phrase *"assume responsibility for exploiting"* was more problematical It is unclear whether it was intended to be interpreted in a narrow sense, meaning that academics themselves should exploit IP which they generate, by means of spin-off companies, university companies, commercial arms of their department or some other entrepreneurial means It could also be interpreted in a wide sense, meaning that academics could exploit their IP themselves and/or arrange to have it exploited by one or more third parties In the latter case, assuming responsibility for exploiting would entail identifying, contacting and negotiating with appropriate companies It was felt that this second, wider definition provided an absolute against which participating universities could be measured. This, in turn, raised an additional problem, however it is unclear whether assuming responsibility in this way should be construed as the academic taking the necessary steps under his

university's direction or taking the necessary steps on his own initiative - or some kind of intermediate position Once again, it was felt that the academic taking the necessary steps on his own initiative provided an absolute against which participating universities could be measured

The phrase "*fullest opportunity and scope*" was hardest to define It was decided to attempt a definition in terms of criteria which would need to be fulfilled in order for academics to have the fullest opportunity and scope to assume the kind of responsibility for exploiting "hard" IP. Under the provisions of the 1977 Act, any UK employee could find that he straightaway acquires sole right to the IP he generates in the course of his duties Patent law overrides most other types of law, except the law of equity, which deals with trade secrets and confidential information. Contract law cannot override the rights of employees as specified by the 1977 Patent Act. However, employers can choose to yield their rights under the 1977 Act. Cambridge University, for instance, has no wish to own IP generated by members of its academic staff, as a matter of policy Cambridge uses these provisions to immediately assign to inventors any rights which might be conferred on it by the 1977 Act by virtue of being their employer [1]. The provisions of the 1988 Copyright, Designs and Patent Act - and, indeed, earlier Copyright Acts - also allow employers to yield to employees first ownership rights to copyright material and designs created by those employees in the course of their work, as a matter of policy, Cambridge University uses these provisions - like the provisions of the Patent Act - to immediately assign rights in designs and copyright material to their creators In the light of this, it was felt that the simplest, most unequivocal criterion of "*the fullest opportunity and scope*" is a positive, unqualified answer to the following question

* **do academics, as a matter of policy, immediately acquire sole ownership of the IP they generate in the course of their duties?**

It was felt that the DES document offered support for this approach as indicated in chapter 5, it appeared to suggest that universities should, as a matter of policy, conditionally assign all their rights to academics who wish to assume responsibility for exploiting their "*findings and ideas*".

If this criterion is fulfilled in the nine participating universities, these academics would, like their colleagues in parts of Europe, have the exclusive right to exploit their IP/arrange to have it exploited in whatever manner they see fit. In principle at least, this represents "*the fullest opportunity and scope to assume responsibility for exploiting their findings and ideas*" which one could imagine.

If this criterion is not fulfilled, fulfilment of a second criterion could still give academics considerable power to determine how their IP is exploited, though it falls short of "*the fullest opportunity and scope*" to assume responsibility for exploiting/having their inventions exploited which sole ownership confers The provisions of the 1977 Patent Act and the 1988 Copyright, Designs and Patent Act allow employers to partially yield to employees their rights in inventions, copyright material and designs, as an alternative to wholly yielding those rights Universities could use those provisions to give their employees joint ownership of IP they generate; this would confer on employees the same rights as employers enjoy when it comes to determining how their IP should be exploited. This falls short of "*the fullest opportunity and scope*" to assume responsibility for exploiting/having their inventions exploited which sole ownership confers, because joint ownership means that both parties must agree on the manner in which that IP is exploited. Academics who are joint owners could be prevented by their university from exploiting their IP/having it exploited in the manner they saw fit. On the other hand, they could equally prevent the university from exploiting their IP in a manner which did not meet

with their approval. The value of joint ownership from the perspective of the academic is that is confers an inalienable legal right on academics to have a say in how their IP is exploited.

This second criterion would be fulfilled if the following question receives a positive, unqualified answer:

- **do academics, as a matter of policy, immediately acquire joint ownership of the IP they generate in the course of their duties?**

If this second criterion is not fulfilled, the situation becomes more complex. A series of alternative criteria need to be taken into account, as will now be shown. A university may elect to assert first ownership of the various types of IP generated by members of the academic staff, however, it may subsequently elect to assign those rights to a third party, rather than retain ownership. If the academic is not party to this decision, he could find himself unable to exploit the IP **intellectually**, let alone exploit it/arrange for it to be exploited **commercially**.

As chapter 2 indicated, there is evidence to suggest that in many fields a discovery is more likely to be commercially exploited - and successfully exploited - if it is "protected" in some manner, rather than put into the public domain. A university may retain ownership of a discovery; however, unless the academic has the right to try and ensure that the IP in question is protected in some way, he may be denied the fullest opportunity and scope to assume responsibility for exploiting it/arranging to have it successfully exploited. It may also be important for the academic to determine the way in which the IP is protected. With some types of tangible IP, there is a choice between protecting it overtly or covertly (patent versus secret know-how), formally or informally (registered design versus design right).

Equally, unless the academic has the right to identify potential licensees/assignees, make the initial contact and negotiate with interested parties, once again he may be denied the fullest opportunity and scope to assume responsibility for exploiting/arranging to have his IP exploited.

Furthermore, unless an academic has the right to decide who is allowed to commercially exploit that IP, his options are limited He could assess company X as the most suitable in the pool of potential licensees/assignees, negotiate a deal with that company in good faith, only to find that the university decides unilaterally to license company Y instead. He could opt to start a company to exploit his discovery, only to find that the university insists on licensing to existing companies.

The academic also needs a say in the terms under which the university grants use of that IP If a university decides unilaterally to grant an exclusive, world-wide, multi-sector license to a third party, this will prevent the academic from pursuing other exploitation opportunities Similarly, unless the academic has a say in the type of return which the university gets on the IP in question, he may be denied the fullest opportunity and scope to assume responsibility for exploiting/arranging to have his IP exploited. In good faith, he could negotiate a deal whereby the return on the IP was partly or wholly indirect, rather than direct - perhaps sponsorship of further research or a lectureship - only to find the university deciding unilaterally that it wants a direct, conventional, financial return on the IP in question

Finally, in order to be able to entrepreneurially exploit the IP he has generated himself, rather than be obliged to license/assign it to a third party, the academic needs permission to start a company

This complex situation can be expressed in terms of the following six criteria In order to have "*the fullest opportunity and scope*" to exploit IP they have generated, where academics routinely acquire neither sole nor joint ownership of their IP, they need to be able to determine.

- **the subsequent ownership of IP they generate;**
- **how that IP is protected;**
- **who is granted use of the IP;**
- **the terms on which use of that IP is granted;**
- **the return, if any, to be levied for use of that IP.**

They also need

- **freedom to start a business while retaining their academic status.**

We may consider these criteria to be **absolutely** fulfilled if the <u>first</u> of the following questions gets a positive, unqualified answer. We may consider them to be only **conditionally** fulfilled if the <u>second</u> of the following questions gets a positive, unqualified answer Whether they acquire joint ownership or no ownership, we may, however, consider these criteria to be **absolutely** fulfilled if <u>each</u> of questions (c)-(j) gets a positive, unqualified answer.

(a) **Do academics, as a matter of policy, immediately acquire sole ownership of the IP they generate in the course of their duties?**

(b) **Do academics, as a matter of policy, immediately acquire joint ownership of the IP they generate in the course of their duties?**

If not, do academics, as a matter of policy, have the right to ...

(c) **determine the subsequent ownership (if any) of IP they generate?**

(d) **determine how that IP is protected?**

(e) **identify, contact and negotiate with appropriate licensees/assignees?**

(f) **start a business while retaining their academic status?**

(g) **determine who is allowed to commercially exploit the IP they generated?**

(h) **determine the terms on which commercial exploitation of the IP in question is allowed?**

(j) **determine the return to be levied for the right to commercially exploit that IP?**

If any of questions (c)-(j) receive a negative or a qualified answer in any of the participating universities, it is likely to indicate that academics in the university concerned do not have the fullest opportunity and scope to assume responsibility for exploiting the IP they have generated/arranging to have it exploited. The number - or more likely, the nature - of the criteria which are not fulfilled should give some objective measure of the extent to which academics in any given university have been denied such opportunity and scope

It must be stressed at this juncture that these questions are concerned primarily with principle, with policy, not with practical or logistical considerations

7.2 Findings

(a) **Do academics, as a matter of policy, immediately acquire sole ownership of the IP they generate in the course of their duties?**

(i) Background

The 1977 Patent Act and the 1988 Copyright, Designs & Patent Act confer upon universities, in their capacity as employers, the right to first ownership [2] of the IP which members of staff generate in the course of their duties; if employees - knowingly or out of ignorance of the law - should happen to take out *eg* a patent in their own name alone, these two Acts empower employers to require those employees to assign ownership to

them There are, nonetheless, two ways in which academics could at once legally acquire sole ownership of the IP they generate in the course of their duties, although one is not quite as immediate as the other

Employers have the option of waiving all their rights in such IP in favour of their employees, that is to say, they can choose not to accept the rights which these two Acts confer upon them. They can indicate this by explicitly saying so in letters of appointment, terms and conditions of employment *etc*, or by making this part of a collective agreement with, say, the relevant trade unions. A waiver would thus apply in every case, unless specific caveats were incorporated in the documentation/agreement

Alternatively, universities could accept the right to first ownership of such IP which these two Acts confer upon them as employers, but could opt to immediately assign those rights to the employees which created the IP - either globally, in every case, or in specific situations. This would inevitably be slightly less immediate, given academics' need to notify the relevant authorities and for those authorities to do the necessary paperwork. This second method would allow a university to assign contingent upon certain conditions being fulfilled at the time or in due course It is this second method which the DES' 1985 statement seems to promote, though either method would fulfil criterion (a)

(ii) Inventions

By the end of the 1989/90 session, every one of the nine participating universities was asserting first ownership of inventions made by members of its academic staff in the course of their duties [3]. As Figure 7a shows, this is a relatively long-standing situation in some participating universities: Glasgow, Strathclyde, Liverpool have done so since 1977/78 City's assertion of first ownership of employee inventions dates from the same

period, although it was not articulated anywhere until 1989 Others took a while to respond to the 1977 Patent Act **Bristol's** assertion of first ownership is believed to date from the early 1980s, although once again, this does not seem to have been formally articulated until 1989 **Kent's** assertion of first ownership of employee inventions also dates from 1982 However, others have asserted first ownership much more recently: **Hull** and **Durham** did so in 1986/87, and **York** finally did so in 1990

None of the nine participating universities has opted as a matter of policy to yield its rights - that is to say, to waive its rights in favour of academics wishing to exploit/arrange to have exploited inventions which they made in the course of their duties - or to immediately assign them [4].

(iii) Computer Software

By the end of the 1989/90 session, eight of the universities participating in this study were effectively asserting first ownership of computer software written by members of the academic staff in the course of their work [5], only **Kent** has not yet done so, but plans to do so

As **Figure 7b** shows, most of the participating universities took this step very recently, in so far as they have done so formally. It was not until June 1990 that a working party recommended **Hull** should do so, the recommendations did not come into force until the end of the 1989/90 session **York** asserted first ownership of computer software in July 1990, **City** did so in April 1989 and **Bristol** did so in March 1989 **Durham** asserted first ownership of computer software a little earlier, in 1987. The two Scottish universities stand out from the rest of the group. **Glasgow** asserted first ownership of computer software written by members of the academic staff in the course of their work as long ago

as 1978 and **Strathclyde** is believed to have done so at some point in the 1970s (no record remains) **Liverpool** cannot trace when it explicitly asserted ownership of computer software; it may be that it has never done so formally, though the university certainly does assert ownership of computer software today

None of the nine participating universities has opted as a matter of policy to <u>waive</u> its rights in favour of academics wishing to exploit/arrange to have exploited computer software which they wrote in the course of their duties Only one of the participating universities has elected as a matter of policy to immediately <u>assign</u> its rights to academics wishing to exploit/arrange to have their software exploited - but only in certain circumstances **York's** policy states explicitly that it is prepared to relinquish all its rights in software at once if that software seems unlikely to have a large-scale application.

(iv) Other Tangible Forms of IP

The nine participating universities differ in the extent to which they assert first ownership over other tangible forms of IP They fall into one group and two mavericks The first group comprehensively asserts first ownership of all other tangible forms of IP. The second group may assert less comprehensive first ownership; the phraseology employed to outline the claims leaves room for doubt about certain forms of tangible IP. The third group has not yet seriously addressed the question.

There are seven universities in the first group **York** and **Hull** both employ the WIPO's exhaustive definition of IP.

> " *the rights relating to literary, artistic and scientific works; performances or performing artists, phonograms and broadcasts, inventions in all fields of human endeavour, scientific discoveries, industrial designs, trade marks, service marks*

and commercial names and designations, and all other rights resulting from intellectual activity in the industrial, scientific, literary and artistic fields" [6].

City defines IP over which it claims first ownership as:

"... inventions capable of protection by patents or by registered designs and design right, know-how of a technical nature and all copyrights including copyright in software" [7].

Glasgow asserts first ownership of.

" .. inventions, inventive ideas, designs, written work (including software) and know-how devised or developed by members of staff in the course of their employment with the University" [8]

Durham asserts first ownership of

"... any work with commercial potential", "any . result developed in the course of .. employment which it is considered might have commercial significance, whether patentable or not" [9].

Similarly, Bristol claims first ownership of

" [any] invention, discovery or finding which there is reason to believe ... may be commercially exploitable, whether patentable or not" [10].

Strathclyde claims first ownership of

".. all Intellectual Property Rights generated by its employees in the course of their duties" [11],

but does not define what, in its view, constitutes IP.

There is just one university in the second group, whose claims may be less comprehensive, it is difficult to tell from the phraseology employed Liverpool claims first ownership of

"*. . the results of research undertaken by research staff supported by the University (sic) during the course of their employment and notes and reports and essential reference specimens associated with the research*"

and.

"*... [all] commercially exploitable industrial property includ[ing] ... confidential know-how*" [12].

Anecodatal evidence indicates that, in practice, **Liverpool** does claim ownership of other tangible forms of IP, irrespective of the phraseology employed. In the 1989/90 session, when a member of staff received an award for a design he had created, the university claimed not only ownership but also a proportion of the prize money. It is not clear whether the phrase "*research results*" is intended to include copyright material other than software, as well; in the view of one of **Liverpool**'s former Vice-Chancellors, a man with a particular interest in IP, it should not be taken to include books, lectures, articles, musical compositions *etc*. It is not clear, either, whether the phrase "*research staff supported by the University* .." relates just to Research Fellows/Assistants or also to Lecturers, Readers, Professors *etc*

By the end of 1989/90 only **Kent** had not seriously addressed the question of first ownership of other tangible forms of IP, although it planned to do so shortly.

Academics at five of the seven universities in the first group immediately acquire sole rights to certain types of IP protected by copyright, as a matter of policy. It is not always clear from the documentation whether they are, *de facto*, first owners, or whether they become second owners as a matter of policy - *ie* whether their university waives its rights in such IP, or whether it assigns it to them as a matter of course [13]

Whatever the mechanism, academics at **York** acquire sole rights to "*books, articles (including journalism), lectures or artistic works other than that specifically commissioned by the University*" [14]. Academics at **Hull** acquire sole rights to: "*original literary, scientific or musical compositions*". Those at **Glasgow** acquire sole rights to: "*books ... or articles for learned journals*" Similarly, those at **Strathclyde** acquire sole rights to "*academic articles, journals and books*". At **City** academics acquire sole rights to: "*printed publications by members of staff other than course notes and syllabuses and examination papers*", but not to material produced as part of a research contract or as part of the specific duties of a member of staff.

At **City** academics also acquire sole ownership of IP covered by the new unregistered design right [15] - unless it is related to development work undertaken in connection with a patent/patent application By attaching this condition, **City** falls short of yielding <u>all</u> its rights to unregistered designs as a matter of policy None of the other universities yields <u>all</u> its rights to unregistered designs, conditionally or unconditionally Similarly, academics at **City** acquire sole ownership of registered designs - again, unless it is related to development work undertaken in connection with a patent/patent application Again, none of the other universities yields <u>all</u> its rights to registered designs, conditionally or unconditionally [16].

The situation in **Bristol** and **Durham** is less clear. Neither appears to yield any rights; perhaps they did not, after all, assert them in the first place [17] or perhaps they have not paid sufficient attention to this aspect of their IP policy On the other hand, perhaps we should take this at face value.

The situation in **Liverpool** is also less transparent than it might be. **Liverpool** does not appear to relinquish any of its rights in "*the results of research*" The staff handbook states "*research staff supported from outside funds*" must seek permission to publish from the principal investigator, who may grant it on behalf of the University, and it is upto HoDs to rule on the disposal of notes, reports and reference specimens, this suggests that **Liverpool** retains the rights to such IP.

Kent - the sole member of the third group - is considering a different approach to most of the participating universities It may well decide, once it has broadly asserted first ownership of other tangible forms of IP, not to yield any of those rights to members of the academic staff - not even ownership of books which they write.

(v) Soft IP

By using the WIPO definition of IP, **York** and **Hull** presumably assert ownership of expertise; the phrase "*all other rights resulting from intellectual activity in the industrial, scientific, literary and artistic fields*" should cover this **Liverpool's** staff handbook suggests that it may also claim ownership of expertise. It states, rather enigmatically from the perspective of this study

> ". . *special expertise of the University ... can often be exploited commercially and ORSIL should be consulted ..* "

None of the other universities makes any reference, oblique or otherwise, to ownership of expertise. However, it could be argued that by virtue of requiring academics to seek permission prior to doing consultancy, tacitly, all of these universities lay claim to ownership of the expertise of members of the academic staff

(vi) Conditions for Relinquishing First Ownership to Academics

With the exception of the examples listed in sub-sections (iii) and (iv) above, academics in

the nine participating universities cannot immediately acquire sole ownership of the IP they generate by virtue of their institution waiving its rights or assigning ownership to them All nine universities will consider assigning ownership eventually, but only if they they come to believe that the IP in question is not likely to yield a worthwhile return commercially, or they have been unable to find an industrial/commercial partner to exploit it.

The manner in which the nine universities implement that common policy differs considerably, however. **Hull** and **City** have committed themselves to making this decision within six months, **York** within three months of being notified of potentially exploitable IP. They have also committed themselves to volunteering to assign their rights in favour of the inventor/author/designer **Strathclyde** also volunteers to assign its rights, but does not commit itself to a time-scale **Liverpool's** policy is similar, though in practice, it is very unlikely to volunteer that information The other four universities neither commit themselves to a time-scale, nor do they volunteer to assign their rights in exploitable discoveries which they come to believe are not likely to yield a worthwhile return commercially. If pressured by the academic, all four would eventually agree to this in most cases, however.

Three universities, **Hull, Glasgow** and **Strathclyde,** would assign their rights unconditionally In the past, **Kent** would also have done so, however, **Kent** now feels it would assign conditionally, to enable it to cover its costs if the IP in question was successfully exploited **Bristol, City, Durham** and **Liverpool** would do likewise. **York** has yet to consider its policy.

(vii) Summary

By the end of the 1980s the nine universities participating in this study had unanimously asserted first ownership of inventions generated by members of the academic staff Eight had asserted first ownership of software, too Seven had asserted first ownership of all other tangible forms of IP and an eighth will probably do so shortly, the situation in the remaining university may well be the same, but the phraseology employed leaves room for doubt

Five of these universities have chosen, as a matter of policy, to yield to members of staff all their rights to certain, specified types of IP as soon as it is created, essentially staff in these universities immediately acquire sole rights to various forms of copyright material, with the exception of software. Just one of these five universities yields all its rights in software, too, in certain circumstances. Another immediately yields all its rights in designs - registered and unregistered - in certain circumstances This situation is summarised graphically in **Figure 8.**

Staff in a further three universities may also, as a matter of policy, acquire sole rights to most forms of written IP, with the probable exception of software; if so, this is not made explicit, however. When the remaining university asserts first ownership of software and other tangible forms of IP, policy may well dictate that staff there do not immediately acquire sole rights to any of it

With two minor exceptions, academics in the nine participating universities can acquire sole ownership of inventions, software and designs which they generate but only if their universities come to believe that the IP in question is not likely to yield a worthwhile return commercially, or they have been unable to find an industrial/commercial partner to

exploit it Unlike some of their European colleagues, therefore, academics in these universities do not have an immediate, inalienable right to determine how their inventions/software/designs are exploited They may eventually acquire that right, but in some universities that process could take years, rather than months

(b) Do academics, as a matter of policy, immediately acquire joint ownership of the IP they generate in the course of their duties?

(i) Background

In much the same way that employers have the option of waiving all their rights in IP in favour of the employees who created it, they can also choose to partially waive their rights, that is to say, they can choose to share with the employees in question the rights which the 1977 Patent Act and the 1988 Copyright, Designs & Patent Act confer upon them Once again, they can indicate this by explicitly saying so in letters of appointment, terms and conditions of employment *etc*, or by making this part of a collective agreement with, say, the relevant trade unions. A partial waiver would thus apply globally, in every case, unless specific caveats were incorporated in the documentation/agreement.

Alternatively, universities could accept the right to first ownership of such IP which these two Acts confer upon them as employers, but could opt to immediately assign those rights into the joint names of themselves and the employees which created the IP. Joint ownership could be granted globally, in every case, or in specific situations. Again, this would inevitably be slightly less immediate, given the necessary paperwork.

(ii) Inventions

Only one of the participating universities, City, reported vesting ownership of patents jointly in the university and the inventors(s) as a matter of policy. There are no conditions

attached, it seems to be irrelevant whether or not the inventor wishes to exploit it/arrange to have it exploited. It is not clear whether joint ownership arises by virtue of a partial waiver or by assigning first ownership into the joint names

As emphasised at the end of section 7.1, it was intended to present verbally-elicited information in section 7 2, drawing on documents provided by the participating universities only to reproduce exactly the extent of their claims over different types of IP. However, it proved impossible to overlook the fact that, in three universities, this documentation explicitly states that ownership of patents will be vested jointly in the university and the inventor(s) Those three universities are **City, Hull and Liverpool.** This is not the place to consider explanations for this discrepancy; suffice it to say that, despite what is written down in the official policy, with one exception [18], ownership of patents is not vested jointly in the university and the inventor(s) at **Hull** or **Liverpool.**

(iii) Other Forms of IP

Only one of the participating universities, **City**, reported vesting ownership of software, designs and all other forms of IP jointly in the university and its creator(s), as a matter of policy Again, there are no conditions attached, it seems to be irrelevant whether or not the creator wishes to exploit it/arrange to have it exploited Again, it is not clear whether joint ownership arises by virtue of a partial waiver or by assigning first ownership into the joint names

There does not appear to be a discrepancy between the official and the unofficial policy at **Hull** or **Liverpool** where other forms of IP are concerned **Hull's** documentation explictly states that rights in everything except patented/patentable IP are vested in the university alone **Liverpool's** documentation contains nothing to suggest that other forms of IP might

also be jointly owned by the university and the academics who generated it.

(iv) Summary

Since joint ownership means that both parties must agree on the manner in which an invention is exploited, academics at City do, indeed, have the legal right to determine how all their IP is exploited. Equally, however, the university has the legal right to determine how the IP in question is exploited Unless both parties can reach agreement, from the academic's perspective this falls short of "*the fullest opportunity and scope*" to assume responsibility for exploiting/having their IP exploited. Nonetheless, City confers on its staff legal rights which academics in none of the other participating universities enjoy

(c) Can academics determine the subsequent ownership of IP they generate?

(i) Rights

In UK intellectual property law, the right to determine the subsequent ownership of IP is a function of owning it in the first place. As we have seen, City alone has chosen to make its academics joint owners of every form of IP they generate Academics there have the legal right - shared with their institution - to determine the subsequent ownership of the IP specified. Joint ownership means, of course, that the two parties must agree on this, if any progress is to be made. As it happens, City does not have particularly strong feelings about the value of retaining ownership of IP and licensing it to exploiters, as opposed to assigning it. However, legally City cannot subsequently assign ownership of the IP specified without the academic's agreement

(ii) Concessions

The other eight universities have remarkably divergent views on the question of subsequent ownership. In three, Glasgow, Kent and Strathclyde, retaining ownership of

"hard" IP has been seen as extremely important In these universities, too, policy and practice seem to coincide IP has been assigned to a third party only in exceptional circumstances, if at all - and usually only with the agreement of the academics concerned **York** has very recently adopted the same approach as a matter of policy; it remains to be seen whether policy and practice will coincide [19]

Hull does not have particularly strong feelings about the value of retaining ownership of IP, however, **Hull** would be unlikely to assign ownership unless there is a concensus between the administration and the academics concerned For **Liverpool**, the distinction between assigning ownership - as opposed to retaining it and granting a license - is seen as academic, provided the relevant agreements incorporate adequate ride-in clauses However, **Liverpool** would "*not want to push a member of staff down a route they didn't want to take*".

Bristol sees a distinction between the "*ideal world*", in which the University would retain ownership of all IP, and the "*real world*", in which various difficulties conspire to make assigning ownership of "hard" IP a more attractive proposition, one such difficulty is the need to exploit IP as cost-effectively as possible in the short-term In **Bristol**, accordingly, it is the ILO who reserves the right to decide on such matters; in time, this should become a less pressing need and academics may have more say in this matter.

In **Durham**, assigning ownership is seen as almost *de rigeur* by the administration. It is, moreover, the administration which reserves the right to decide whether to retain ownership of IP, a right which it seems to exercise in practice as well as principle Now that the administration is responsible for IP, it is likely that **Kent** will now adopt a similar approach, it sees retaining ownership as an expensive red herring

In several of these universities the BTG is perceived as a thorn in the side, notwithstanding the removal of its monopoly. The BTG invariably demands that universities assign to it subsequent ownership of IP which it has agreed to exploit In the course of this study, only one case was identified of the BTG accepting a license to exploit, in this case, the circumstances were exceptional 3i Research Exploitation Ltd, formerly known as the Research Corporation, makes the same demand [20]. Until recently, **Kent** has avoided any dealings whatsoever with the BTG, precisely because of this problem **York** also expressed concern about this aspect of the BTG's *modus operandi*, though it does still deal with BTG occasionally

In contrast, **Liverpool** offers most of its IP arising out of publicly-funded projects to the BTG - and plans to use 3i Research Exploitation and DTE if these organisations increase their current level of activity Assigning to the BTG does not conflict with **Liverpool's** general views about assigning versus retaining ownership, of course, however, the university would not take this route unless the academics in question were happy about it Now that the administration is in charge of IP, there are signs that **Kent** will also place considerable reliance on the BTG, too [21]. Since, in any case, **Kent's** administration regards owning IP as an expensive red herring, it may be immaterial from the perspective of the academic whether his IP is assigned to the BTG or to an industrial partner, of course

In the other participating universities, the BTG is unlikely to cause academics concern in this respect **Bristol** has little time for the BTG, because the ILO feels it is interested chiefly in finding high revenue-generating replacements for cephalosporins, on which the patents have lapsed, rather than more speculative opportunities **Strathclyde** offers the BTG four or five IP opportunities a year. However, this happens only if all other options

have been ruled out, and only with the agreement of the academics involved. Hull has little faith in the BTG's judgement after its forerunner, the NRDC, turned down the opportunity to exploit liquid crystals This has created such widespread scorn of the BTG within the academic community that Hull does not feel encouraged to call on its services City had a similar experience of the NRDC where its gas sensing technology was concerned However, City often asks BTG to evaluate its IP and is not averse to assigning that IP to the BTG to exploit This cannot happen without the agreement of the academics, of course

Durham seldom deals with the BTG when it comes to evaluating or exploiting IP, in any case, since the administration regards assigning subsequent ownership as virtually *de rigeur*, it is probably immaterial from the perspective of the academic whether his IP is assigned to the BTG or an industrial partner

(iii) Summary

When it comes to determining the subsequent ownership of IP, the nine participating universities fall into three distinct groups

Academics at City have the legal right to determine the subsequent ownership, if any, of the IP they have generated They can exercise this right, provided their views do not conflict with their university's, equally, they can prevent their university from making arrangements which conflict with their wishes.

Academics in Glasgow, York, Strathclyde, Liverpool and Hull are dependent on concessions which are not formally articulated anywhere In other words, they are dependent on the university's goodwill, on it maintaining the stance that it will not assign

IP without their agreement

Academics at **Bristol, Kent** and **Durham** have neither the legal right nor even the assurance of concessions. In these universities, the ILO/administrator responsible for IP reserves the right to decide whether to retain ownership or to assign At **Bristol** IP is liable to be assigned only if it proves impossible to retain ownership and exploit the discovery or if retaining ownership would result in considerably less than optimal exploitation It remains to be seen what criteria the administration at **Kent** will employ to determine whether ownership of IP is retained or assigned and how flexible the university will be about applying these criteria

The least flexible of the nine participating universities appears to be **Durham**, certainly where patentable discoveries are concerned **Durham** has acquired only three patents in its own name since 1985; during the same period, 12-20 non-obligated discoveries a year have been assigned to third parties, on the understanding that they patent them. If this pattern is maintained - and there is no reason to suggest it will not be [22] - it would appear that academics have no more than a 5 per cent chance of their university retaining ownership of IP arising out of projects funded by the Research Councils or charities, possibly less

(d) Can academics determine whether - and how - that IP is protected?

(i) Background

This question has relevance to some types of tangible IP, but not to others With some types of IP, there is no debate, since there is only one form of protection and that protection is conferred automatically and without cost. As detailed in Appendix H, this is the situation where IP protected by copyright is concerned [23]. With designs, however,

there is a choice between what we might call formal and informal protection (registered design versus design right) With inventions, there is a choice between overt and covert protection (patent versus secret know-how) There is a choice because even though UK patent law obliges employees to notify their employer of potentially exploitable inventions, it does not oblige the employer to patent the invention in question - unlike German and Swedish patent law. Under UK patent law, it is the employer who determines how an invention will be protected. As Phillips (1981) points out, unless the employer relinquishes those rights, under UK law the inventor may legally be frozen out, both in terms of decision-making and reward [24]. The analysis which follows will focus chiefly on inventions, since the new design right was not introduced until 1988 and only one of the participating universities seems to have considered its approach to this form of IP in any detail

First, however, it is pertinent to consider why it could be important to choose one method of protecting inventions rather than another From a purely commercial perspective, the preferred choice is likely to vary according to circumstances. In the IT and electronics industries, for instance, technology becomes obsolescent at such a pace that smaller companies, in particular, often opt for informal protection where designs are concerned, and covert protection where inventions are concerned In the pharmaceutical industry, in contrast, it is standard practice to patent In other industries, there may be arguments in favour of either option. Some companies simply prefer to exploit inventions on a secret know-how basis A patent conveys a limited monopoly over published technology and it alerts competitors to a company's latest activities Moreover, it is one of the fundamental tenets of the patent system that competitors are encouraged to "invent around" patented technology Secret know-how could convey an indefinite monopoly, provided no other organisation makes the same discovery - by chance or by intent If that should happen, the

first company has no redress Other companies may prefer to exploit discoveries which have been patented - erecting, where possible, a "thicket" of patents around a product to prevent competitors from entering the field at all The DIY "Workmate" marketed by Black & Decker is one such product, the subject of dozens of patents, it has been impossible for the duration of the patents for another company to market a rival product The manner in which inventions and designs are protected could therefore affect the likelihood of companies exploiting them, the effort which they put into exploiting them and therefore the return to the university and the inventor

From a university perspective, the preferred choice may be different. A university may be influenced by considerations of cost - patenting is considerably more expensive than deals based on secret know-how and it is not always possible to claw back the cost of patenting from a licensee. Conversely, it may be influenced by its obligation to disseminate knowledge In many cases, a discovery which has commercial value may also have intellectual value The manner in which inventions are protected could affect the inventor's ability to publish. A discovery which is protected by means of secret know-how cannot, by definition, be described in an academic paper/lecture, at least for an agreed period In contrast, a discovery which is protected by means of a patent may be exploited both commercially and intellectually, from the moment an initial registration is filed, or, more safely perhaps, from the time a full patent is granted The question posed here applies equally to IP which is assigned, if IP is assigned prior to the "A" publication [25], the company concerned is free to let the application drop and keep the IP secret, unless the agreement specifies otherwise.

(ii) Rights

As indicated, in the UK the right to determine how - and, indeed, whether - IP is

protected is a function of owning the IP in question. Eight of the participating universities do not, as a matter of policy, immediately yield any of their IP rights; academics in these universities do not, therefore, have an exclusive legal right to determine whether or how their IP is protected. These academics will acquire that right only if their university eventually decides to assign them its rights because it believes that the IP in question is not likely to yield a worthwhile return commercially - or it has been unable to find an industrial/commercial partner to exploit it, in some universities, it may take years rather than months to reach that decision. **City** constitutes a slight exception here, in so far as it will, as a matter of policy, immediately yield to academics all its rights to unregistered designs unless they are associated with a patent/patent application

As we have seen, **City** alone has chosen, as a matter of policy, to share ownership of IP. Just like determining the subsequent ownership of IP, joint ownership means that the two parties must agree on whether and how the IP in question is to be protected, if any progress is to be made **City** has no principled objection to treating IP as secret know-how with a view to licensing/selling it on that basis but it admits to lobbying fairly persuasively on occasion to achieve its preferred way of protecting the IP in question However, **City** cannot do so without the academic's agreement.

(iii) Concessions

Six of the other eight universities also have a preferred position when it comes to protecting inventions **Bristol, Durham, Glasgow, Liverpool** and **Strathclyde** prefer not to protect IP by treating it as secret know-how, though most will agree to such arrangements provided there is an agreed time-limit on disclosure. In **Liverpool** and **Strathclyde**, the limit would normally be two years In **Bristol** it is usually one year, and there is an additional condition the university must be free to use the IP in question in

both teaching and research Neither **Glasgow** nor **Durham** quote a strict time-limit, **Durham** is fairly averse to protecting and exploiting IP in this manner, whatever the time-limit In contrast, **Kent** now actually prefers to protect and exploit inventions by treating them as secret know-how; the administration is very much against spending money on patenting unless circumstances are exceptional. The other two universities do not have a preferred position **Hull** is content to be guided by the academic when it comes to deciding how to protect inventions/designs and **York** has yet to decide its approach to this question

Those with preferences have not inscribed them in tablets of stone. Most of these universities treat their preferred position as a basis on which to start deciding how to protect an invention In the final analysis, **Strathclyde** is almost invariably guided by the inventor's preference. The only exception is cell lines **Strathclyde** believes that the prerequisites of the patent system leave cell lines open to abuse [26]. Accordingly, cell lines are invariably protected and exploited on a secret know-how basis **Glasgow** is also guided by the academic's preference, as is **Liverpool**, generally At present, this is what happens at **York** in practice, but this has not been established as a routine concession

Bristol is a little more directive in this matter, coaxing inventors away from what it regards as onerous secret know-how arrangements and towards patenting by dint of reference to Senate guidelines and referral to the Dean, if necessary. However, **Bristol** would be unlikely to patent a discovery unless the inventor agreed **Durham** is probably the least flexible of these universities, though it remains to be seen how **Kent** will now handle this

(iv) Summary

When it comes to determining whether and how inventions/designs are protected, the nine participating universities fall once again into three rough groupings Academics in **City** have the legal right to determine how their IP is protected They can exercise this right, provided their views do not conflict with their university's, equally, they can prevent the IP specified from being protected in a way which they do not want, they may find the management being fairly persuasive on occasion.

Academics at **Strathclyde, Glasgow, Liverpool, Bristol** and **Hull** have no such right They are dependent on concessions which are not formally articulated anywhere In other words, they are dependent on the university's goodwill, on it maintaining the stance that it will protect inventions/designs in the manner preferred by the academic In practice, a similar situation obtains at **York,** though this has not been established as a routine concession

Academics at **Kent** and **Durham** have neither the legal right nor the assurance of concessions In these universities, it is the administrator responsible for IP who reserves the right to decide how protect IP. It is difficult to gauge how flexible either is prepared to be on an *ad hoc* basis

(e) Can academics embark on the process of identifying, contacting and negotiating with potential licensees/assignees on their own initiative?

(i) Background

Whether by dint of relying on UK intellectual property law or on domestic

regulations/agreements, the nine participating universities all require members of staff to notify them if they generate inventions - and in the majority of cases, other tangible forms of IP, too Few regard this as the end of the obligation for the member of staff In eight of the nine universities it is just the beginning, for it is obligatory for members of staff to co-operate with the IL office/administrator responsible for IP when it comes to exploiting their discoveries. This is not actually stated in writing in every one of the eight, but where inventions are concerned, it is certainly in keeping with the provisions of the 1977 Patent Act

(ii) Rights

Inventors at City are also obliged by domestic regulations/agreements to co-operate with the administrator responsible for IP, despite jointly owning their IP. At first sight, it might seem as though these domestic regulations/agreements could infringe the rights conferred upon them by joint ownership; only an IP expert could deduce whether that was, in fact, the case [27] In practice, since academics have the right to embark on all three stages of the exploitation process independently but cannot sign an agreement without the co-signature of their university, the question is probably of no more than academic interest.

(iii) Concessions

While Strathclyde certainly encourages academics to contribute to the process of exploiting their discoveries, it does not oblige them to do so through the IL office Strathclyde alone allows its IL office to be used on a purely voluntary basis - as a matter of policy Once academics have notified the IL office of their potentially exploitable discovery, they have the right to embark on the process of identifying, contacting and negotiating with potential licensees/assignees entirely on their own initiative. They need not make contact again until they are ready for contracts to be signed. Only the IL office

has the authority to sign such contracts on behalf of the university, but it claims to accept as a *fait accompli* whatever an academic has managed to negotiate This policy is not stated in writing anywhere, but is conveyed by word of mouth to academics who make contact with the IL office

Although the other eight universities oblige academics to co-operate with the IL office/administrator responsible for IP when it comes to exploiting their discoveries, they do not all see their role in the same light. **Bristol, Glasgow, Hull, Kent, Liverpool** and **York** believe they should assume a purely facilitative role, whereas **Durham** believes it should adopt a fairly directive role **City** sees its role as lying somewhere between these two modes However, the concessions which each university makes to academics when it comes to the process of identifying, contacting and negotiating with potential licensees/assignees are surprisingly different and could not be predicted by the role which they claim to play

Identifying Potential Licensees/Assignees

All of the participating universities look to the academics who generated the IP in question to identify a pool of potential licensees/assignees In **Durham** this pool is likely to consist exclusively of candidates suggested by the academics. Now that the administration is responsible for IP, this will probably be the case at **Kent**, too, although the administration seems likely to add the BTG to the pool of candidates suggested by academics. **Glasgow** and **Bristol** tend to rely exclusively on candidates identified by academics in the fields of veterinary science/medicine and engineering respectively

In other fields, **Glasgow** and **Bristol** are likely to treat the candidates suggested by academics as the first pool in which to fish for a licensee/ assignee They will move onto

another pool only if the first does not yield a catch. The second pool will consist of candidates identified by the IL office through judicious use of in-house contacts/ databases A third pool of candidates might be constructed from published directories, public sector agencies and so on This is also how **Kent** operated before the administration assumed responsibility for IP It is how **Strathclyde** operates, too, if academics choose to involve the IL office.

In **City, Hull, Liverpool** and **York,** the pool of candidates suggested by the academics is liable to be augmented from the beginning At **City,** potential licensees/assignees are identified collectively by the research team, the Vice-Chancellor, the Secretary, the Director of Finance - and possibly an "*uncle*". At **Liverpool,** the IL office uses its own database of companies with which the university has had contact and local databases supplied by the innovation centre to add to the pool of candidates suggested by the academic **York** operates on a similar basis, using an in-house database which it constructed to solicit membership of its Enterprise Club. **Hull** generally uses extensive knowledge of the market to expand from the beginning the pool of candidates suggested by the academics

However the pool of candidates is identified, in some cases they are ranked by order of priority and approached in sequence, in others, several candidates may be approached simultaneously. This usually appears to be an *ad hoc* decision

Contacting Potential Licensees/Assignees

In **Bristol, Durham, Glasgow** and **Liverpool,** academics are free to make the initial contact with potential licensees/assignees, usually armed with a confidentiality agreement Academics at **Kent** were also free to operate in this way in the past, it remains to be seen

what will happen now that the administration is in charge of IP. As indicated, academics at **Strathclyde** are free to make the initial contact with potential licensees/assignees, but if they choose to involve the IL office, the IP officer likes to do so himself, to ensure that discussions take place within a proper framework

In **City** and **Hull**, the initial contact tends to be made by both the academic and the Secretary/ILO, with the academic in a subsidiary, advisory capacity at **Hull**, but an equal partner at **City** Only **York** is against the idea of the academic making the initial contact, seeing this as falling within the remit of the IL office itself.

Negotiating with Potential Licensees/Assignees

Once one or more candidates have expressed interest in being assigned/granted a license to use the IP in question, it is necessary to negotiate the terms of the deal(s) In **Durham** and **Hull**, negotiations are conducted by the administrator responsible for IP and the ILO respectively, usually alone If the academic is invited to attend, it is only for the purpose of providing the requisite technical support This is also the role of academics at **Bristol**, **Glasgow** and **Liverpool**, but at these universities they are invariably invited to attend

In **City**, the university management and academics participate in the negotiations as equal partners - as befits joint owners This approximates to the situation in **Kent** in the past, even though academics there were not joint owners; it remains to be seen what will happen in future

It is only in **York** - and, of course, **Strathclyde** - that academics are free to conduct negotiations themselves, if they choose to, without a representative of the university participating In due course, **York** intends to move away from this mode towards that of

Bristol, Glasgow and Liverpool

(iv) Summary

At eight of the participating universities, academics who want to assume full responsibility for identifying, contacting and negotiating with potential licensees/assignees are dependent on their employer making concessions Only one of the eight, **Strathclyde,** currently allows its academics - as a matter of policy - to embark independently on all three stages of the exploitation process. In the other seven, academics are prevented from assuming full responsibility for at least one of the three stages In none of these eight universities - not even **Strathclyde** - are these concessions formally articulated anywhere This means that academics are dependent on the university's goodwill, on it continuing to allow them to assume full responsibility for the part(s) of the exploitation process indicated

Academics at **City** alone have the legal right to embark on all three stages of the exploitation process irrespective of the form of IP concerned, accordingly, academics at City are equal partners in all three stages

(f) Are academics allowed to start and run businesses, while retaining their academic status?

In principle, all nine participating universities allow academics to start and run businesses, while retaining their academic status However, in eight of the participating universities, this kind of entrepreneurial activity is treated on the same basis as "outside work"; consequently, academics are expected to formally seek permission from the relevant authorities [28]. The only exception to this is **Kent,** which does not require academics to seek permission to start or run a business At seven of the other eight universities, the

requirement that would-be academic entrepreneurs formally seek permission is not explicitly articulated in the current documentation relating to outside work; it is only at Hull that this is stated explicitly - and that has only been the case since June 1990 [29]. This requirement is implicit in the documentation relating to outside work in one or two participating universities, though. Curiously, both Glasgow and Strathclyde articulated this requirement explicitly in earlier documentation [30], but have since removed the relevant clauses.

In practice, academics are given permission to start and run businesses providing they continue to fulfil their primary academic commitments In Glasgow, permission is generally given for an initial three-year period, after which the situation is reviewed In one or two universities, most notably City, academics involved in the line management of a "hard" company would eventually be expected to make a choice between academia and business

(g) Can academics determine who is allowed to commercially exploit the IP they generate?

(i) Background

This question is concerned as much with types of commercial exploiters of IP as much as with specific examples of those types. IP can be licensed/assigned to companies or to enterprises with a different legal status Where companies are concerned, IP can be licensed/assigned to existing companies or to start-up companies Existing companies may be small or large, privately-owned or publicly quoted, free-standing or subsidiaries of a conglomerate Start-up companies may be founded by the university itself, by the university in a joint venture with one or more third parties, by the university in a joint

venture with academics and possibly one or more third parties, by a third party/parties alone - or by academics, independently. In theory, all these types of company may be located in the UK or overseas, but UK universities were authorised to assume responsibility for exploiting IP on the basis that they did so in a manner which benefitted the UK economy, universities wishing to export IP are not prevented from doing so, but are advised to contact the DTI first.

Use of IP may also be granted to organisations which do not have company status, such as institutes/centres/units which function as the commercial arm of individual departments or groups of departments, or perhaps certain external organisations

(ii) Rights

In the UK the right to determine who is allowed to commercially exploit IP is also a function of owning the IP in question Since none of the nine participating universities yields all its rights - with two minor exceptions detailed in section 7 2 (a)(iii) - academics in these universities do not have the exclusive legal right to determine who is allowed to commercially exploit IP they have generated Academics will get that right only if their university decides to assign them its rights As indicated above, this will usually happen only if the university comes to believe that the IP in question is not likely to yield a worthwhile return commercially or cannot find an industrial/commercial partner, in some universities, this could take years, rather than months

As we have seen, City has chosen to partially relinquish its rights to all forms of IP Academics there have the legal right, therefore - shared with their institution - to determine who is allowed to commercially exploit the forms of IP specified Joint ownership means, of course, that the two parties must agree on this, if any progress is to

be made City has fairly defined views on what types of organisation should and should not be allowed to commercially exploit its IP. it prefers to license/assign to existing companies or to assign to the BTG In general, City would be unlikely to consider any entrepreneurial arrangement - be it campus company, joint venture, academic spin-off company or third party start-up - which looked likely to generate a profit of less than £100,000 p.a within 4/5 years Moreover, City believes in *"horses for courses" - ie.* companies set up to exploit specific opportunities, rather than an umbrella company which adds to its portfolio each new IP opportunity as it arises. City would not let an institute/centre/unit functioning as the commercial arm of a department or group of departments become the vehicle for exploiting "hard" IP, either. At City the Vice-Chancellor has to approve all such deals before they are signed. These preferences may well prevent academics acting on entrepreneurial hunches which look as though they will not generate the minimum required profit in the short-term, even though they jointly own the IP

(iii) Concessions

The other eight universities also have views about which types of organisation should or should not be granted use of IP generated by members of the academic staff As **Figure 14** shows, these views differ somewhat Only **York** seems happy to allow institutes/centres/units functioning as the commercial arm of individual Departments or groups of Departments exploit "hard" IP themselves - though **Kent** might have allowed this in the past, had the situation arisen Attitudes to assigning IP to the BTG to exploit also differ, as described in section 7 2 (b) above

Similarly, attitudes to more entrepreneurial ways of exploiting IP differ. In principle, **York** has no problem about the idea of licensing IP to independent academic spin-off

companies, even if they are managed by the academic concerned; **Bristol** and **Kent** are beginning to consider this as an option **Hull** is prepared to license spin-off companies founded by academics to exploit their research discoveries if it has faith in the academics concerned. **Liverpool** is considerably more reluctant to do so, and **Durham** has only done so once. **Strathclyde** will license an academic spin-off company only if it is managed by an experienced entrepreneur, not by the academic. **Glasgow** will not license an independent academic spin-off company to exploit "hard" IP, no matter how it is managed

Attitudes to joint ventures with members of the academic staff differ, too. **Strathclyde, York** and **Glasgow** are in favour of the idea of this kind of joint venture, and all three have put this policy into practice not just once but several times. **Strathclyde** and **Glasgow** will only license a joint venture managed by an experienced entrepreneur, however, not one managed by an academic; **Hull** and **Kent** have both set up their first joint ventures, as has **Liverpool. Bristol** has not yet done so, though it is open to the idea in principle **Durham** has not ruled out the idea of exploiting IP via a joint venture, but is not particularly enthusiastic about it

Strathclyde has no interest in setting up a campus company in which the academic has no involvement beyond a technical, consultancy-based input. **Durham** is not in favour of campus companies, either, it wound up its holding company during 1990 without any subsidiaries having been formed. In the same year **Liverpool** wound up ULTRA, which was intended to function as a holding company but ended up more like an umbrella company, adding new IP opportunities to its portfolio as they arose, **Liverpool** is now prepared to consider setting up campus companies on a "*horses for courses*" basis, but this is by no means its preferred way of operating This is how **Hull** has been operating for

some time, but it still uses the mechanism of a holding company. **Glasgow** would be prepared to set up a campus company if the right opportunity presented itself. **Bristol** is only now moving towards setting up subsidiaries of its holding company. Of the six, **York** has the most positive attitude towards campus companies **Kent** has yet to come to a decision about the value of campus companies.

With two exceptions, these six universities regard existing companies as the most appropriate type of licensee - or, in some cases, assignee Only **Strathclyde** and **Kent** claim to be open-minded, preferring to let the technology and - in **Strathclyde's** case - the academics involved determine the choice Several of the participating universities prefer licensing/assigning to large rather than small companies. Indeed, if there were a choice between an academic spin-off company and an existing company, **Durham** would choose the existing company every time Likewise, if there were a choice between a large and a small existing company, it would almost certainly choose the large company. None of the other universities expressed their preferences quite so unequivocally, but most seem loathe to countenance routine concessions about the type of organisation which is allowed to commercially exploit their IP, let alone specific licensees/assignees

Only **Strathclyde** has been prepared, as a matter of policy, to make this concession to academics As indicated, **Strathclyde** allows use of its IL office on a purely voluntary basis. The IL office claims to accept as a *fait accompli* not only the terms which an academic has managed to negotiate, but also the choice of licensee/assignee It could be a start-up company - be it a third party start-up or a spin-off company - as long as it is managed by an experienced entrepreneur, not by the academic

(iv) Summary

Only at **City** do academics have the legal right to co-determine who is allowed to commercially exploit all forms of IP. Only **Strathclyde** makes a routine concession to academics as a matter of policy - albeit with one restriction In practice, by virtue of being free at the moment to conduct negotiations themselves if they choose to, without another representative of the university participating, academics at **York** can determine both the type of licensee/assignee and the specific example of that type However, this is not a routine concession - rather a temporary state of affairs, pending the ILO acquiring the skills he feels he needs to conduct license negotiations

In all the other participating universities, academics would have to lobby for their choice on a case-by-case basis against a background of positive and negative preferences, of which they may not initially be aware There is considerable variation in universities' preferences. In the absence of the routine concession enjoyed by academics at **Strathclyde, York** and **Kent** are probably least restrictive about the type of organisation which may commercially exploit their IP **Durham** and **Glasgow** are probably the most restrictive

(h) Can academics determine the terms on which commercial exploitation of the IP in question is allowed?

(i) Background

This question is concerned with the terms on which IP is assigned/licensed, it focusses on exclusivity and conditions

Assigning IP automatically gives complete exclusivity However, licenses can be exclusive, sole or non-exclusive. The degree of exclusivity can vary they can relate to

one or more designated market sectors (*eg* leisure, but not health), or be global, they can relate to one or more designated geographic areas (*eg* the UK and Europe) or be world-wide, they can also be for a limited period of time The analysis which follows will focus chiefly on licenses, since the attitude of the participating universities to assigning has already been discussed.

IP can be licensed - or assigned - unconditionally or conditionally It can, for instance, be assigned on the basis that products incorporating the technology are brought to market (or to specific markets) within an agreed time-scale, and/or that they meet a fixed sales target within an agreed time-scale - or ownership reverts to the original owner(s) Licenses can incorporate similar conditions which, if they are not fulfilled, allow the owner(s) to withdraw the license These conditions are designed to prevent a licensee/assignee from suppressing or squandering the technology involved IP can also be licensed/assigned in a way which permits specific uses but prohibits others, for example, uses which benefit mankind (*eg* medicines), as opposed to those which endanger it (*eg*. chemical warfare) The analysis which follows will focus on exclusivity, since other conditions tend to be dictated more by the IP in question than by principle

Companies will usually try to secure for themselves as much exclusivity as they need in order to prevent or minimise competition This may be done as a matter of standard business practice, or it may be motivated by a genuine concern about the company's ability to recoup the costs of developing, manufacturing and marketing products incorporating the IP in question

Owner(s) of IP may have several reasons for denying exclusivity or minimising the degree of exclusivity granted There may be concern that no matter how detailed and well-written

the conditions (the "ride-in" rights) are, in practice exclusivity may allow the technology to be suppressed or squandered. Exclusivity also entails considerable risk, whereas non-exclusive arrangements could spread that risk. When the owner of the IP is a university, there may also be a moral concern where discoveries arising out of Research Council-funded projects are involved. preventing a private, monopoly gain being made from a discovery which was publicly funded The academic who generated the IP may also be concerned about the use to which it could be put As chapter 2 showed, this is by no means an exhaustive list of potential concerns.

(ii) Rights

In the UK the right to determine the terms on which commercial exploitation of IP is allowed is also a function of owning the IP in question Once again, since none of the nine participating universities immediately yields all its rights, with the two minor exceptions detailed in section 7 2 (a)(iii) above, academics in these universities do not have the exclusive legal right to determine the terms on which their IP is licensed/assigned Academics will get that right only if their university later decides to assign its rights in their favour.

As will by now be clear, however, academics at City alone have the legal right - shared with their institution - to determine the terms on *which all forms of IP are* licensed/assigned. Joint ownership means, of course, that the two parties must agree on those terms, if any progress is to be made. Where third parties are concerned, City prefers in principle to grant non-exclusive licenses, but is prepared to grant licenses with some degree of exclusivity [31] in certain circumstances [32], it expects a higher return in exchange for this concession.

(iii) Concessions

Six of the other eight universities also prefer in principle to grant non-exclusive licenses where third parties are concerned, but differ in their determination to adhere to that principle. **Durham** does not have particularly strong feelings about exclusivity, which is logical, given its attitude towards assigning **Hull** and **York** regard exclusivity/degrees of exclusivity as something they are prepared to grant - for a much higher return **Liverpool** tries not to grant exclusive licenses but is prepared to grant exclusivity/some degree of exclusivity if it is necessary to conclude a deal [33]; this seems curious, given its attitude to assigning **Glasgow** also tries to adhere to the principle, having had its fingers burned over this question [34]. Only **Kent** purports to adhere totally to the principle, the administrator recently made responsible for IP is very much against the idea of granting exclusive licenses, but it remains to be seen whether policy and practice will coincide

The other two universities do not have in-principle preferences **Bristol** tends to make an *ad hoc* decision, taking account of the likely risk, return and amount of effort required to negotiate more than one license deal. **Strathclyde** lets the technology dictate the type of license - if the university is involved in the negotiations Like **Hull** and **York, Strathclyde** regards exclusivity/degrees of exclusivity as something it is prepared to grant - if a very much higher return makes it worthwhile However, the university may not be involved in the negotiations.

By virtue of allowing use of its IL office on a purely voluntary basis, **Strathclyde** is the only participating university which routinely gives academics the concession of determining the type of license granted to a third party and the conditions attached In practice, by virtue of being free at the moment to conduct negotiations themselves if they choose to, without another representative of the university participating, academics at

York can also determine the type of license granted to a third party and the conditions attached However, this is not an in-principle concession but a temporary state of affairs, pending the ILO acquiring the skills he feels he needs to conduct license negotiations Like the other five universities, **York** seems loathe to countenance concessions when it comes to determining the type of license granted to third parties to exploit university-owned IP or the conditions attached to it

(iv) Summary

Only at **City** do academics have the legal right - shared with their university - to determine the terms on which commercial exploitation of all forms of IP is allowed Only **Strathclyde** makes a routine concession to academics as a matter of policy In practice, by virtue of being free at the moment to conduct negotiations themselves if they choose to without a representative of the university participating, academics at **York** can determine the terms on which their IP is licensed/assigned, again, this is not a concession but a temporary state of affairs, pending the ILO acquiring the skills he feels he needs to conduct license negotiations.

At **Bristol, Durham, Liverpool, Glasgow, Kent** and **Hull** academics could find themselves at odds with an in-principle or an *ad hoc* preference which they were not initially aware of - all the more so if there has been a recent change in responsibility for IP, as there has been at **Kent** It may be extremely difficult for academics at **Kent** to get the university to grant a license with any degree of exclusivity - far more so than at **Durham** *or* ***Liverpool***

(j) Can academics determine the return required in exchange for the right to commercially exploit that IP?

(i) Background

This question is concerned with the return required in exchange for the right to commercially exploit IP [39]; it focusses on the type of return, the level of that return, the time-scale within which that return is expected - and its certainty

IP can yield various types of return At the simplest level, we might categorise these as financial or non-financial - or a combination of both. Discriminating further, we might categorise a financial return as direct or indirect. A direct financial return would commonly entail the licensee/assignee making an upfront payment and/or royalties based on a percentage of sales, often with agreed sales targets built in An indirect financial return could involve all manner of arrangements, from supporting research students/staff or lecturers or perhaps endowing a new professorial Chair, to paying for new equipment/books or even endowing a new laboratory/library It could also take the form of the licensee/assignee paying for follow-on research or perhaps offering the university and/or the academic concerned equity in the company at a preferential rate - or even giving it outright A non-financial - or not purely financial - return might entail offering the academic concerned a directorship, appointing him as scientific advisor or perhaps seconding him to the exploiting company on a temporary basis. Other non-financial returns might include kudos for contributing to local economic development, gaining new insights into future research and how to update teaching programmes. This is by no means an exhaustive list

Each of these types can yield a high, medium or low level of return. This is easiest to quantify in the case of a direct financial return, where it can be measured in terms of the

percentage on sales which determines the royalty payments, the amount of any up-front payment *etc.* The level is perhaps less easy to quantify in the case of an indirect financial return and most difficult - if not impossible - to quantify in the case of a non-financial return In any case, the task may be complicated by questions of time-scale. Up-front payments are clearly more immediate forms of return than royalty payments and considerably more immediate than an equity stake, moreover, royalty payments can be structured to yield a higher percentage return on early sales than subsequent sales - or *vice versa*. Support for research students/staff or lecturers, endowment of a new Chair, substantial assistance for new equipment/laboratories/books and funding for follow-on research may also be more immediate forms of return than royalty payments or an equity stake. Moreover, many of these forms of return are more certain than the return yielded by royalty payments or an equity stake

From the **assignee/licensee's** perspective, it is often preferable to negotiate a return which is delayed for as long as possible - and as uncertain as possible Again, this may be done as a matter of standard business practice, or it may be motivated by a genuine concern about the company's ability to recoup the costs of developing, manufacturing and marketing products incorporating the IP in question. In the case of start-up companies, this is liable to be a particularly pressing concern. From the assignee/licensee's perspective, it may also be less expensive and more beneficial to its long-term interests to make an indirect financial return, at least in part

A **university's** perspective may be quite different On the grounds of accountability, universities may feel they need to demonstrate a reasonable level of return - especially where IP arising out of publicly-funded projects is concerned This may dispose them towards a direct financial return rather than a less easily quantifiable type of return.

Moreover, universities may prefer a quick, certain return in the shape of agreed up-front payments, at the expense of possibly greater returns over a longer period [36]. Furthermore, the focus of the various types of return differs considerably. In some of the above examples, the return would come to the centre, which would be obliged to distribute part of it to the academics in question as a personal benefit; it might not, however, be obliged to distribute any of it to the department from which the IP sprang In other examples, the return would go to the faculty, the department, the research team concerned or even an individual academic - or a combination of these, with the centre receiving at best an overhead. Clearly, each of these groups could have different preferences - either in general or relative to a specific piece of IP Indeed, as chapter 2 indicated, there may be cases when, for one reason or another, academics are against the idea of demanding any financial return at all, direct or indirect

The situation becomes even more complex when academics wish companies which they have founded/co-founded to acquire the right to exploit IP they have generated This is particularly so in the case of independent academic spin-off companies in which the university has no stake. Here, there is clearly potential for a conflict between the interests of the academic *qua* academic, member of a certain department in a certain university, and the interests of the academic *qua* would-be entrepreneur [37]. Even in the case of joint ventures with the university, the dynamics of the situation are still fairly complex.

(ii) Rights

The right to determine the type, level and certainty of the return on a piece of IP - and the time-scale within which that is achieved - is also a function of owning it. Once again, since none of the nine participating universities immediately yields <u>all</u> its rights, with the two minor exceptions detailed in section 7 2 (a)(iii) above, academics in these universities

do not have an exclusive legal right to determine all these aspects of the return on IP they have generated They will get that right only if their university eventually decides to assign its rights.

Academics at City alone have the legal right - shared with their institution - to determine all these aspects for all forms of IP. Joint ownership means, of course, that the two parties must reach agreement, if any progress is to be made City does not have a firm, detailed policy governing so complex an issue However, it is prepared to accept an indirect financial return - and possibly even a non-financial return City's Code of Practice commits it to taking the course of action which is "*most likely to be profitable for a particular discovery*". However, "*profitable*" is not interpreted in a purely financial sense; City would consider whether an agreement offering a solid financial return might be detrimental academically. It would take into account both the academic plan and the institutional plan City is also prepared to postpone getting a return on its IP - thereby taking a risk. It is prepared to accept/take an equity stake in a start-up company exploiting its IP, in lieu of a conventional up-front payment, later it would receive dividends and, hopefully, a profit from the sale of its shares, rather than a conventional royalty stream

(iii) Concessions

None of the other eight universities has a firm, detailed policy governing so complex an issue, either However, it is possible to discern differences in their general approach, in so far as they have one **Bristol, Durham** and **Hull** definitely do **Bristol's** approach to each individual case is coloured by the overall state of its IP portfolio at any given time Academics may state their preferences but it is the ILO who determines the return **Bristol** feels that at the moment it needs a preponderance of agreements yielding a direct, certain and fairly immediate financial return - and relatively few agreements where the return is

more long-term or speculative This means it tends to go for more conventional arrangements with a guaranteed minimum in the first few years and all ongoing patenting costs covered. In time, as this policy pays off, **Bristol** will be more open to a return on its IP which is less immediate, less certain - but possibly greater in the long term. In time, too, **Bristol** may also be more open to a less direct, less quantifiable return on its IP, at part of the deal, at least. **Durham** also prefers a direct, certain and immediate return on its IP, particularly where inventions are concerned. It believes that the chances of a patent yielding any further return are negligible. Accordingly, **Durham** prefers to receive an immediate £5,000 in exchange for the right to patent a discovery; it accepts royalties based on a lower percentage of sales than it might otherwise get and it regards these as the icing on the cake if they actually materialise Academics seem to have little or no say in this process **Durham** appears to take their wishes into account only in so far as agreements commonly incorporate follow-on research funding for the team concerned, though this is more likely to be for development than new research **Hull** has adopted what it describes as a "*low risk, low reward*" philosophy, preferring to go for an immediate, direct financial return in the shape of up-front payments, at the expense of lower or even zero royalties in years to come, **Hull** prefers certainty to uncertainty Agreements may incorporate an indirect financial return in the shape of follow-on research funding, particularly development funding, which also gives a guaranteed and immediate return

Glasgow has a fairly flexible approach to the return which it gets on its IP; provided that a part of it, at least, takes the form of a direct, financial return from which the centre is able to benefit, **Glasgow** is open to the idea of arrangements which might also incorporate a less certain and/or less immediate financial return, an indirect financial return, or even a non-financial return

Liverpool is committed to getting the "*best*" return that it can on its IP, but takes several factors into account when determining what that might mean in any given situation Although academics have no formal say in the type of return the university gets on their IP, the level of that return, the time-scale within which that return is expected or the certainty, the IL office is concerned that they should be happy with the arrangements it makes **Liverpool** is also committed to making a contribution to local economic development, so this might play a part in its decision It is concerned, though, that the university is not put at risk. In practice, this seems to mean that **Liverpool** is open to arrangements incorporating some less conventional types of return, but is chary of others At least one deal has included the inventor being given a directorship in the company exploiting his IP, for instance Another has included the inventor receiving an equity stake in the company exploiting his IP; **Liverpool** saw this as a handy way to keep track of its IP On the other hand, if the **university** had been offered an equity stake, it might have rejected it because of a perceived risk

Neither **York** nor **Kent** has worked out a general approach, due to lack of experience [38], in both, judgements are made entirely on a case-by-case basis. Agreements concluded to date at **Kent** suggest that it is open to taking equity in a start-up company in lieu of a direct, up-front payment, though it may still look for a direct return in the shape of royalties in years to come It is also clear that **Kent** tries to incorporate into its agreements follow-on research funding for the team concerned, though this is more likely to be for development rather than new research. There is some evidence that in the past, academics might have been allowed to negotiate the return on their IP, but this was certainly not a matter of policy; it is not clear how much say academics will have, now that the administration is responsible for IP Judging by its (more numerous) agreements, **York**, too, is flexible about the type of return it gets on its IP, the level of that return, the time

-scale within which that return is expected - and its certainty Agreements have included an equity stake in *lieu* of up-front payments, and, in one instance, support for an additional lecturer in the relevant department In the past, many of these agreements were concluded by the academics involved, rather than the centre. Today, they are still free to conclude arrangements with third parties if they choose to, without a representative of the university participating - although they would be expected to report their progress to the university This is not a routine concession but a temporary state of affairs, pending the ILO acquiring the skills he feels he needs to conduct license negotiations.

Only **Strathclyde** has been prepared, as a matter of policy, to give a routine concession to academics As indicated, **Strathclyde** allows use of its IL office on a purely voluntary basis. The IL office claims to accept as a *fait accompli* not only the academic's choice of licensee/assignee and the conditions attached to the agreement, but also the type of return, the level of that return, the time-scale within which that return is expected - and its certainty. If academics choose to involve the IL office, they still have a considerable say - possibly the say - in the return which is required from a third party in exchange for the right to commercially exploit the IP which they have generated

(iv) Summary

Only at **City** do academics have the legal right - shared with their university - to determine the type of return on their IP, the level of that return, the time-scale within which that return is expected - and the certainty. Only **Strathclyde** makes this concession to academics as a matter of policy. In practice, by virtue of being free at the moment to conduct negotiations themselves if they choose to, without a representative of the university participating, academics at **York** can determine the return on their IP, again, this is not a concession but a temporary state of affairs, pending the ILO acquiring the

skills he feels he needs to conduct license negotiations

7.3 Evaluating the Findings

It was the aim of this chapter to establish objectively whether the nine participating universities give their academic staff the fullest opportunity and scope to assume responsibility for the exploitation of the IP they generate Section 7 2 has shown discursively - and **Figures 8-16** summarise diagramatically - that the policies of the nine participating universities in respect of questions (a)-(j) differ considerably It is evident that none of these institutions give members of the academic staff the fullest opportunity and scope to assume responsibility for the exploitation of the IP they generate, as defined in section 7 1. Academics do not, as a matter of policy, immediately acquire sole ownership of the IP they generate in the course of their duties Nor is there a single example of academics immediately, as a matter of policy, acquiring joint ownership of the IP they generate and being able to unconditionally answer questions (c)-(j) affirmatively However, **Strathclyde** comes very close to fulfilling the third test with one minor caveat, academics there can unconditionally answer questions (c) to (j) affirmatively, even though they do not own/jointly own the IP they generate. Once they have notified the IL office of their discovery, they are free, as a matter of policy, to assume responsibility for every single stage of the exploitation process, except signing the contract between the university and the licensee/assignee Indeed, they are largely free to do this even if they choose to involve the IL office There is only one stricture imposed on them. if they wish to found a company to exploit the IP in question themselves, it must be managed by a professional with a track record At present, **York** comes very close to fulfilling the third test, too Academics there are free at the moment to assume responsibility for every stage of the exploitation process except making the initial contact with potential licensees/assignees However, this is a matter of current practice, rather than policy, and if the present ILO

has his way, it will not be a permanent arrangement, he intends to take control of more stages of the exploitation process in due course

The other seven universities cannot unconditionally answer question (a) or questions (b) and/or (c)-(j) affirmatively However, it is evident that academics in some of these institutions are given considerably more scope and opportunity than their colleagues in other institutions. Because joint ownership of IP confers rights on academics - yet they cannot fully exercise those rights unless their university concurs with their approach, it proved impossible to devise the kind of objective scoring system which is employed in chapters 8 and 9. Accordingly, it was not possible to rank the remaining seven universities quite as objectively as had been hoped at the outset However, judging by the number of negative answers to these questions, **Durham** and **Bristol** seem to occupy the other end of the spectrum from **Strathclyde** and **York** Both reserve the right to carry out/dictate the outcome of most stages of the exploitation process - and routinely exercise that right Academics at **Bristol** may determine whether or not their invention is patented and which companies should be included in the first "pool" of potential licensees/assignees, they may also make the first approach to these companies - but that is all. Academics at **Durham** may only decide on the composition of the "pool" of potential licensees/assignees and make the initial contact with them All the other procedures and decisions are taken out of their hands

Four of the remaining five universities cluster around the middle of the spectrum **City** is probably closest to **Strathclyde** and **York** Academics there have the legal right to participate as equal partners in every stage of the exploitation process, for every form of IP They could probably answer questions (c)-(j) affirmatively - but conditionally. Joint ownership means that both parties must agree on how to proceed at every stage, or the IP

is unlikely to be exploited at all As we have seen, when it comes to choosing licensees/assignees, **City** has fairly strong preferences about which sorts of company which are acceptable and which are not. Those preferences may well prevent academics from acting on entrepreneurial hunches which look as though they will not generate the minimum required profit in the short-term

Academics at **Liverpool** and **Glasgow** could answer many but not all of questions (c)-(j) affirmatively. Both institutions conduct negotiations with potential licensees/assignees themselves, with academics playing a subordinate role providing technical support Both institutions have fairly strong preferences about which sorts of company which are acceptable and which are not **Liverpool** is chary of university companies, joint ventures with members of staff and independent academic spin-off companies, though it would not rule out any of them if the circumstances seemed propitious **Glasgow** will not consider licensing IP to an independent academic spin-off company, even if it is managed by a professional with a track record.

Academics at **Hull** would be obliged to answer several of questions (c)-(j) negatively Whilst **Hull** is generally content to let academics decide whether to retain ownership or assign it, and how their inventions/designs should be protected, they play an increasingly subordinate role in later stages of the exploitation process They are usually excluded altogether from the negotiation process If their views do not coincide with the university's, they may not get the outcome they want **Hull** is fairly amenable about the type of licensee/assignee chosen and the conditions, but less amenable about the return it requires in exchange for licensing/assigning IP

It is difficult to locate **Kent** on this spectrum at the time the fieldwork was carried out. The administrator who recently assumed responsibility for IP has had insufficient time, experience - and possibly interest - to have thought this through coherently. It is possible, though, to rank the other eight universities in terms of the extent to which they currently give members of their academic staff opportunity and scope to assume responsibility for the exploitation of the IP they generate. Judged by the number of stages in the exploitation process which academics can carry out or where they can dictate the outcome, these eight universities should be ranked in the following descending order

1 **Strathclyde, York**

3 **City**

4 **Glasgow, Liverpool**

6 **Hull**

7 **Bristol**

8 **Durham**

So far in this evaluation, the same weight has tacitly been attached to every procedure/decision encompassed by questions (c)-(j) It may be misleading, of course, to evaluate the extent to which the participating universities give their academic staff opportunity and scope to exploit the IP they generate on this basis The ability to assume responsibility for some procedures/decisions may carry more weight with academics than others There is little doubt that this is a highly individual matter This consideration raises an important question for this study is it possible to evaluate the extent to which the participating universities give academics opportunity and scope to assume responsibility for the exploitation of their IP in a way which takes some account of the relative weight of the different procedures/decisions? The short answer to this is probably - no, not without surveying a large sample of IP-creating academics and controlling for variables like institution, institutional type, discipline, work experience,

status, age, career objectives *etc* This would probably be an interesting and worthwhile exercise, if one could overcome the obvious difficulties entailed [39]. Without such survey results, any attempt to weight the decisions/procedures encompassed by questions (c)-(j) would be purely speculative We are left, therefore, with the rank order listed above

7.4 Discussion

(i) Introduction

It was emphasised at the end of chapter 1 that it is a general objective of this study not simply to establish the **facts** of a situation, but to explore the **processes** which led to that state of affairs. As we have seen, two or three of the participating universities seem to give their academics what is tantamount/close to the fullest opportunity and scope to assume responsibility for the exploitation of their IP, if they wish to; two or three apparently give them very little/virtually no scope at all, the others let their academics assume responsibility for certain decisions/procedures, but not others A number of questions spring to mind immediately. Are these differences the result of policy decisions taken advisedly, influenced perhaps by objective constraints or critical incidents? Or have policy-makers devoted insufficient attention to this aspect of their IP policy - or no attention at all? Alternatively, perhaps, have policy-makers not thought through the implications for the implementation of their policy clearly enough? Or have they failed to convey their conclusions to their policy-implementers with sufficient force and clarity? Or are policy-implementers simply ignoring their university's guidelines in this respect?

Answering these questions with any degree of certainty is fraught with difficulties. Most of these might be described as operational, from the perspective of this study, though some undoubtedly reflect on the state of affairs within at least some of the participating

universities, too Many of these difficulties stem from the concept "policy-maker", employed so logically and unquestioningly in the preceding paragraph There is at least one sound reason for employing it in this manner· the ESG made it clear that universities authorised by the Research Councils were expected to monitor the fruit of their labours and, in the light of experience, to request the ESG's permission to amend the policies their institution had contracted to observe [40]. Underlying the ESG's explicit requirement in this respect was surely the assumption that each university had an individual policy-maker/a group of policy-makers with a reasonably constant/overlapping membership with responsibility for this task? In practice, policy-makers seem to come and go with surprising rapidity Voluntarily or involuntarily, several of the participating universities have had a series of policy-making groups during the 1980s - and in some cases, there has been little or no overlapping membership.

Glasgow now has a standing committee with responsibility for IP policy [41], whereas prior to 1987 policy was made by an *ad hoc* group which was not formally constituted, only one individual was a member of both groups, albeit for a short period [42] **Kent** used to have what was intended to be a standing committee, it became moribund before it formulated much IP policy to speak of It was replaced in 1988 by a standing board, several of whose members were on the old committee [43]; it, too, has yet to make a contribution to the university's IP policy. Since the early 1980s, therefore, **Kent's** IP policy, in so far as it has one, has been formulated by four separate policy-implementers in quick succession In the mid-1980s **Hull** and **York** established what were intended to be standing sub-committees, **York's** was formally wound up in 1988 due to operational difficulties, whereas **Hull's** seems to have died without benefit of funeral rites [44]. More recently, **York's** policy was formulated by an *ad hoc* group which was not formally constituted [45] and which included only one member of its earlier sub-committee **Hull's**

original policy was extended by another, formally constituted group, which also included only one member of its earlier sub-committee [46].

These four universities contrast with **City** where, since 1983 the policy-maker has been the same individual [47] - though until 1988/89, his role was to "*grow custom and practice*" rather than to formulate policy Prior to 1983, custom and practice was grown by the Vice-Chancellor and the Director of Finance, who had been in post from 1978 and 1981 respectively, providing a measure of continuity with regard to IP which is unusual in the participating universities **City** is not unlike **Strathclyde,** in the sense that there is no formally constituted policy-making group, since the early 1980s, policy seems to have been made by one individual, in the main **Strathclyde** has not had the same degree of continuity as **City,** however

Both these groups contrast with **Liverpool,** where it is extremely difficult to put one's finger on who exactly the policy-makers are; there seems to be no group formally constituted as such **Liverpool** never established a committee or a working party to formulate its IP policy; on the recommendation of the Research Committee, the Senate simply adopted the CVCP's 1978 recommendations, wholesale. In 1989/90 the senior management team seemed to assume responsibility for formulating the institution's IP policy, but it is not clear how long this had been the case or whether this was part of their formal remit or a purely informal arrangement [48] At **Bristol,** too, it is difficult to pinpoint who was formally responsible for formulating policy in 1989/90 Certain recommendations were made by formally constituted but *ad hoc* working parties in the early-mid 1980s [49], but no detailed policy seems to have been formulated, as a result, it seemed to be the policy-implementer who determined policy, to a large extent, the Vice-Chancellor, to whom he reported, may have had a hand in this, too

This turnover of policy-makers created problems when it came to eliciting all the relevant information during the course of the fieldwork. It was possible to interview the person responsible for **City's** most recent policy decisions, one of the people responsible at **Durham** [50], two at **Hull** and four at **York** **Glasgow** nominated a very senior member of the administration to detail policy; the person concerned is not a member of the policy-making committee, though he may well influence it indirectly However, the policy-implementer is also a member of the committee responsible for formulating IP policy at **Glasgow** - and was also an informant At **Strathclyde**, the university nominated the principal policy-implementer to detail policy; although the Principal appears to be chiefly responsible for policy-making at **Strathclyde**, this seems to be an ongoing process to which the principal policy-implementer also contributes in practice At **Liverpool**, too, the university nominated its policy-implementers to detail policy, one, at least, has made some contribution in the past to policy-making

At **City**, **Durham**, **Hull**, **Liverpool** and **Strathclyde** and **York**, some or all of the policy informants interviewed were actively involved in 1985, too, when Sir John Kingman's letter and the DES statement arrived, indeed, they were either identical to or a constituent part of the group responsible for drafting their institution's final response to the ESG in 1986 [51] [52] It was possible to identify and interview someone of equivalent standing at **Glasgow**, but at **Kent** this proved to be impossible At **Bristol** it proved possible to identify and interview someone involved in policy-making at the time, such as it was, but the university's response to the ESG was drafted by a separate group, whose members proved hard to track down [53].

Taking these precautions did not make it possible to elicit all the relevant information during the course of the fieldwork - or to have complete trust in all the information which

was elicited Only five of the participating universities had committed their policy to paper in any detail, **Bristol, Durham, Kent** and, apparently, **Strathclyde** have no comprehensive document, relying instead on paragraphs in this document and that, which did not combine to provide a comprehensive picture "Policy" is, of course, a relatively elastic term at the best of times, policy may be coherent and comprehensive, it may focus on a particular area, neglecting others, or it may amount to no more than a few statements of principle. The five universities with a dedicated IP policy document certainly demonstrate this elasticity; moreover, from the perspective of this study, they do not go into sufficient detail about the underlying rationale Guidelines for policy-implementers did not provide a solution to this problem, either There were, in fact, no such guidelines at **Bristol, Hull** or **Kent** Given the manner in which policy was formulated at **Bristol** and **Kent** this is not surprising, perhaps, though one might have expected each of **Kent's** outgoing policy-implementers to have provided some guidance for their successor **Hull's** explanation was that their policy-implementer took up his post with unexpected rapidity, before the university could get around to producing any guidelines None had been produced in the intervening years, though, either IP ranks very low in the university's priorities or **Hull** places sufficient trust in the policy-implementer's judgement as to obviate the need for guidelines. No other university admitted to having no documentation to guide its policy-implementers However, several indicated they were unwilling to release private material of this ilk. This absence of documentation - or sufficiently detailed documentation - created another operational difficulty, which probably reflects on the state of affairs in at least some of the participating universities, too· it was necessary to rely to a considerable extent on informants' memory When it came to eliciting "historical" information, this proved to be a questionable, though unavoidable *modus operandi*, many informants commented that 1985 was a long time ago, that a lot of water had flowed under the bridge in the meantime This was clearly an honest assessment of their ability to

remember in some cases, rather than an excuse for being evasive, sometimes informants flatly contradicted other members of the same policy-making group

Human frailty was exacerbated by the manner in which the participating universities have gone about formulating their IP policy. Some seem to have adopted what we might call a stop/go approach, formally reaching certain policy decisions in one year and revising or extending them only years later. In others, policy formulation seems to be an ongoing, incremental process - in practice, if not officially Some seem to have been doing this for years While one would commend this strategy if it yields a better IP policy, if it is not accompanied by documentation, it is very difficult - from the perspective of this study - to pinpoint when certain decisions were taken, let alone why. It may also be difficult for members of staff to get a handle on policy, if it is constantly evolving and the changes are neither documented nor explained

Universities which nominated policy-implementers to provide information on policy also make one wonder about the quality of the resulting data, particularly where the underlying rationale is concerned; the information may well be "second-hand", rather than first-hand A further difficulty attaches to universities where there was no option but to interview policy-implementers because there appear to be no official policy-makers, *viz.* **Bristol** and **Kent** it is difficult to disentangle how much is a matter of evolving policy as opposed to the way in which the policy-implementer happened to go about implementing that evolving policy

There were fewer difficulties attached to interviewing policy-implementers At **City**, **Durham**, **Hull** and **Strathclyde** the incumbent was in post by 1985, at **Liverpool** one of the current policy-implementers was in post at that time At **Bristol** and **York** a senior

member of the administration implemented the university's policy, such as it was, until 1987 and 1989 respectively, it was possible to interview the appropriate administrator at both institutions At **Glasgow**, the current policy-implementer took up his post early in 1986, which was considered to suffice. **Kent** was the only participating university to create serious difficulties in this respect, by 1989/90 **Kent** had had four different policy-implementers since 1985. It was possible to interview only two one who took up his post in mid-1987 and his successor, who assumed responsibility for IP in mid-1989.

It is worth noting, finally, that some universities appeared to participate in this study with greater enthusiasm than others. This is not entirely a subjective judgement, though it is difficult to quantify in terms of the number of people who made themselves available, the time and energy which they devoted to interviews, the speed and generosity with which they made documentation available *etc* The nine universities differ considerably in their organisational approach to IP, both historically and at the time the fieldwork was carried out, and it would be spurious to construct a "norm". Suffice it to say that **Glasgow, Hull, Liverpool** and **York** stand out from the others in this respect - indeed, **Liverpool** was anxious to obtain feedback at the end of the study In contrast, **Kent** was extremely hesitant about taking part and **Durham** agreed to do so with just a hint of reluctance or resignation.

The difficulties described should make us extremely circumspect when it comes to trying to answer the questions posed in the first paragraph Rather than draw unwarranted conclusions, it is better to accept that in some cases, this study will not be able to explain all the differences outlined in section 7 2 in terms of the processes which led to them

(ii) Ownership of IP

Sections 7.1 and 7.2 devoted considerable attention to the ownership of IP, pointing out that academics who immediately acquire sole ownership of the IP they generate should automatically have the fullest opportunity and scope to assume responsibility for the exploitation of that IP by virtue of the legal rights which ownership confers It was explained that academics could acquire sole ownership by one of two possible routes: universities could waive their rights or they could assign them With the exception of **York**, which immediately yields its rights to software with limited applications, and **City**, which does the same where designs unconnected with a patent/patent application are concerned, none of the participating universities lets academics immediately acquire sole ownership of the IP they have generated - by either route. Section 7.2 also indicated that if this criterion could not be fulfilled, joint ownership would at least confer on academics the legal right to participate as an equal in the decisions and procedures of the exploitation process. Again, universities could confer joint ownership on academics by partially waiving their rights or by assigning them into joint names In practice, only one participating university makes academics joint owners of all the IP they create; **City** appears to do this by partially waiving its rights, rather than assigning them into joint names At **Hull** and **Liverpool**, policy indicates joint ownership where inventions are concerned, but this does not happen in practice

Two key questions demand an explanation

1 why do some universities partially waive their rights to IP while others do not?

2 why do none of the participating universities immediately (but conditionally) assign ownership of all types of IP to academics wishing to assume responsibility for its exploitation?

Two related but subsidiary questions, spring to mind, too

1a why do policy-implementers at **Hull** and **Liverpool** contravene their explicit policy concerning joint ownership?

2a why do **York** and **City** immediately (and apparently unconditionally) assign ownership of certain types of IP, provided certain conditions are fulfilled?

Four of the participating universities had already made a decision about the ownership of IP some years before 1985. **Strathclyde** seems to have made up its own mind in the late 1960s/early 1970s, before any of the reports mentioned in chapter 5 were circulated **City**, **Glasgow** and **Liverpool** did so at the end of the 1970s, when they first sought to formulate an IP policy/custom and practice [54] **Glasgow** and **Liverpool** are both known to have used the CVCP's 1978 report in their deliberations Indeed, **Liverpool** adopted the report's recommendations and regulations wholesale Custom and practice at **City** certainly bore many of the hallmarks of the CVCP's report, too As described in chapter 5, this report focussed on patented/patentable IP, it advised universities that under the terms of the 1977 Patent Act, it might sometimes be difficult to determine who owned such IP, it recommended joint ownership as a strategy for avoiding/minimising conflict and its sample regulations conferred joint ownership upon inventive academics in those institutions which adopted them *verbatim*. For reasons which are not clear after the passing of so many years, **Glasgow**'s policy-makers did not opt for joint ownership of patented/patentable IP at this time, nor did they seven years later, after seeking advice from a solicitor and patent agent on how to respond to note (x) of the Kingman letter However, key figures at **City** did opt for joint ownership and so did the Research Committee and Senate at **Liverpool** - unwittingly, it would seem Judging by **Liverpool**'s response to the Kingman letter [55], policy-makers did not grasp - either then or during the intervening years - the fact that, by adopting the CVCP's sample regulations *verbatim*, the

university was conferring joint ownership upon its inventive academics

Policy-implementers at **Glasgow, Liverpool** and **Strathclyde** expressed disapproval of the practice of joint ownership, believing that the disadvantages outweigh any advantages which it might confer on academics - something which the CVCP's report did not even mention, let alone address However, it is not disapproval which causes **Liverpool's** policy-implementers to vest ownership of patents exclusively in the university; they, too, clearly believe that this is university policy

Two universities, **Durham** and **Hull,** were in the process of deciding on the terms of their first IP policy when the Kingman letter and the DES statement arrived Both reported using the CVCP's 1978 report to guide them, indeed, like **Liverpool** before it, **Hull** adopted not only joint ownership but the relevant section of the report, wholesale. **Durham** also used the Kingman letter to guide its deliberations; it seems to have used literature from the SERC, too, for the definition of IP over which it may assert ownership is exactly the same as that employed in the SERC's research grant conditions of the period In the end, according to one policy-maker, **Durham** decided not to make a policy decision about ownership, but to judge each situation on an *ad hoc* basis This does not seem to have been committed to paper anywhere, however, and there is evidence to suggest a certain amount of confusion on this subject, both on the part of policy-makers themselves and with regard to implementation of the policy by the policy-implementer [56]

In practice, **Hull's** policy-implementer vested ownership of patents in the university alone. At first he seemed unaware that this contravened the university's explicit, written policy; he then explained it as a matter of administrative convenience, declaring that patents could be jointly owned if the inventor insisted Since **Hull's** policy-makers seem to have

forgotten what they decided on in this respect (see two paragraphs below), it seems unlikely that they would notice the discrepancy between official and unofficial policy, even if they did monitor the policy-implementer's activities in this respect

Three universities, **Bristol, Kent, York,** did not formulate a detailed IP policy until the late 1980s, at which time **Hull** also extended the scope of its IP policy. By this time, UDIL's 1988 report had been circulated and although only **York** and **Hull** mentioned having used it, the policies of all four universities bear its hallmark. In the first three, all forms of IP are owned exclusively by the university, in **Hull,** all forms except patented/patentable IP are owned exclusively by the university. As chapter 5 described, UDIL's 1988 report did not mention the idea of joint ownership, let alone dismiss it Indeed, unlike the CVCP's 1978 report, which recognised the difference between imposing a contractual obligation to undertake research and demonstrating that the nature of any given piece of research was such than an invention might reasonably be expected to result from it, UDIL's 1988 report asserts that the nature of <u>all</u> university research is such that an invention may reasonably be expected to result from it This last group of universities seems to have been influenced by UDIL's (possibly unwarranted) certainty in this respect. Since this report was given the CVCP's *imprimatur*, it is distinctly possible that policy-makers in these universities regarded its 1978 report as redundant - if, indeed, they read it at all

In Hull's case, one of the people responsible for this, more recent policy decision had certainly read the CVCP's 1978 report How can we explain **Hull's** rather paradoxical decision to vest ownership of patented/patentable IP jointly in the academic and the university, but ownership of other types of IP in the university alone? Could it have been a very literal interpretation of the CVCP's report, which did not deal with other types of

IP? It may be wrong to assume that Hull's policy-makers made this decision so advisedly. when the chairman of the sub-committee which formulated Hull's patent policy was asked about his institution's policy on ownership of patented/patentable IP, he was unable to answer, this same individual had just finished chairing the committee which made the decision about ownership of other types of IP

The decisions which the participating universities made about the ownership of different types of IP seem to have had little to do with objective factors such as the size of a university. As defined for the purposes of this study, one of the three universities which opted for joint ownership is large, one medium-sized and one small. Nor does it seem to be connected with the relative size of the science base, judged by proportional numbers of staff, **Liverpool** has proportionately the second largest science base of the participating universities, **Hull** has the second smallest and **City's** is almost exactly mid-way between these two Equally, this decision seems to have nothing to do with the relative wealth of a university, **Liverpool's** private funds represent a higher proportion of its annual budget than almost any other provincial university, **Hull's** represent a considerably lower proportion and **City** has very little in the way of private funds. Moreover, as defined for the purposes of this study, **Liverpool** falls into the group of universities least afflicted by the UGC's 1981 cuts, whereas **City** and **Hull** were amongst the most seriously afflicted universities in the country. Nor does university type seem to explain their decision, one of the pre-war civics opted for joint ownership, the other did not, one of the ex-CATs opted for joint ownership, the other did not.

It seems more likely that the decisions which the participating universities made *vis-a-vis* IP ownership were influenced by timing - or rather, by the advice on IP ownership which was in circulation at the time first the CVCP's and latterly UDIL's, which had the

CVCP's approval There is no evidence that other sources of advice, such as the AUT's, played any part in the decision, though it was the local AUT which persuaded **York**, as a matter of policy, to immediately relinquish its rights in software without large-scale application; however, **York's** local association was unaware of the existence of the AUT's IPR working party or the material which it produced and negotiated this concession on the basis of the strength of feeling in the university's Computer Science Department

It is also possible that organisational factors, such as the role of policy-implementers in the decision-making process, had some influence Policy-implementers were not involved in **City's, Hull's** or **Liverpool's** decision about joint ownership of patents No policy-implementer was involved in **Durham's** decision to judge each case on an *ad hoc* basis It is no longer clear who was responsible for **Strathclyde's** original decision, however, the principal policy-implementer certainly supports the university's practice of vesting ownership in the university alone At **Kent**, certainly, and possibly **Bristol**, the policy decision about ownership of IP seems to have been left to the policy-implementer, similarly, the policy-implementer at **Hull** was a member of the working party which recently decided that all forms of IP except inventions should be exclusively owned by the university Likewise, the policy-implementer at **York** was a member of the *ad hoc* group which decided that all IP should be exclusively owned by the university. Not only are policy-implementers at the last five institutions members of UDIL; four were recruited from industry, not from academia or university administration and three, at least, were used to the idea that employee inventions are owned exclusively by the employer [57].

It is less easy to establish why none of the participating universities immediately (but conditionally) assigns ownership of all types of IP to academics wishing to assume responsibility for its exploitation, as the DES suggested. It is evident that, with the one or

two minor exceptions noted, all the participating universities have taken a quite contrary policy decision· to assign their rights in IP to its creators only if they come to believe that the IP in question is not likely to yield a worthwhile return commercially or they have been unable to find an industrial/commercial partner to exploit it. We should refrain from concluding that this necessarily stems from a positive rejection of the DES' suggestion, however; in at least three cases, it quite clearly does not.

As we have seen, it seems largely to have fallen to the policy-implementer at **Bristol** to formulate most of the university's policy on IP. Despite the fact that Sir John Kingman himself was installed there as Vice-Chancellor, neither the Kingman letter, the DES statement nor the letter detailing the exploitation arrangements agreed between the university and the ESG were available for this individual to refer to, both the originals and every copy had been filed without trace and the policy-implementer did not feel it appropriate to contact the SERC and ask for a copy, he does not seem to have thought of asking colleagues at other universities for a copy of the Kingman letter or the DES statement

A similar situation obtained at **Kent** where, in the absence of active policy-makers, three separate policy-implementers have been left to devise policy since the end of 1985 It is not clear whether the first two - both of whom were recruited from industry - had access to the DES statement, certainly, the administrator who recently assumed responsibility for IP at **Kent** was unable to locate a copy of either this, the Kingman letter or the university's final response to the ESG. Unlike **Bristol's** policy-implementer, he chose to contact the SERC and ascertain what the university had committed itself to - though for some reason he did not acquire the documentation itself It remains to be seen whether he will be as ready to (conditionally) assign ownership of IP to academics who wish to

assume responsibility for its exploitation as he is to assign it to third parties

Policy-makers at Hull certainly had access to all the relevant documents in 1985/86, when they were completing their deliberations on the university's patent policy However, according to the chairman of the relevant sub-committee, neither the ESG's requirement in respect of the academic in the exploitation process nor the DES' 1985 statement made a big enough impact on them as to influence Hull's policy They appear to have paid scant attention to either the DES statement or the notes emanating from the CVCP at the time, which emphasised the ESG's requirement in respect of the role of the academic It is questionable how much real attention they paid to the CVCP's 1978 report, either, Hull's policy-makers do not seem to have grasped what the CVCP failed to realise the implications of vesting ownership of inventions jointly in the university and the inventor(s) for the role of the academic in the exploitation process.

We may assert with some certainty that policy-makers in at least one of the participating universities - and probably two or three - did consider the DES's suggestion and reject it advisedly, however This certainly happened at City City's very recent decision to assume the rights to and responsibilities for IP arising out of Research Council-funded projects encouraged it to review custom and practice, including the question of ownership In 1988/89 City codified custom and practice into policy for the first time, opting to retain the custom of joint ownership of patentable IP - and to extend it to other forms of IP. City's policy-maker took this decision because it makes for an "*equitable*" arrangement - the very word used by the CVCP eleven years earlier The important point to note here is that unlike the CVCP's 1978 report, City fully understood the rights which joint ownership confers on members of staff, academics there have been able to assume equal responsibility for the exploitation of their IP for many years without the need for a DES

-inspired mechanism as a guarantee. In fact, the mechanism suggested by the DES works on a different basis It treats academics in the same way as any third party wishing to assume responsibility for the exploitation of their discovery, despite the imposition of conditions, it effectively deprives the university of control of the exploitation process at the outset, leaving it to recoup what it can from unsatisfactory exploitation attempts by invoking those conditions. This was not acceptable to City, whose policy-maker believes that the university should have at least as much control over the exploitation process as the academics concerned, so that academics do not inadvertently disadvantage either themselves, their department or the university.

Strathclyde's principal policy-implementer considered the DES' suggestion, but rejected it, he saw it as unnecessary for academics to acquire ownership of their IP, given that other, less formal mechanisms could be - and were - employed to guarantee their role in the exploitation process Since policy-making at Strathclyde seems to be an ongoing process to which the principal policy-implementer contributes, we may perhaps regard this as a policy decision

Like their counterpart at Strathclyde, policy-implementers at Glasgow and Liverpool considered the DES' suggestion. They, too, regarded it as unnecessary for academics to acquire ownership of their IP, given that other, less formal mechanisms can be employed to guarantee their role Since Glasgow's policy-implementer was also a member of the standing policy-making committee, once again perhaps, we may take this to be a policy-decision

It is less clear why the other two universities did not act upon the DES' suggestion that ownership of IP should be immediately (but conditionally) assigned to academics wishing

to assume responsibility for its exploitation. This would not have represented a major change in thinking at **York**, it would have amounted to no more than a formalisation of what often happened in practice prior to 1990. We know that **York's** policy-makers relied to a considerable extent on UDIL's 1988 report when formulating their policy As outlined in chapter 5, this report made no reference to the ESG's requirement that, in practice, academics should be allowed to assume responsibility for the exploitation of their discoveries, if they wished, accordingly, it did not consider the question of conditionally assigning ownership to academics to facilitate this process

(iii) Assuming Responsibility for the Decisions and Procedures of the Exploitation Process

Sections 7 1 and 7 2 devoted the remainder of their attention to the ability of academics in the nine participating universities to make/carry out the various decisions/procedures of the exploitation process It was shown how, if they are not granted ownership of the IP they generate, academics will not have the fullest opportunity and scope to assume responsibility of that IP unless they are allowed to make/carry out every decision and procedure of the exploitation process It is abundantly clear from section 7 2 that the participating universities vary enormously in the extent to which they let their academics make/carry out the various decisions/procedures of the exploitation process.

In 1989/90 only two universities allowed their academics to make every decision and carry out every - or just about every - procedure of the exploitation process. At **Strathclyde**, this arose from the fact that the policy-maker decided advisedly to allow academics to assume this degree of responsibility for the exploitation of their IP. The ESG's requirement concerning the role of the academic was not the trigger for his decision **Strathclyde** started to develop its IP policy in the 1960s, before any of the reports

detailed in chapter 5 were circulated, which perhaps accounts for its idiosyncratic approach - or rather, approaches, for there have been a number **Strathclyde's** lengthier experience has given it greater opportunity to recognise its mistakes, learn from them and make the necessary changes. Academics there were not given what is tantamount to the fullest opportunity and scope to assume responsibility for the exploitation of their IP because the Kingman letter hinted at it, the DES wished it and the ESG extracted a commitment from it to do so, but because the university itself has found it to be the most effective strategy to counteract its earlier mistakes **Strathclyde** no longer espouses the "closed shop" approach to technology transfer skills, as it used to [58], it sees it as immoral and counter-productive to take academics' IP away from them and place it in the hands of experts who subject it to a series of arcane processes, from which the academics are excluded **Strathclyde** regards it as far more productive from the perspective of both the academic and the university to inculcate the necessary skills in as high a proportion of the academic community as possible, to make them familiar with every stage of the exploitation process by means of what we might call "action learning".

Strathclyde not only made this an explicit part of its policy; it also thought through very clearly the implications for every stage of the exploitation process Academics there are encouraged to participate, at least, in every decision and to carry out as many procedures as they want to in the exploitation process, even if they choose to involve the IL office They are told how to do elementary market research, how to identify potential licensees/assignees - should their own suggestions not prove fruitful, how to approach them, how to assess their suitability, how negotiations are conducted, how to write business plans *etc* - and sent away to do this, if they are willing. Thus, they are able to make decisions on a more informed basis Even if academics choose to work through the various stages of the exploitation process alone, **Strathclyde** is prepared to accept the

consequences. Its only concession to caution is to require companies started by academics to be managed by a professional with a track record; this caveat arises because of the failure of several spin-off companies, set up and managed by academics at **Strathclyde** during the late 1970s and early 1980s - *ie.* it is the result of a series of critical incidents This clear - and bold - thinking about its policy and how to implement it, together with its interest in "skilling" the academic community, distinguishes **Strathclyde** from most of the universities in this study. It accounts for many of the differences identified in section 7.2 in respect of the opportunity and scope given to academics to assume responsibility for the exploitation of their IP.

As indicated in section 7 3, judged by its approach in 1989/90 **York** ranked equally with **Strathclyde**, giving its staff what was tantamount to the fullest opportunity and scope for assuming responsibility for the exploitation of their IP **York** arrived at this situation by a quite different route to **Strathclyde**, however **Strathclyde** learned from experience that the "closed shop" approach to technology transfer was counter-productive, if this is a common phenomenon, **York** had yet to discover it, for in 1989/90 it had never espoused that approach to technology transfer. No academic at **York** has had their IP taken away them and placed in the hands of experts who subject it to arcane processes, from which they are excluded - unless the IP in question was obligated to the BTG/the research sponsor Academics have been free to do as they see fit in a university whose *laissez-faire* attitude in respect of IP seems to differ from that of Cambridge in being less disengaged, more supportive. There are indications that this may change in future, however, once the ILO acquires the requisite skills At this point, **York** may end up journeying in the opposite direction to **Strathclyde.**

City's position immediately below **Strathclyde** and **York** in the rank order detailed in section 7 3 reflects the fact that in 1989/90 its approach to the exploitation of IP was not dissimilar to **Strathclyde's** in some respects For instance, **City's** policy-maker also believed that "*whisking away*" academics' IP and subjecting it to processes over which they have no control was counter-productive, this is less a question of morality, perhaps, than pragmatism - he believes this tactic would lead to bad staff relations There is nothing to suggest that **City** has learned this from its own experience - *ie.* from making the same kind of mistakes which **Strathclyde** made Indeed, since the 1970s, **City** appears to have exploited/arranged for the exploitation of its IP together with the academics concerned, so this seems unlikely, however, it may well be that **City's** policy-maker brought with him insights gained from similar responsibilities at his previous university. It is clear that at **City**, as at **Strathclyde**, the ESG's requirement concerning the role of the academic was not the trigger for the university's adoption in 1989 of a policy whereby academics make every decision and carry out every procedure of the exploitation process in partnership with the university - though it may have reinforced it. As indicated, this policy was based on custom and practice which dated back to the 1970s. It is part and parcel of the university's practice of vesting ownership of patents jointly in the university and the inventors

City differed from **Strathclyde** in that in 1989/90 it was not prepared to adopt a totally "hands off" approach, leaving every decision and procedure in the exploitation process to be made/carried out by the academic alone This does not seem to be the result of critical incidents either, but due rather, as sub-section (ii) indicated, to a desire to prevent academics from inadvertently disadvantaging either themselves, their department or the university The policy-maker - who is also **City's** principal policy-implementer - had nearly 20 years' experience of managing IP generated by academics, in **City** and his

previous university He felt he had insights and skills which they did not, which should be brought to bear on the exploitation process [59], as the following quotes illustrate

" . *[There is a] need to commercialise reasonably quickly Academics may want to improve on something to the point where you are actually losing lead-times There is a kind of academic who will never be satisfied until it is 101 per cent perfect* ."

"IP tends to be close to superannuation arrangements Everyone knows it is exceedingly important in certain circumstances, but few people actually have the dedication or interest to sit down, put a wet towel round their heads and work their way through what is a technical matter .."

There seems to be more to this than the relative skills of the policy-maker/implementer and the academic community, though. His approach seems to be more in keeping with City's general approach to university affairs, City was the only participating university to go out of its way to insist that it had a "*management*", not an administration. Indeed, City's policy-maker commented that the institution was run more like a traditional Scots university than a traditional English one - *ie.* in a directive rather than a facilitating mode This probably accounts for City's practice of lobbying fairly hard to achieve its preferred outcome when it comes to determining the exploitation route for IP generated by members of staff, too, notwithstanding the fact that they jointly own it

City regards itself as a university which is prepared to take risks, when it seems appropriate, it attributes this to the fact that both the current and former Vice-Chancellors and the Director of Finance all came from a background which encouraged this approach

This probably explains why City seemed more prepared than many of the participating universities to postpone the return which it got from the exploitation of its IP in the hope of a greater return at some point in the future It is also a university which was obliged to develop a "*business edge*" somewhat sooner than many other UK universities, following the introduction of differential fees for overseas students at the end of the 1970s and the swingeing cuts imposed by the UGC in the early 1980s This is evidenced not only by its various campus companies, but also by the manner in which academic developments take place, such as City University Business School, which is entirely self-funded City is also an institution with a tradition of gearing its teaching to vocations It is not in sympathy with the quip "if you can't do it, teach it", preferring to see its staff doing as well as teaching; this includes entrepreneurship of one sort or another. Moreover, City views entrepreneurship as a logical extension of the university's mission statement Nonetheless, it is cautious about exploiting its IP entrepreneurially, despite the singular success of its first campus company. There are three main reasons for this Firstly, City accepted the local AUT's concern that academics who generated entrepreneurially exploitable IP might feel they were being "*pushed down the road where they had to form a company, depart from the university and become businessmen*". Secondly, City firmly believes that it was lucky where its first campus company was concerned, that its success was due to a niche market materialising at just the right moment Thirdly, it feels there is a down side to many university companies· unless they successful enough to pay for a dedicated company secretary, the onus is on the university Secretary and Director of Finance to make the necessary annual returns. This is why City was happy to follow the advice tendered by UDIL in its 1988 report, which recommended setting up a company to exploit IP only if it looks likely to generate a profit of >£100,000 p a. within 4/5 years. This same caveat seems likely to apply to joint ventures - and possibly independent academic spin-off companies - though this is purely hypothetical at present, since none of City's academics

had proposed such an arrangement, this may reflect the fact that the university is situated in central London, with all its attendant difficulties Although exploiting IP via research centres/institutes/units might minimise these inherent disadvantages, City would not be happy about academics exploiting their discoveries within the framework of the university in this way - in case "*the tail [ended up] wagging the dog*".

Whereas **Strathclyde** and **City** made a conscious decision to let academics assume sole or equal responsibility for the exploitation of their IP, **Glasgow** decided, as a matter of policy, to exercise some measure of control over their role in the exploitation process, where previously it exercised none. There were several triggers for this, which had a cumulative impact The 1977 Patent Act and the CVCP's 1978 report clearly had an affect on university policy, leading to its first set of guidelines on IP The new conservative government's emphasis on universities working for the good of industry and the economy had a greater impact, however **Glasgow** had a feeling that its staff was doing just that, but having shown no interest in their activities, the administration was not in a position to document this; it lacked the necessary management information Soon after this, the cuts imposed by the UGC focussed the administration's mind even more sharply. It became aware that in some quarters of the university, the Faculty of Medicine in particular, academics had been negotiating technology transfer deals with companies which brought an income to the departments concerned, but excluded the centre In other cases, academics had exploited/arranged for the exploitation of their IP in a manner which cut out both the centre and the department Moreover, it appeared that the exploitation arrangements made by academics did not always maximise the potential of their IP, indeed, some more entrepreneurial exploitation attempts appeared to squander it altogether.

In much the same way that Glasgow's grasp of the situation was a gradual process, the controls which the university chose to exercise over the exploitation process seem to have evolved gradually over the course of the 1980s Despite having asserted ownership of inventions generated by members of staff, the guidelines circulated in 1982 give the impression that the university did not assert itself unduly when it came to evaluating, protecting and arranging for the exploitation of those inventions Academics were "*encouraged*" to provide a description of their invention, including a rough evaluation of its commercial potential, so that the university could decide whether or not to seek patent protection They were "*encouraged*" to make their discoveries available to industry for commercial purposes There is no indication that companies started and run by academics would not have been granted a license from the university at this time Although the Court reserved the right to conduct negotiations with licensees/assignees and determine the terms of deals, it did not always exercise that right in practice, perhaps because the Registrar, who was responsible for IP, had no more - and possibly less - experience than the academics concerned Although Glasgow recruited its first ILO in 1982 and he came from industry, it is not clear whether he came equipped with the relevant skills, an anecdote told by one informant suggests he may not have done [60] Nor is it clear how he operated between 1982 and 1985 where the exploitation of IP was concerned, the university conceded that his job specification was not detailed as it might have been, particularly in relation to IP. Suffice it to say that during the course of the mid-late 1980s, Glasgow defined more clearly the kind of controls which it wishes to exercise over the exploitation process

Since Glasgow's policy-implementer was a member of the policy-making committee, it is sometimes difficult to distinguish whether academics were denied the opportunity to make certain decisions/carry out certain procedures in the exploitation process because of policy,

or because of the manner in which the policy-implementer had chosen to work. It is evidently policy that academics themselves should be free to decide whether their discovery is exploited intellectually or commercially - or both; Glasgow regards teaching and research as the university's *raison d'etre* and publications as the priority output of research, it was not prepared to compromise this by pressuring academics to generate income from their research discoveries If academics agree that their discovery should be exploited commercially, it is policy that they should decide how it is protected, if there is a choice In any case, the policy-implementer himself has an ambivalent attitude; on the one hand, he believed that industry still sees a patent as a yardstick of credibility where university inventions are concerned, on the other, he was convinced that secrecy is really the best route into the marketplace - but secrecy is very difficult for universities to enforce and more risky than a patent, even with a confidentiality agreement The policy-implementer relies on the academics concerned to identify potential licensees because, in his view, they generally have a far better working knowledge of the market than "outsiders" such as himself [61]; similarly, he found it more effective for them to make the initial approach, exploiting contacts which they already have to "sell" the technology. However, it was policy for the policy-implementer to conduct the final negotiations with companies. There were several reasons for this, most notably the fact that licenses which relate to Europe are subject to the competition laws of the European Community - that is to say, granting a company a license to manufacture/market a product/process in specified parts of the European Community, excluding others, may contravene the Treaty of Rome. Glasgow had already suffered the consequences of making this mistake and was keen not to repeat the experience; it was believed that as a result the policy-implementer had a better grip of the requirements of the Treaty of Rome than the average academic It was also policy for the policy-implementer to conduct the final negotiations because the university wished to get the best deal it could; although the academics concerned have a

say in the kind(s) of return sought on their IP, the policy-implementer wished to be sure that any deal incorporated a direct, financial return which benefitted the centre, as well as any other kind(s) of return which the academics might want Finally, in 1989/90 it was university policy rather than a whim of the policy-implementer's to license companies set up by academics to exploit their research discoveries only if they were run by an experienced entrepreneur with a track record It was Glasgow's belief that this strategy should minimise the possibility of IP being squandered, as it sometimes had been in the past

When Glasgow responded to the Kingman letter in October 1985, the SERC (on behalf of the ESG) wrote asking for further details concerning the role of the academic in situations where the university wished to participate in the exploitation process It is clear from Glasgow's reply that it saw the relationship between the academic and the university as a collaborative one [62], rather than one in which the academic was given *carte blanche* to make every decision and carry out every procedure connected with the exploitation process entirely on his/her own initiative There is no reason to believe that Glasgow had changed its view over the intervening years; any restrictions which it imposed on the academic in the exploitation process were clearly motivated by a desire to ensure that the exploitation route chosen by the academic in collaboration with the policy-implementer was pursued with a degree of professionalism in order to get the strongest deal possible, within parameters agreed between the academic and the policy-implementer

At Liverpool, IP was initially regarded as an academic rather than a financial concern It was the Research Committee which recommended that the university should adopt *verbatim* the IP regulations contained in the CVCP's 1978 report and the Senate which adopted this recommendation. As indicated in sub-section (ii), Liverpool's policy-makers

failed to grasp the fact that adopting these regulations *verbatim* conferred joint ownership of patented IP on inventive members of staff, let alone the implications of joint ownership **Liverpool's** policy therefore granted academics no formal part in the decision-making process. Moreover, they were supposed to carry out only those procedures which they were instructed to carry out by the university Judging by the small print, this appeared to mean providing the relevant scientific and technical information to the BTG, and, if necessary, to patent agents and potential licensees/assignees In the early days, **Liverpool** may not have adhered particularly strictly to this policy, but within the space of a few years, **Liverpool's** administration came to see exploitable IP as a potential source of income and therefore a financial, rather than an academic issue. Far from delegating responsibility to academics, as the DES wished, **Liverpool's** approach to the exploitation of IP has been characterised since the early 1980s by the ability to exercise control at a high, if not the highest level.

Liverpool made no secret of its approach in its response to the Kingman letter Outlining possible exploitation routes, the letter stated

> " . *the University is establishing a wholly-owned subsidiary Company through which research discoveries can be commercialised* ***The Company will assume responsibility for all aspects of the commercialisation of the discovery*** ..." (added emphasis)
>
> "*If it is judged inappropriate to use the Company,* ***the University will attempt to interest an existing commercial organisation [author's emphasis]*** ... *Once a recipient company has agreed to take on the exploitation of a discovery,* ***it would assume full responsibility for all aspects of such exploitation*** ..." (added emphasis)

"BTG offers a patenting and licensing service for academic discoveries which the University may wish to use on occasions [added emphasis] BTG can also contribute to the costs of the development of an invention in partnership with a commercial venture and again the University would be able to explore this avenue [added emphasis] in appropriate cases ..." [63]

Whilst the letter conceded that the academic making the discovery might wish to undertake its commercialisation by setting up a company under license from the university, it stated unequivocally.

" *The primary role of the academic is in identifying discoveries which might be exploited ... the primary role of the University is in securing the exploitation of a discovery once identified ..."*

Although **Liverpool** recognised that this would require the "*active participation*" of the academic, it is clear that the university had no intention of giving its academics "the fullest opportunity and scope to assume responsibility" for the exploitation of their IP, as defined for the purposes of this study This doubtless explains why the SERC (on behalf of the ESG) wrote asking for further details concerning the role of the academic in situations where the university wished to participate in the exploitation process **Liverpool's** reply indicated that academics could contribute to the technical development of their invention, that the choice of exploitation route would be made "*in consultation with the academic*", that exploiting an invention through a subsidiary of ULTRA should give the inventor "*a strong feeling of involvement in and commitment to the marketing of his or her idea*", plus an equity stake in the company, and that academics "*would be encouraged to take an active interest in the development project, perhaps on a consultancy basis or as a partner in a joint venture*" with an existing company - *ie* a "*major role*", whichever exploitation route was chosen [64]. The ESG appears to have accepted this response, despite the fact that in most exploitation routes, it either cast the academic in a very traditional role

(technical development, consultancy) or allowed him/her little more than the semblance of a more entrepreneurial involvement

Liverpool has kept a tight rein not only on the role of the academic in the exploitation process, but also on the role of its policy-implementer(s) Until 1987, for instance, it was **Liverpool's** senior management team - *ie* the Vice-Chancellor, the Pro-Vice-Chancellors and the Registrar - which decided whether an invention should be patented The policy-implementer would submit a paper summarising his reasons for recommending that the university should seek a full patent, or even an initial registration. This would be supplemented by material from the inventor, his HoD and the Chairman of the Research Committee At that time, only one other participating university expected the policy-implementer to seek authority to proceed with an initial registration or even a full patent application [65]. This requirement has since been relaxed Policy-implementers may make this decision themselves, bearing in mind two pages of guidelines detailing the university's patenting strategy. However, they still felt sufficiently uncertain about the extent of their authority that, if in doubt, they tended to "*play safe*" by referring matters "*upstairs*". They were encouraged to do this by documentation produced in 1988/89 to guide them [66]. This emphasised that they had a responsibility to seek the advice or support of a special advisory group for all commercial work relating to research/consultancy contracts or IPR, in 1989/90 that advisory group consisted of the former Acting Vice-Chancellor, a prominent lay member of Council and the local manager of 3i

Given this background, it is not surprising that policy-implementers at **Liverpool** did not let academics conduct negotiations with potential licensees/assignees - though the level of their own skills probably played a part in this decision One policy-implementer acquired his skills through courses and through actually conducting negotiations for a number of

years; the other had no previous experience of conducting license negotiations and has not had the opportunity to gain as much "*on the job*" experience as his colleague. He did not feel particularly confident about his ability in this respect and preferred to have a senior member of the university present in an advisory role Having been appointed from within **Liverpool's** academic community, one could imagine that he would be unlikely to be comfortable with the idea of delegating responsibility for negotiations to former academic colleagues, or even treating them as equal partners. In fact, policy-implementers in the majority of participating universities have no previous experience of conducting negotiations with potential licensees/assignees, either [67]. At **Liverpool**, though, the policy-implementers' decision to limit academics' involvement in negotiations to providing scientific or technical support is undoubtedly influenced by uncertainty about the extent of their own authority, too· in the 1988 guidelines, **Liverpool's** policy-makers recommended taking "*difficult and extensive*" negotiations out of the policy-implementers' hands and making them the responsibility of a special negotiating team which would include a senior lay officer with commercial experience During the course of the fieldwork **Liverpool's** policy-implementers insisted they would not embark on any course of action without the agreement of the academic; one wonders, though, what kind of guarantees they could give if the negotiations could be taken out of their hands Even if the special negotiating team took academics' wishes into account, effectively the university was playing the part of a beneficent master, a master who wishes to prevent his servant from making mistakes in the first place, rather than withdraw his patronage after the fact, as the DES' 1985 statement proposed, in this context, the servant may be the academic or the policy-implementer, it would seem.

The university's urge to retain control is also demonstrated by its foray into more entrepreneurial ways of exploiting its IP As indicated, **Liverpool's** first university

company, ULTRA, was intended to be a holding company, setting up subsidiary companies to exploit "hard" IP via joint ventures with members of the academic staff, when **Liverpool** responded to the Kingman letter, it had already set up a framework within which would-be academic entrepreneurs could exploit their IP themselves. However, members of staff were to be allocated 49 per cent of the equity, with the university retaining 51 per cent - and control. Moreover, it was important to the university that ULTRA itself remained a wholly-owned university company, even when it ceased operating as a holding company and started marketing IP itself, directly·

" . *Within the University there were great expectations of [ULTRA], so perhaps for that reason we wanted to have it all for ourselves. Maybe we were greedy ..* "

In time, this attitude prevented the company from acquiring £2m of second-round funding which its CEO felt was needed, the university itself was not prepared to invest more than £0 25m from its private funds - the sum it had earmarked at the outset As a result, ULTRA was forced to cut back the scale of its operations considerably It never became the company which had originally been envisaged and in 1990 it was wound up. **Liverpool** concedes that it should possibly have gone for venture capital, but this did not prevent it from setting up its next enterprise as a wholly-owned company, preferring to borrow from the bank rather than bring in a partner and dilute its equity [68].

Liverpool's controlled, cautious approach to the exploitation of its IP and its reliance on lay members of Council is in keeping with its general approach to financial affairs. The university is rooted in a city which derived its wealth from commerce, not industry Lay members of Council have tended to be local businessmen or members of the professions, whose approach has been very conservative The university believes this is why its private funds represent a higher proportion of its annual budget than almost any other provincial university Against this background, the losses incurred by ULTRA - notwithstanding the

university's efforts to retain control - constitute a critical incident Since the then President of Council, a stockbroker, had counselled against ULTRA from the outset, lay members' conservatism seemed as though it was vindicated As a result, in 1989/90 **Liverpool's** policy was even more risk-averse. it looked for zero risk, rather than minimal risk. Even though academics played no part in ULTRA's demise, the fall-out from this critical incident affects them to this day. In part, at least, risk-aversion is what lies behind **Liverpool's** reluctance to license IP to companies started by academics, in the university's view, the risk inherent in that situation is greater than the risk entailed in licensing/assigning to an established company. The negative view of would-be academic entrepreneurs propounded by ULTRA's second CEO reinforced this perception

We must conclude, then, that academics at **Liverpool** were denied the fullest opportunity and scope to assume responsibility for the exploitation of IP, as defined for the purposes of this study, because this did not coincide with the university's general approach to financial management It was not an unintended side-effect of the way in which the policy-implementers chose to work; indeed, given that much of their *modus operandi* seems to have been prescribed by the policy-makers, it is clear that **Liverpool's** policy-implementers let academics make as many of the decisions and carry out as many procedures as they can

In 1989/90 **Hull's** situation was very similar to **Liverpool's** in terms of policy, but its approach to the implementation of that policy differed - most notably in the extent to which the university retained the right to exercise central control When **Hull's** policy-makers decided in 1985/86 to adopt the relevant sections of the CVCP's 1978 report more or less wholesale, like their counterparts at **Liverpool** - and like the CVCP itself, apparently, they failed to grasp the implications of the legal rights conferred on academics

by virtue of joint ownership of inventions Thus, at **Hull**, too, it was the university which assumed sole responsibility for the development and exploitation of employee inventions Academics there were granted no formal part in the decision-making process and were supposed to carry out those procedures which they were instructed to carry out by the university and no others.

It is pertinent to consider how it was possible for these same policy-makers - or a constituent part of them - to make a commitment to the ESG at the very same time that, in practice, academics would be allowed to assume responsibility for the exploitation of their IP That commitment appears to be the complete antithesis of the newly-adopted policy, given that it contained no provision for the university to delegate that responsibility to members of the academic staff, moreover, since **Hull** produced no documentation to guide its policy-implementer, there was no possibility of indicating it there, either Was **Hull** simply paying lip-service to that commitment, then? As indicated in sub-section (ii) above, neither the DES' 1985 statement nor the ESG's requirement in respect of the role of the academic made a big enough impact on **Hull's** policy-makers as to influence policy They apparently paid scant attention to the DES' statement or the notes emanating from the CVCP which emphasised the ESG's requirements in this respect There is no guarantee, of course, that they would have formulated their policy differently, had these documents made a greater impact on them; although **Hull** aimed to accommodate academics' wishes with regard to the exploitation of their IP, this was "*not an absolute rule*". The university evidently preferred to retain control over what happened to its IP from the outset, rather than delegate responsibility to members of the academic staff and salvage what it could from any mishaps which occurred

Whereas policy-makers at **Liverpool** retained the ability to exercise control at a very high level, **Hull** was content for that control to reside in the policy-implementer, however This is not what was originally intended, for the sub-committee which formulated **Hull's** original IP policy was supposed to become a standing committee which would decide whether or not the university should try to exploit each discovery notified and if so, how the discovery should be protected In practice, the policy-implementer never called on this committee and nobody ever challenged the fact that he has effectively usurped its authority In other respects, though, **Hull's** policy-implementer was given considerable freedom to implement the university's policy as he saw fit The university provided no documentation to guide him in this respect - and only a few verbal clues One concerned the nature of the return which he should seek on IP successfully exploited Academic members of the policy-making committee wanted a substantial part of it to take the form of a direct, financial return, more specifically, an upfront payment Administrative committee members were happy to endorse this view in the light of a critical incident which had occurred some years earlier. **Hull** had become involved in a dispute with an industrial partner about whose scientists had developed a particular discovery - *ie* who owned the resulting IPR; the university was not prepared to tangle with the company's lawyers and so was forced to accept what it saw as a derisory settlement. Another verbal clue related to **Hull's** positive view of members of staff setting up and running/participating in small start-up companies exploiting their IP **Hull** had already incubated a number of successful academic spin-off companies and the Registrar was familiar with Bullock's account of the role which similar companies had played in creating the "route 128" phenomenon around Boston, Massachussetts (Bullock, 1983)

If **Hull's** policy-implementer adhered to the university's stated policy and vested the ownership of inventions jointly in the university and the inventor, academics who

generated patented/patentable IP would be legally entitled to make every decision and participate in every procedure in the exploitation process as equal partners with the university - irrespective of the subservient role they were allocated in Hull's IP policy. Hull's policy-implementer did not seem to be aware of the consequences of his decision to vest ownership of inventions in the university alone - either in general or relative to the university's commitment to the ESG, indeed, he did not seem to have seen the Kingman letter, the DES' statement, the relevant notes from the CVCP or the university's response to the ESG. Given this hiatus in communication and understanding and the terms of the policy which he had to implement, it is probably fair to say that he let academics make as many decisions as possible He would not force them to exploit a discovery commercially if they preferred to exploit it intellectually and saw the two activities as incompatible, he would not assign ownership of IP without the academic's agreement and he would go along with the academic's preferred method of protecting a discovery When it came to procedures, however, he was less happy to delegate his authority and did so less and less as the exploitation progressed through its various stages Whilst he identified potential licensees/assignees "*hand in hand*" with academics, their role was to "*tag along*" when it came to approaching candidate companies and they were generally excluded from the negotiations altogether, although he discussed strategy with them beforehand This was not prescribed by the university; it was the policy-implementer's own chosen *modus operandi* and it may be misleading to attribute this to reluctance to delegate authority, *per se*. Hull's policy-implementer claimed to be motivated by the belief that if academics were perceived as "*hard-nosed [and] grasping*", this would affect the quality of their consultancy relationship with the licensee/assignee during the development phase With the policy-implementer taking charge of the negotiations, academics may be prevented in practice from determining another aspect of the exploitation process the terms on which their IP is licensed/assigned - unless the ILO was able to adhere strictly to the strategy he

agrees with them beforehand Both the academic and the policy-implementer were obliged to bear in mind the university's stated preference for getting the bulk of its return in the shape of direct, upfront payments, of course.

It would seem, then, that academics at Hull were denied the fullest opportunity and scope to assume responsibility for the exploitation of their IP because of an unfortunate sequence of oversights, omissions and unauthorised practice Hull's policy-makers claimed not to have noticed what the DES and the ESG required of them, accordingly, the policy they formulated did not accommodate their commitment to the ESG with regard to the role of the academic in the exploitation process. Not surprisingly, Hull's policy-implementer was not told about the ESG's requirement or the university's commitment in this respect This situation was exacerbated by the fact that, just like the CVCP, both the policy-makers and the policy-implementer at Hull failed to recognise the significance of academics jointly owning their inventions; the policy-implementer compounded this by deciding, for reasons of administrative convenience, to vest ownership of inventions in the university alone Only sharp-eyed inventors who insisted on joint ownership and who fully understand the rights this confers on them were able to assume responsibility for every decision and every procedure in the exploitation process - but only on an equal basis with the university, from 1985 to 1990, though, only one academic had been sufficiently sharp-eyed as to insist on joint ownership. Those who generated IP covered by copyright or the two design rights had no right to insist on participating as equals, of course

Bristol's position near the bottom of the rank order given in section 7.3 arises from circumstances which were similar to Hull's in one or two respects but quite different in others Like Hull, Bristol took no notice of the CVCP's 1978 report at the time it was published Indeed, the university took little or no interest in IP until the 1981 cuts,

following which a working party investigating income generation identified IP as a potential earner. In 1983 this led to the Senate and the Council agreeing on a formula governing the distribution of income from IP. Unlike **Hull**, though, no further policy decisions seem to have been made at that time, even though the working party had referred to the CVCP's report. When the Kingman letter arrived, the Committee of Deans [69] was obliged to come up with a policy which satisfied the eleven points the ESG wished to see addressed There is no evidence that the resulting policy was committed to paper in any form but the university's response to the ESG Since there was no copy of the university's response to the ESG in the relevant file when the ILO was appointed in 1987, there was no policy document for him to refer to, let alone guidelines on its implementation. As a result, **Bristol's** policy-implementer also had to take on the role of policy-co-ordinator, possibly even policy-maker.

In doing this, **Bristol's** policy-implementer has had to take account of attitudes and decisions already taken which impinged on the exploitation of IP These included, for instance, **Bristol's** aversion to being seen as a "*go-getting, commercial, whizz-kid university*", it is extremely important to **Bristol** to be seen as "*an academically high-class university*", not one which might give the impression of relegating its academic objectives to second place. **Bristol** had not gone so far as to single out particular no-go areas, so this is something which its policy-implementer has always to consider Hand in hand with this goes **Bristol's** approach to publication, the university has a long-standing reluctance to get involved in any research which would impose more than a minimum delay on publication, a reluctance which has been minuted by the Senate. It fell to the policy-implementer to translate this reluctance into hard and fast numbers - *ie* to determine the maximum delay on publication allowed in the interest of commercially exploiting research findings This prevented IP generated at **Bristol** from becoming the subject of "*onerous*" secret know

-how deals. Another example was a working party recommendation dating from 1985 that **Bristol** should begin to exploit IP entrepreneurially Beyond deciding to set up a holding company, this recommendation had not really been pursued in any detail, either in principle or practice Again, it fell to the policy-implementer to outline the various options - university companies, independent academic spin-off companies, joint ventures with members of staff, joint ventures with third parties *etc* - and to get the Council to agree that all of these options are permissible in principle. In practice, the policy-implementer had to weigh these entrepreneurial options against the fact that the university was "*fairly averse to risk*" - financial risk, the risk of litigation, risk to its scholarly reputation; in the policy-implementer's view, **Bristol's** approach to any proposal was always to enquire - "*what is the worst this can do to us? - rather than - what is the best this can do for us?*"

While **Bristol's** policy-implementer seems to have tried diligently to accommodate these particular attitudes and decisions, he has not accommodated the ESG's wish that, in practice, academics should be allowed to assume responsibility for the exploitation of their IP. He has been unable, of course, to find a copy of the university's response to the ESG on file anywhere in the university He has chosen not to obtain a copy from the SERC, apparently motivated by a desire to spare the university's blushes This alone provides one explanation of why academics at **Bristol** were denied opportunity and scope to assume responsibility for the exploitation of their IP. **Bristol's** policy-implementer took a serious view of the rights and responsibilities which the Research Councils authorised the university to assume Since the university delegated the exercise of those rights and responsibilities to the IL office, in turn, he felt <u>he</u> should determine how academics' discoveries were exploited, drawing on years of experience gained in industry and commerce He did not believe that the university should compromise its (*ie.* his) mature judgement to accommodate academics' wishes, let alone allow them to take charge of the

exploitation of their IP. He had not read the DES' 1985 statement and was apparently unaware that universities were actively encouraged to delegate those same rights and responsibilities to academics who wished to assume them, albeit conditionally. He portrayed himself as altogether less accommodating than his counterparts at **Glasgow, Liverpool and Hull**· if academics' wishes could be fulfilled without compromising what he judged to be the best approach, they would be, if not, they would not be. Whether or not their wishes were fulfilled, he was prepared to put pressure on academics to co-operate with his exploitation agenda, at **Bristol** the academic's role in the exploitation process tended to depend on the contribution which the policy-implementer decided he <u>needed</u> them to make, not the contribution they <u>wanted</u> to make

Whereas policy-implementers in many universities seem, on the whole, to deal with each discovery as a relatively discrete item, **Bristol's** policy-implementer tended to view it as an integral part of his overall plan for the financial year This plan entailed assigning ownership of a considerable proportion of the discoveries notified in any one year, in order to minimise cost, risk and effort, this was likely to be the plan for some time to come It may be overstating the case to say that academics had no say at all in the decision to assign or retain ownership of their particular discovery, but the policy-implementer certainly reserved the right to make that decision, irrespective of their wishes - and was prepared to exercise it This was the policy-implementer's chosen *modus operandi* in 1989/90; it was not a matter of university policy. Nor was it a result of being constrained by the university's patenting budget, the policy-implementer himself recommended the level of resources to be allocated to the various budget headings

In fact, most of the exploitation process was conducted according to the policy-implementer's own chosen *modus operandi*, university policy appeared to influence only a

couple of aspects of it. One was the manner in which inventions were protected; policy frowned on IP which was licensed/assigned in the form of secret know-how, though it did not rule it out altogether In practice, an invention would not be patented, though, unless the academic agreed Other than this, Bristol's policy-implementer let academics make only one decision in relation to the exploitation process, namely the composition of the first "pool" of potential licensees/assignees In principle, given that it was university policy to start exploiting IP entrepreneurially, this could include the academic's own company, a campus company or a joint venture - started expressly to exploit a discovery. In practice, the policy-implementer would decide for or against such proposals on the basis of the proportion of IP opportunities already being exploited entrepreneurially at any one time and the likely risk - here we see a second university "policy" counterbalancing the first

If he vetoed entrepreneurial ways of exploiting a discovery, preferring to license/assign to existing companies, the policy-implementer would let academics carry out only one procedure on their own initiative, namely making contact with (existing) companies in the "pool" of candidates; it is not clear why he let them carry out this particular procedure He chose to conduct the negotiations himself, sometimes with the assistance of a member of the finance office, because he brought skills to the task from his previous employment and was anxious to have maximum control of the outcome He preferred the terms of licenses to reflect the degree of risk he perceived - *eg* a non-exclusive license where he felt the risk should be spread. In 1989/90 he also preferred a substantial part of the return to take the form of a direct, financial return, more specifically, an upfront payment. This fitted in with his overall plan for the financial year, which required a preponderance of agreements yielding a direct, certain and fairly immediate financial return In time, as this policy pays off, he will be more open to a return on the university's IP which is less

immediate, less certain - but possibly greater in the long term He may also be more open to a less direct, less quantifiable return, as part of the deal, at least

The disappearance of the university's response to the ESG certainly provides one explanation of why academics at **Bristol** are denied opportunity and scope to assume responsibility for the exploitation of their IP. It is puzzling, though, that **Bristol's** policy-implementer did not seem to have taken the trouble to acquire from his counterparts at other universities a copy of the documentation which was sent to universities at the time of the Research Councils' offer, including the DES' 1985 statement It is worth noting, *en passant*, that the working party which recommended the creation of his post saw his role as facilitating the exploitation of IP, rather than taking charge of it The role in which the appointee cast himself was considerably more directive than facilitating, judging by the characterisation furnished for the purposes of this investigation. There are a number of possible explanations for this apparent discrepancy It may be partly or wholly a question of semantics; alternatively, perhaps the university did not properly communicate its wishes to him. Perhaps, though, this simply does not coincide with his own view of the role he should play

Like **Hull** and **Bristol, Durham** took no notice of the CVCP's 1978 report at the time it was published. It was another CVCP document altogether which triggered the university's interest in IP· the computer users' agreement which was presented for signature in 1983/84 In **Durham's** case, it was the administration, rather than the academic community, which evinced a sudden interest in IP - encouraged by the newly-appointed Vice-Chancellor. In keeping with **Durham's** customary *modus operandi*, a working party composed of administrators and academics was established to investigate IP matters In the end, due to unforseen circumstances, it was the administrative members of this working

party who were largely responsible for the policy which finally emerged - and for Durham's response to the ESG.

Although Durham did not formally adopt the relevant sections of the CVCP's 1978 report, in some respects its approach is not dissimilar Internal documentation suggests, for instance, that the university regards itself as very much in the driving seat when it comes to determining how its IP will be exploited [70] It is unlikely, though, that the CVCP's report provided the rationale for this Although internal documentation describes Durham's approach to the exploitation of IP as an *ad hoc* one - treating each discovery as a "*discrete transaction*", in fact, the university was so strongly influenced by its anxiety to avoid any course of action which might entail risk to its reputation or its resource base that this is almost a meaningless statement As we have seen, Bristol's attitude was very similar, but whereas Bristol left it to its policy-implementer to work out what that might mean in practice, Durham's policy-makers seem to have thought this through in more detail Where patentable IP is concerned, in 1989/90 it was university policy to immediately assign ownership to a third party in the vast majority of cases, rather than retain it Durham believed this strategy exposed it to less risk - particularly risk of litigation - and required less effort to manage. This same anxiety underlay Durham's policy of assigning patentable IP to particular types of assignee, namely large, reputable companies, rather than smaller/less well-known companies or start-up companies. As far as Durham was concerned, this minimised both types of risk at a stroke It believed that large companies like ICI could be trusted to check out the worldwide potential of a discovery at once and to take out patent protection in the relevant countries without the university having to devote any effort/resources to this, in Durham's view, smaller companies or those whose reputation was less well-known were probably less reliable in this respect, indeed, less reliable in many respects Furthermore, Durham's policy-makers

believed that retaining ownership of patentable IP and exploiting a discovery entrepreneurially via a university company or a joint venture would risk depleting the university's funds today in the (possibly vain) hope of financial gain tomorrow; they did not feel they could justify this unless the circumstances were quite exceptional. One wonders how lay members of Council managed to persuade the university to set up a holding company in 1988, with a view to exploiting its IP more entrepreneurially; it is no great surprise to learn that **Durham** decided to wind up the company just two years later, having made no use at all of the framework it provided

It is difficult to know what makes **Durham's** policy-makers so risk-averse; unlike **Liverpool**, the university is not constrained by extremely cautious lay members of Council - indeed, the lay members may be less cautious than those members of the administration and the academic community responsible for devising the university's IP policy. Nor is **Durham's** risk-aversion based on experience - at least, not its own, the university has only once allowed patentable IP to be exploited entrepreneurially and has never been the victim of a critical incident. If **Durham** was influenced by knowledge of critical incidents in other UK universities, it made no mention of this Interestingly, **Durham** was a little less anxious about the risk attached to other types of IP and was prepared, for example, to indulge in direct marketing of computer software, as well as marketing it via agreements with major hardware companies.

Whatever the reason, if academics at **Durham** were to challenge the university's policy of immediately assigning to a third party ownership of the IP they had generated, as far as the university is concerned, it would fall to the Treasurer to decide whether or not to relax or uphold that policy; the policy-implementer would have little or no say in this If academics disagreed with the Treasurer's decision, the matter would probably go to the

Vice-Chancellor for arbitration. The legality of this approach has already been questioned It raises another question altogether in connection with the respective roles of the university and the academic in the exploitation process how was it possible for these same policy-makers - or a constituent part of them - to make a commitment to the ESG in respect of its requirement regarding the role of the academic in the exploitation process at the very same time as formulating this policy? Was Durham paying no more than lip-service to this requirement in the interests of political expediency [71]? The explanation seems to be that **Durham** interpreted/chose to interpret this requirement in terms of the scientific/technical contribution to technology transfer conventionally made by academics, rather than a more commercial/entrepreneurial contribution - and the ESG did not go out of its way to query **Durham's** reponse to the Kingman letter [72] This interpretation is supported by a line in **Durham's** annual report to the ESG It states "*Inventors . remain involved in the exploitation of their IPR as far as they wish*" [73] If ownership of their IP has been assigned to a large existing company, the only involvement they will be able to have is a scientific/technical involvement. This may also explain why **Durham's** academics were allowed to identify potential assignees/licensees and approach them, but not allowed to conduct or even participate in the negotiations **Durham** believes that the vast majority of academics in the science base have links with companies - even junior academics It expects academics to make contact with the scientific/technical staff of a company - *ie* with those members of staff with whom they already have links through consultancy work or collaborative research - not with the higher echelons of management On the other hand, this may not be university policy, it may simply be how the policy-implementer has decided to operate

It was observed at the end of section 7 3 that it is difficult to locate **Kent** on the spectrum which has universities which give their academic staff the fullest opportunity and scope to

It was observed at the end of section 7.3 that it is difficult to locate Kent on the spectrum which has universities which give their academic staff the fullest opportunity and scope to assume responsibility for exploiting their research findings and ideas at one end and zero opportunity at the other In large part this is because 1989/90 was a year in which considerable change took place, with responsibility for the protection, evaluation and exploitation of IP arising out of Research Council-funded projects being withdrawn from the remit of the managing director of KSIP and added to the remit of a career administrator This particular administrator had no experience in such matters and was often unable to say how the university would respond in terms of measures (a)-(j) - or was able only to give an off-the-cuff response. The very fact that he could give only off-the-cuff responses answers most of the questions posed at the beginning of section 7 4 - *viz* to what extent are differences between the nine participating universities the result of policy decisions, taken advisedly, influenced perhaps by objective constraints or critical incidents, have policy-makers devoted insufficient attention to these aspects of their IP policy - or no attention at all; have policy-makers not thought through the implications for the implementation of their policy clearly enough, have they failed to convey their conclusions to their policy-implementers with sufficient force and clarity; or have policy-implementers simply ignored their university's guidelines?

The creation of KSIP and the drive to get the university involved in industrial liaison - and, presumably, the exploitation of IP - was led by *academics* - specifically, the Dean of the Faculty of Natural Sciences in 1979 In the view of the administrator with responsibility for IP, this was seen by the administration and the rest of the academic community as a personal hobby which he should be allowed to pursue His pursuit of it was aided by the UGC's decision to award a pump-priming grant of £34,000 in 1980/81. It would appear that policy-making was left to KSIP's Board of Directors, which consisted

the result that KSIP's first managing director was effectively given *carte blanche* to proceed as he saw fit. When he left in 1986, Kent recognised that this had not been the most effective *modus operandi*. At this stage, Kent formally established a readily identifiable group of policy-makers - *viz* the Industry, Research & Development Committee (IRDC) However, this was wound up in 1989 because it had failed to meet once during the previous two years In April 1989, an Industrial & Commercial Policy Board (ICPB) was established, to replace the IRDC and to "*review policy and practice with regard to IPR and patents*". By the autumn of 1989 it had apparently met only once and had failed to provide the Senior Assistant Registrar with any policy whatsoever - nor had it made any attempt, either formally or informally, to seek his advice or give him advice Thus, once again, it appears, Kent's policy-implementer was left to concoct his own policy-by-default - or to react on an *ad hoc* basis, as the case may be (in view of the lack of IP infrastructure, the latter seems the more likely) Moreover, unlike his predecessors, this particular policy-implementer had no relevant experience to assist him. Given that, sequentially, four different people were responsible for the identification, evaluation, protection and exploitation of IP at Kent during the 1980s, and that they all, seemingly, had marked differences of opinion on how to go about this, it is evident that members of the academic community at Kent have been subjected to very mixed messages, in so far as they have received any messages at all On reflection, we should probably locate Kent at the bottom of the rank order given on page 320 - by default, rather than by design. Who should we hold responsible for this situation? The administrator who assumed responsibility for IP matters in 1989 attributed this to a lack of leadership "at the top", where IP matters were concerned It is worth noting that in his opinion, this was not atypical where Kent was concerned

CHAPTER 8

8 TO WHAT EXTENT DO THE NINE PARTICIPATING UNIVERSITIES ENCOURAGE ACADEMICS TO ASSUME RESPONSIBILITY FOR EXPLOITING THEIR DISCOVERIES?

8.1 Introduction

Sir Keith Joseph's statement of 14 May, 1985 not only expressed the wish that UK universities should give researchers the fullest opportunity and scope to assume responsibility for exploiting their discoveries; it also asked universities to **"encourage"** their staff to do so Once again, the document made no attempt to prescribe or even list means by which universities might do this - with one exception It required universities to equitably share any revenue arising from the exploitation their IP with the relevant academics It suggested, furthermore, that the academics' share should be commensurate with the responsibility they assumed for that exploitation

To establish the extent to which participating universities encourage their academics to assume such responsibility, we need to employ objective measures. It was felt that appropriate measures could be constructed using the various means by which universities could encourage their academics However, it proved difficult to translate theory into practice, owing to a singular lack of information on the various means which universities might reasonably be expected to employ Only one of the sources of assistance discussed in chapter 5 proposed means other than the financial incentive outlined by the Secretary of State in his statement, the AUT suggested that academics whose IP was successfully exploited should be rewarded not only financially, but also in terms of career progression. This yielded just two measures, which were not felt to be adequate to the task.

In the absence of guidance or literature on this subject, it was decided to construct for the purposes of this study a variety of possible means, many of which could be employed by any university without involving significant costs or other resources.

(i) Information Dissemination

Prior to 1985/86, there relatively were few opportunities for academics to assume responsibility for the exploitation of their discoveries, IP was usually obligated to the BTG or to the industrial/commercial sponsor Even if it was not, universities which asserted ownership of such IP often opted for exploitation routes entailing as little effort and risk to the institution as possible. they assigned/licensed it to a third party. The removal of the NRDC/BTG's monopoly after 35 years and the subsequent authorisation of universities was, therefore a significant change in itself At the same time, an even more significant change occurred, however Even though universities were authorised by the Research Councils, rather than individual academics, it was Secretary of State's wish that, in practice, academics should effectively inherit the BTG's right of first refusal to exploit their IP This particular aspect of the change-over was, if we may make an analogy with patent law, not only novel but also non-obvious Nonetheless, the highest echelons of university administration should have been made aware of these changes - and their significance - by virtue of receiving Sir John Kingman's letter and the DES statement and having to draft a reply. The Research Councils themselves provided material for Registrars and/or Secretaries to send to the relevant administrators, current grant holders and HoDs in science and engineering disciplines [1]. However, other academics were not systematically targetted by the Research Councils and were probably unlikely to know about these changes - or their significance - unless they were specifically informed [2]. These considerations yielded the following four measures

(a) **were academics informed of the removal of the BTG's right of first refusal; if so, when, and by what means?**

(b) **were academics informed of the Research Councils' offer and whether their institution planned to seek authorisation?**

(c) **were academics informed that their university had assumed the rights to and responsibility for the exploitation of IP arising out of Research Council-funded projects; if so, when and by what means?**

(d) **were academics informed of the Government's wish that, in practice, they should assume responsibility for exploiting their IP if they wished to; if so, when and by what means?**

The academic community of any university is, of course, dynamic rather than static; in any year a proportion of the academic staff leaves and, if the department is fortunate, is replaced by academics from other universities or by new appointments Where lecturing staff are concerned, this process was stimulated during the mid-late 1980s by the introduction of funding for "new blood" lecturing posts [3] and the early retirement scheme [4]; it is being encouraged during the 1990s by the NAAS scheme [5]. Where dedicated research staff are concerned, rapid turnover is the norm, due to the use of short, fixed-term contracts. These considerations yielded the following two measures

(e) **are new staff informed that their new employer has assumed the rights to and responsibility for the exploitation of IP arising out of Research Council-funded projects; if so, when and by what means?**

(f) **are new staff informed of the Government's wish that, in practice, they should assume responsibility for exploiting their IP, if they wished to; if so, when and by what means?**

As indicated in chapter 2, it is evident that most academics do not generate potentially exploitable IP all that frequently in their careers. It may therefore be advisable to remind them of these facts periodically. This consideration yielded the following two measures·

(g) **are staff periodically reminded that their university has assumed the rights to and responsibility for the exploitation of IP arising out of Research Council-funded projects; if so, how often and by what means?**

(h) **are staff periodically reminded of the Government's wish that, in practice, they should assume responsibility for exploiting their IP, if they wished to; if so, how often and by what means?**

(ii) Response to External Policy Initiatives

These eight measures are all concerned with concrete information relating to changes, the initiative for which originated outside universities They convey little about an individual university's response to those initiatives, in terms of its own policy initiatives There is a significant difference between informing academics of the Government's wish in this respect and signalling that the institution itself regards such activities favourably Universities can clearly do this by making appropriate policy statements; they could reinforce these by creating frameworks/structures which, by their very existence, signal their moral support These include university companies and/or a university company which can engage in joint ventures with members of staff, either directly or by forming subsidiaries For many academics, assuming responsibility for the exploitation of their discoveries is *terra incognita*, universities could also create one or more structures which signal the provision of practical support These might include, for example, a central office which provides/can refer academics to various kinds of practical support These considerations yielded the following two measures·

(j) **does the university signal its moral support by means of appropriate policy statements; if so, how does it ensure they are common knowledge?**

(k) **does the university signal its moral and practical support for academics assuming such responsibilities by creating appropriate frameworks/structures; if so, what kind - and how does it ensure their existence is common knowledge?**

(iii) Incentives

The Government evidently felt that simply urging academics to assume responsibility for exploiting their IP might not, in itself, be effective, it was seen as essential to create incentives Accordingly, the DES statement advocated revenue-sharing arrangements which financially reward academics to a degree which is commensurate with the level of responsibility they have assumed, this differs significantly from the revenue-sharing arrangements recommended in the various sources of assistance detailed in chapter 5, which simply reward academics if their IP is successfully exploited, whether or not they have had a hand in the exploitation process The AUT advocated a second incentive rewarding academics who played a part in the successful exploitation of their IP in terms of career progression, too

These incentives all reward academics personally and the university centrally, they do nothing for the department which generated the IP in question and which may have contributed to its successful exploitation by enabling academics to devote the necessary time, effort and resources This consideration yielded the following three measures

(l) **are academics whose IP is successfully commercialised rewarded financially; if so, what is the size of that reward and how is it determined?**

(m) **are departments which generate successfully commercialised IP rewarded financially; if so, what is the size of that reward and how is it determined?**

(n) **are academics whose IP is successfully commercialised - or who successfully commercialise it themselves - rewarded in terms of career progression?**

It is possible, of course, that universities have devised other incentives to encourage academics to assume responsibility for exploiting their research discoveries This thought yielded the following measure

(p) **what other incentives has the university devised to encourage academics to assume responsibility for exploiting their research discoveries?**

Clearly, all of these incentives will have little or no force unless the academic community is aware of them This thought yielded an additional measure

(q) **does the university ensure that academics and their departments are aware of the incentives it has created; if so, by what means?**

This list of means by which universities might encourage their staff to assume such responsibility does not pretend to be comprehensive In recognition of the fact that there might be other means, the final measure is:

(r) **does the university employ any other means of encouraging academics to assume responsibility for the exploitation of their discoveries?**

By identifying a number of potential means and allowing for the use of others, at least 15 measures of the extent to which universities encourage their staff to assume such a responsibility have been constructed

The remainder of chapter 8 will be structured as follows Section 8 2 will present the data elicited in relation to the nine participating universities' information dissemination activities and will evaluate their performance in terms of measures (a)-(h) Section 8 3 will summarise those findings Sections 8 4-8 5 will adopt the same approach with regard to measures (j)-(k), while sections 8 6-8 7 will focus on measures (l)-(r) Section 8 8 will conclude by considering whether differences in performance between the nine univerities are associated with objective factors such as the relative size of the university, the relative size of the science base, the severity of the 1981 cuts *etc* It will also attempt to reveal the processes which led to the situations described in the preceding sections in order to see whether these offer an explanation of differences in performance

8.2 Information Dissemination: Findings and Evaluation

(a) Were academics informed of the removal of the BTG's right of first refusal; if so, when, and by what means?

(i) Findings

Figure 17 shows whether the participating universities formally publicised the removal of the BTG's monopoly, it also shows who the recipients of the information were, if they did publicise it - and how long after the event they received this information. Essentially it reveals that the nine participating universities fall into three broad groups those which quickly informed everyone in the academic community of the removal of the BTG's right *of first refusal*, those which informed only selected members of staff, and those which at the time formally conveyed this information to neither the academic community at large nor to selected members of it.

Bristol and Glasgow are the only undisputed members of the first group. **Bristol** used its newsletter to convey this information to the academic community at large - albeit in small

print on the third page of a five-page supplement - on 16 May 1985, *ie* just two days after the announcement in Parliament. The supplement was concerned with the recommendations of a Senate committee investigating how to improve the university's relations with industry and provided a convenient "peg" on which to hang this news **Glasgow** devoted a whole article to the removal of the BTG's monopoly in its newsletter of 13 June, referring back to the Lancaster House announcement of 1983 and explaining the Government's motivation in taking this step. **City** also felt it had used its newsletter to publicise this information; it proved impossible to locate any mention of it in backnumbers of the newsletter, however, so this may not be the case [6]

At the time, universities in the second group, **York, Durham** and **Hull** and **Kent** formally conveyed this information only to the handful of senior academics who were members of committees/working parties drafting their institution's policy on IP and its exploitation - or, in **Kent's** case, those who were on the board of KSIP. At **York** the academic community at large did not learn of the removal of the BTG's monopoly until a year later, when it was mentioned in passing in the newsletter. **Durham, Hull** and **Kent** apparently made no effort, centrally, to convey this information to the wider academic community, either at the time or in the years which followed

Members of the third group, **Liverpool** and **Strathclyde,** did not at the time formally communicate this information to the academic community at large or to senior academics. **Strathclyde** soon passed the information informally, by word of mouth, to "*the active players*" in the university, it did not formally communicate it to the academic community at large until December 1987 At **Liverpool** the academic community at large learned about the removal of the BTG's monopoly at the end of 1986

(ii) Evaluation

Universities performance in relation to measure (a) will be evaluated collectively once the initial findings for measures (a)-(d) have been presented This was felt to be the most appropriate approach, in view of the fact that the four pieces of information are intimately connected with each other, at the time, information relating to one or two of these events would have made little sense without accompanying information relating to the others

(b) Were academics informed of the Research Councils' offer and whether their institution was seeking authorisation; if so, when and by what means?

(i) Findings

Figure 18 shows whether the participating universities formally publicised the Research Councils' offer and indicated whether the institution was seeking authorisation, it also shows who the recipients of the information were, if they did publicise this - and how long after the event they received this information It reveals that, once again, the nine participating universities fall into three broad groups those which quickly informed the academic community at large about the Research Councils' offer and the university's plans, those which conveyed both pieces of information to selected members of the academic staff, and those which, at the time, formally conveyed this to nobody outside the administration.

The only member of the first group is Glasgow. The newsletter article of 13 June 1985 announced the arrival of the Kingman letter and comprehensively outlined its implications. It indicated that the university would have to decide whether to assume the rights and responsibilities previously held by the BTG, giving it the choice of exploiting IP via third party companies, via limited companies set up expressly for the purpose, or via the BTG - if it chose to The article concluded by describing the Exploitation Scrutiny Group's

(ESG) role in vetting universities' responses and monitoring annual reports from those which were duly authorised. However, the article gave hint as to whether **Glasgow** planned to seek authorisation, or what the consultation and decision-making processes might entail.

Bristol, Durham, Hull, Kent and **York** make up the second group. Despite taking the trouble to inform the academic community that the BTG's right of first refusal had been removed, **Bristol** did not spell out in its May 1985 newsletter article the fact that the Research Councils had offered the university the chance to assume the rights to and responsibilities for the exploitation of IP previously obligated to the BTG - or whether the university planned to seek authorisation Information regarding the Research Councils' offer was transmitted only to the Committee of Deans [7] at that time and it is not clear when or, indeed, if it was ever conveyed to the academic community at large. Similarly, **York, Durham, Kent** and **Hull** formally told only a handful of senior academics at the time, these were members of committees/working parties drafting their institution's policy on IP and its exploitation - or, in **Kent's** case, members of the board of KSIP. Although **York** mentioned the removal of the BTG's monopoly in the newsletter of May 1986, it made no mention of the Research Councils' offer or whether it planned to seek authorisation Confusingly, in view of the fact it did not report this, the article indicated that **York** was still using the BTG but that it was exploring the possibility of using the Research Corporation, too.

At the time, neither **City, Liverpool** nor **Strathclyde** formally told anyone outside the administration about the Research Councils' offer or its response **City's** omission is probably due to the fact that the management had unilaterally decided not to seek authorisation until it had fleshed out a detailed policy, based on experience. Once again,

Strathclyde soon passed the information informally, by word of mouth, to "*the active players*" in the university; it did not formally communicate it to the academic community at large until December 1987. At **Liverpool** the academic community at large learned about the Research Councils' offer at the end of 1986, however. Thus, all three universities seem to have received their letter of authorisation from the Research Councils before the academic community at large was informed that the offer had been made in the first place.

(ii) Evaluation

As indicated, universities' performance against measure (b) will be evaluated at the end of section 8 2(d)

(c) Were academics informed at the time that their university had assumed the rights to and responsibility for the exploitation of IP arising out of Research Council-funded projects; if so, when and by what means?

(i) Findings

Figure 19 shows whether the participating universities formally publicised the fact that they had been authorised by the Research Councils; it also shows who the recipients of the information were - and how long after the event they received this information. It reveals that the nine participating universities divide into four groups, broadly Members of the first group, **Glasgow, Liverpool** and **York**, made efforts to ensure that everyone in the academic community learned fairly quickly that their university had been authorised to assume the rights to and responsibilities for exploitation of IP arising out of Research Council-funded projects **Glasgow** publicised its authorisation from the Research Councils by means of a newsletter article in March 1987, four months after receiving the actual letter. In late 1986 **Liverpool** sent to every member of staff in the Faculties of Science,

Engineering, Medicine and Veterinary Science a letter detailing both the removal of the BTG's monopoly and its authorisation from the Research Councils, the same letter was sent to departmental research correspondents in the other Faculties, with a request to circulate it. This was followed in June 1987 by a special issue of the newsletter, dealing with "*Resources and Research*", a section headed "*Exploitation of Research Council Inventions*" detailed the removal of the NRDC's (*sic*) right of first refusal, the Research Councils' offer and their subsequent letter of authorisation. **York** did not receive its authorisation from the Research Councils until October 1987, nearly a year after most universities; within weeks, **York** sent to every HoD a copy of both its submission to the Exploitation Scrutiny Group and the resulting letter of authorisation HoDs were asked to circulate the information to every member of staff, it proved impossible after so many years to establish whether they did, in fact, and if so, by what means Once again, **City** felt that it had used its newsletter to publicise the authorisation from the Research Councils, received in July 1989, once again, it proved impossible to locate any mention of this in backnumbers of the newsletter However, **City's** code of practice relating to IP, which was authorised by Council in July 1989, mentioned in passing that the university had been authorised to exploit IP arising from Research Council-funded projects without being obliged to give first option to the BTG, it was circulated to every member of staff in the summer of 1989

The sole member of the second group is **Durham**, where only Deans and HoDs were formally told that the university had been authorised to assume the rights to and responsibilities for exploiting IP arising out of Research Council-funded projects; they received a memo to this effect shortly after the letter of authorisation arrived **Durham** missed at least one tailor-made opportunity for informing the academic community at large in 1987, when it amended its terms and conditions of employment to take account of its

new IP policy, all staff were notified of the changes, but they were not told the reason for them. In fact, no evidence could be found that the academic community at large has ever been told about the university's authorisation from the Research Councils

Members of the third group, **Hull, Kent** and **Strathclyde,** seem to have made no effort to formally communicate to the academic community at large or even to senior academics that they had been authorised by the Research Councils - either at the time or within a few months of receiving the letter. At **Kent** the Vice-Chancellor, in his capacity as Chairman of KSIP, had pledged to do this once the authorisation was received, in the event, it appears he neither did so himself, nor did he delegate that responsibility to anyone else. At **Hull,** too, at least one tailor-made opportunity for informing the academic community was missed in February 1987 the university circulated a copy of its patent policy to every member of staff, it made no mention at all of the Research Councils' authorisation In the intervening years, neither **Hull** nor **Kent** have rectified this omission in any formal way - though **Kent** considered the idea in 1989 [8] However, a year and a half after it was authorised by the Research Councils, **Strathclyde** got around to formally telling the academic community at large, in December 1987 this was explained in an article in the newsletter, written by the newly appointed IPR officer Prior to that, **Strathclyde** had continued its policy of passing such information to "*the active players*" informally, by word of mouth.

It is not clear what happened at **Bristol** Files show that, at the time, the university considered various options, from telling senior academics to informing the entire academic community. However, there is no record of which option was chosen. It is entirely possible that, in the end, academics were not formally told until 1987, when, it is believed, the Vice-Chancellor sent a memo to at least some members of staff concerning

the authorisation from the Research Councils

(ii) Evaluation

As indicated, universities' performance against measure (c) will be evaluated at the end of section 8 2(d).

(d) Were academics informed of the Government's wish that, in practice, they should assume responsibility for exploiting their IP; if so, when and by what means?

(i) Findings

Figure 20 was designed to show whether the participating universities formally publicised the the government's wish with regard to the role of the academic in the exploitation process, who the recipients of the information were - and how long after the event they received this information What it reveals is a resounding silence on this subject It proved impossible in eight of the participating universities to locate any documentation - or even the remembrance of documentation - which explicitly or implicitly informed academics of the Government's wish in this respect, either at the time or in the following months/years. At **Glasgow**, however, when outlining the implications of the Research Councils' offer for the university, the newsletter article of June 1985 mentioned that the university had to decide whether to let the rights previously held by the BTG pass to individual academics. There is no evidence that the university's position in this respect was ever clarified, though We are forced to conclude, therefore, that the concept has not been explicitly conveyed to members of the academic staff in eight of the participating universities, it is debatable whether many academics in **Glasgow** realised the implication of the newsletter article

(ii) Evaluation

Figures 17-19 all showed whether the participating universities formally publicised three separate but related events within 6, 12, 18 or 24 months of them happening, and who was the target of that publicity. Figure 20 showed whether they publicised the government's wish with regard to the role of the academic in the exploitation process within 6, 12, 18 or 24 months of being informed of this, *etc.* The reason for showing when the participating universities chose to inform the academic community they had been authorised by the Research Councils should be self-evident There is a reason for showing when they communicated the two preceding events - and the government's wish with regard to the role of the academic in the exploitation process, other than the fact that these events are intimately connected Although universities were asked to respond to the Kingman letter by October 1985, no date was given for authorising universities which satisfied the ESG's eleven criteria - indeed, there was no hint of the timetable envisaged. It was made clear, however, that if an academic made a potentially exploitable discovery during this transitional period, universities should informally consult the Research Council funding the project [9]. This was intended to convey that, although no authorisation had yet been made, where individual cases were concerned, the Research Councils were prepared to - and, indeed, did - discuss exploitation routes which did not involve the BTG [10]. Thus, there was a reason for informing the academic community as quickly as possible despite the fact that no authorisation had been granted, academics might be able to assume responsibility for the exploitation of their discoveries straightaway, with the Research Council's approval. Moreover, even if the academics concerned did not wish to assume responsibility for the exploitation of their IP, the university itself could discuss with the relevant Research Council exploitation routes which did not involve the BTG. This alone meant it was appropriate for the academic community to be told to contact the university during this transitional period, rather than the BTG directly, as many of them were used

to doing

For these reasons, the scoring system devised in respect of measures (a)-(d) weighted the timing of the information dissemination It also weighted the focus of the information dissemination, section 8 1 described how the Research Councils themselves provided universities with letters to send to current grant-holders and HoDs in science and engineering disciplines and outlined why it was appropriate for universities to ensure that all other academics were formally told, too. It was recognised that universities might have delegated this responsibility to HoDs However, it was felt that HoDs might not have acted upon this responsibility, or delayed acting upon it. So, universities which took the trouble to do this centrally should score more than those who delegated this responsibility. Within any 6-month period, therefore, universities which took the trouble to inform the whole academic community scored twice as many points as those which simply informed only selected academics It was decided to treat each of the four pieces of information as carrying equal weight, however It was recognised that the two most important pieces of information were probably the authorisation by the Research Councils and the government's wish regarding the role of the academic in the exploitation process, it was felt, though, that the three events - the removal of the BTG's monopoly, the Research Councils' offer and their subsequent authorisation of individual universities - were so intimately connected that it would be nonsense to pass on one without passing on the others, too. Moreover, as indicated, there was a reason for disseminating each individual piece of information as quickly as possible

Notes [11]-[13] outline the scoring system employed, **Evaluations 8.1-8.3** show the scores achieved by the participating universities in respect of their thoroughness in formally disseminating to existing members of staff news of these three events and news of the

government's wish regarding the role of the academic in the exploitation process, in respect of the focus of their efforts and the timing

EVALUATION 8.1: SCORE FOR THOROUGHNESS OF INFORMATION DISSEMINATION - MEASURES (a)-(d)

University	(a)-(c)	Score	%	(d)	Score	%
Bristol		3	100		0	0
City		1	33		0	0
Durham		3	100		0	0
Glasgow		3	100		0	0
Hull		2	66		0	0
Kent		2	66		0	0
Liverpool		4	133		0	0
Strathclyde		3	100		0	0
York		4	133		0	0

EVALUATION 8.2: SCORE FOR FOCUS OF INFORMATION DISSEMINATION - MEASURES (a)-(d)

University	(a)-(c)	Score	%	(d)	Score	%
Bristol		4	66		0	0
City		2	33		0	0
Durham		3	50		0	0
Glasgow		6	100		0	0
Hull		2	33		0	0
Kent		2	33		0	0
Liverpool		6	100		0	0
Strathclyde		6	100		0	0
York		4	66		0	0

EVALUATION 8.3: SCORE FOR TIMING OF INFORMATION DISSEMINATION - MEASURES (a)-(d)

University	(a)-(c)	Score	%	(d)	Score	%
Bristol		12	100		0	0
City		4	33		0	0
Durham		12	100		0	0
Glasgow		6	50		0	0
Hull		8	66		0	0
Kent		4	33		0	0
Liverpool		8	66		0	0
Strathclyde		6	50		0	0
York		12	100		0	0

If we aggregate the scores allocated to each university to create an indicator of information dissemination in relation to news of these four events, we obtain the following, descending rank order

	University	Indicator	Score
=1	**Glasgow**	50	(300/600)
=1	**Liverpool, York**	50	(299/600)
4	**Durham**	42	(250/600)
5	**Bristol**	40	(241/600)
6	**Hull**	28	(165/600)
7	**Kent**	22	(132/600)
8	**City**	17	(99/600)
9	**Strathclyde**	14	(82/600)

While there is no obvious connection between relative performance with regard to measures (a)-(d) and university type or overall size or the proportionate size of the science base, there may be an association between relative performance and the way in which these universities were treated by the UGC in 1981 - as defined for the purposes of this study It is noticeable that all three of those which were treated leniently share joint first position in the rank order, two of those which were treated neither particularly harshly nor particularly leniently occupy the middle ground, while two of those which were treated harshly occupy positions in the rank order close to the bottom It may be that performance is related in some way to the severity of the cuts, perhaps hard-hit universities tried to save money on staff time and resources by reducing the amount of information emanating from the centre, or perhaps these universities were quite simply distracted by the seriousness of their financial situation and paid little attention to something which even the AUT conceded was less important than other concurrent events [14]

(e) **Are new staff informed that their new employer has rights to and responsibility for the exploitation of IP arising out of Research Council-funded projects; if so, when and by what means?**

(i) Findings

Figure 21 shows whether the participating universities inform new staff that they have acquired the rights to and responsibility for the exploitation of IP arising out of Research Council-funded projects; it also shows the medium employed to communicate this and the date from which this information has been communicated to new staff.

Broadly, the nine participating universities fall into three groups Members of the first group, **City, Liverpool, York** and possibly **Durham** explicitly inform new staff that the institution has assumed the rights to and responsibilities for the exploitation of IP arising out of Research Council-funded projects At **York**, new members of staff now receive a copy of the new intellectual property regulations, which explicitly state that the university has been authorised by the Research Councils Prior to mid-1990, though, new staff were given no information on IP at all, since attendance at **York's** induction course for new staff is voluntary, and since all categories of staff attend the same course, making a presentation on IP policy and practice has not been seen as worthwhile In future, the information contained in the intellectual property regulations may be reinforced by a one-to-one conversation between the ILO and new academic staff, instead In future, too, information on the Research Councils' authorisation will be included in the staff handbook There will also be an explicit reference in the terms and conditions of employment. At **Liverpool**, new appointees receive a copy of the (extremely compendious) staff handbook, which now contains explicit references to the Research Councils' authorisation, prior to January 1990, it did not However, the subject was usually mentioned in the course of a presentation on IP policy and practice which the ILO

routinely makes at the induction course for new staff, this is a mandatory course, but new staff are only required to attend within three years of being appointed. Since July 1989, new members of staff at **City** have received a copy of the university's code of practice on IP, which mentions that the university has been authorised to exploit IP arising from Research Council-funded projects. The induction course for new staff is compulsory at **City**; however, although part of the course deals with issues relating to research, IP is not discussed in great detail. There is no guarantee that this opportunity is taken to reinforce the message regarding the university's authorisation At **Durham**, new appointees receive no written documentation referring explicitly to the authorisation from the Research Councils, **Durham's** terms and conditions of appointment refer broadly to IP without discriminating between IP arising from Research Council-funded projects as opposed to other projects However, the induction course for new staff is compulsory at **Durham** and since 1988 the Treasurer has used it as a forum for making a presentation on IP; the administrator responsible for IP presumes that the removal of the BTG's monopoly and the authorisation from the Research Councils is covered in the course of this presentation.

Bristol, Glasgow, Hull and **Strathclyde** belong to the second group, whose members broadly convey the institution's policy *vis-a-vis* IP without specifically mentioning this. Since 1989, the terms and conditions of employment of new staff at **Bristol** have made explicit reference to IP, citing the 1977 Patent Act and the 1988 Copyright, Designs and Patent Act, but they make no reference to the Research Council authorisation; prior to this, there was no reference to IP at all The ILO has proposed making a presentation on IP at the annual induction course for new staff, where such information could be conveyed in detail, his offer has yet to be taken up by the Personnel Office At **Glasgow**, since the summer of 1989, new staff have received a copy of the policy statement on IP, this makes no reference to the Research Council authorisation The induction course for new staff

does not include a presentation on IP, either At **Hull**, new staff have received a copy of the university's patent policy, which makes no reference to the university assuming exploitation rights and responsibilities; nor does the new policy statement, drawn up in 1990 **Hull's** induction course for new staff does not include a presentation on IP, either For years, new staff at **Strathclyde** have received the same set of guidelines on IP; however, these simply indicate that they are required to assign to the university all the rights in any IP which they generate They make no reference to the rights and responsibilities which the university has assumed. The induction course for new staff does not include a presentation on IP, so this is not explained there, either However, it is planned to incorporate in the staff handbook for 1990/91 a more detailed section on IP which makes explicit reference to those rights and responsibilities The guidelines on IP which new members of staff receive will be modified at the same time

The only member of the third group is **Kent** It is difficult to establish whether new members of staff routinely learn anything about the university's policy *vis-a-vis* IP, let alone details such as the Research Councils' authorisation This is because academics, academic-related staff and technicians are appointed by the individual Faculties, which also deal with the personnel aspects of such appointments.

(ii) Evaluation

Universities performance in relation to measures (e)-(f) will be evaluated collectively once the initial findings for both measures have been presented This was felt to be the most appropriate approach, in view of the fact that both pieces of information are intimately connected

(f) Are new staff informed of the Government's wish that, in practice, they should assume responsibility for exploiting their IP, if they wish; if so, when and by what means?

(i) Findings

Figure 22 was designed to show whether the participating universities inform new staff about the government's wish with regard to the role of the academic in the exploitation process; it was also to show the medium employed to communicate this and the date from which this information has been communicated to new staff Once again, it reveals a resounding silence on this subject In the same way that it proved impossible to locate any documentation - or even the remembrance of documentation - which informed existing staff of the Government's wish in this respect, no evidence was found of the Government's wish being conveyed to new members of staff in any of the participating universities We are forced to conclude, therefore, that this information is probably not conveyed to new members of staff

(ii) Evaluation

As **Figures 17-19** revealed, some attempt had been made to disseminate information about these three related events to existing members of staff during 1986 in **Liverpool** and possibly **Bristol**, during 1987 in **Durham, Glasgow, Strathclyde** and **York**, during 1989 in **City, Hull** and **Kent** do not seem to have completed the process, however. These dates should clearly determine the dates from which this information was formally disseminated to new members of staff Accordingly, the scoring system devised in respect of measures (e)-(f) weighted the timing of the information dissemination No justification was seen for weighting, relative to each other, the two mechanisms which universities might employ to disseminate this information - in writing (in terms and conditions of appointment/policy guidelines *etc*) and face-to-face, during the induction course for new staff, accordingly,

these were weighted equally However, the scoring system took account of whether the participating universities employed just one of these two mechanisms or both.

Notes [15]-[16] outline the scoring system employed; **Evaluations 8.4-8.5** show the scores achieved by the participating universities in respect of their thoroughness in formally disseminating these two pieces of information to new members of staff - and their timing.

EVALUATION 8.4: SCORE FOR THOROUGHNESS OF INFORMATION DISSEMINATION - MEASURES (e)-(f)

University	(e) Score	%	(f) Score	%
Bristol	0	0	0	0
City	1	50	0	0
Durham	1	50	0	0
Glasgow	0	0	0	0
Hull	0	0	0	0
Kent	0	0	0	0
Liverpool	2	100	0	0
Strathclyde	0	0	0	0
York	1	50	0	0

EVALUATION 8.5: SCORE FOR TIMING OF INFORMATION DISSEMINATION - MEASURES (e)-(f)

University	(e) Score	%	(f) Score	%
Bristol	0	0	0	0
City	1	100	0	0
Durham	2	66	0	0
Glasgow	0	0	0	0
Hull	0	0	0	0
Kent	0	0	0	0
Liverpool	1	25	0	0
Strathclyde	0	0	0	0
York	1	33	0	0

If we aggregate the scores allocated to each university to create an indicator of information dissemination in relation to new staff, we obtain the following, descending rank order.

	University	Indicator	Score
1	**City**	38	(150/400)
2	**Liverpool**	31	(125/400)
3	**Durham**	29	(116/400)
4	**York**	22	(88/400)
5	**Bristol, Glasgow, Hull, Kent, Strathclyde**	0	(0/400)

There is no obvious connection between performance in relation to measures (e)-(f) and university type or objective factors such as relative university size, relative size of the science base, relative severity of the cuts *etc*

(g) **Are staff periodically reminded that their university has assumed rights to and responsibility for the exploitation of IP arising out of Research Council-funded projects; if so, how often and by what means?**

(i) Findings

Figure 23 shows whether the participating universities periodically remind staff that they have assumed these rights and responsibilities, it also shows the media employed, the focus of the reminders and their onset and frequency It reveals that the nine participating universities differ considerably in their approach to this question Some explicitly remind staff about the rights and responsibilities which they have assumed, moreover, these all do so formally, in writing, on a regular basis Others try to raise awareness of IP in a more general way, without singling out Research Council-funded projects in particular Some issue reminders on a regular basis, others do not seem to work to any system Some use a variety of tactics, others rely on one or two tactics.

Bristol, Durham, Glasgow, Liverpool and **Strathclyde** explicitly remind selected members of staff about the rights and responsibilities which the institution has assumed, moreover, they all do so formally, in writing **Durham** and **Liverpool** send an annual

memo to HoDs and Deans, soliciting information which forms the basis of their annual report to the ESG **Glasgow** sends an annual circular to all postgraduates funded by the Research Councils and to their supervisors. **Bristol's** Vice-Chancellor is believed to send an annual memo to at least some members of staff, though it is not clear which **Strathclyde** has adopted a different approach, however: every time a proposal is successful in attracting funding from any of the Research Councils, the grant-holder is sent a standard letter, reminding him/her that notification of potentially exploitable IP is a condition of receiving that funding, grant holders are asked to make an appointment to discuss that potential with the IL office in due course **Durham, Liverpool** and possibly **Bristol** [17] have sent their reminders since 1987; **Strathclyde** and **Glasgow** started sending theirs later - in 1988 and 1989 respectively.

York, Hull and **Kent** have taken no steps to explicitly remind some/all members of staff of the rights and responsibilities which the institution has assumed, indeed, as section 8 2(b) indicated, at **Hull** and **Kent** the academic community does not appear to have been formally informed at all, let alone reminded However, **York** may regard its policy statement of summer 1990 as a reminder, the first since it informed HoDs late in 1987 that the university had been authorised by the Research Councils

City was authorised by the Research Councils so recently that it has not yet felt it necessary to issue any reminders However, **City** has started considering the best way to do so in due course Ideas proposed to date include a notice in the university newsletter, occasional presentations on IP as part of the staff development programme, periodically sending out a memo to this effect together with the monthly statements issued by the research grants and contracts office It is not clear whether these represent alternatives or tactics to be employed in tandem, no decision has yet been reached on this, or on how

often such reminders would need to be issued

Several of the participating universities have what we might describe as "ongoing", written reminders, as well as/instead of the iterative, "trigger" reminders described so far At **Liverpool**, for example, both the staff handbook and the research handbook contain references to the institution's rights and responsibilities in relation to IP arising from Research Council-funded projects; the next edition of the staff handbook at **York** and **Strathclyde** will do likewise **Hull's** new research handbook should contain a similar reference - unless no-one gets around to correcting out-of-date references to the NRDC contained in the draft version Institutions with dedicated policy statements, **York, City, Hull** and **Glasgow**, also employ an "ongoing" written reminder, however, only the first two of these explicitly mention being authorised by the Research Councils

(ii) Evaluation

Universities performance in relation to measures (g)-(h) will be evaluated collectively once the initial findings for both measures have been presented Once again, this was felt to be the most appropriate approach, in view of the fact that both pieces of information are intimately connected

(h) Are staff periodically reminded of the Government's wish that, in practice, they should assume responsibility for exploiting their IP; if so, how often and by what means?

(i) Findings

Figure 24 was designed to show whether the participating universities periodically remind staff that, in practice, they should assume responsibility for exploiting their IP, if they wish to, it also shows the media employed, the focus of the reminders and their onset and

frequency. Not surprisingly, perhaps, once again it reveals a resounding silence on the subject. In the same way that it proved impossible to locate in any of the participating universities any documentation - or even the remembrance of documentation - which explicitly informed academics of the Government's wish in this respect at the time, no evidence was found of the Government's wish being formally conveyed to members of staff in the intervening years. From this we must conclude that no such reminders were issued.

(ii) Evaluation

Figures 23-24 showed whether the nine participating universities have periodically reminded the academic community that they have been authorised by the Research Councils to assume responsibility for the exploitation of IP arising out of Research Council-funded projects - and that it is the government's wish that, in practice, academics themselves should assume that responsibility, if they are so minded The information was presented in terms of the media employed, the focus of the reminders, their onset and frequency. The media employed to remind staff about the authorisation from the Research Councils have been distinguished in order to give some indication of how thoroughly the participating universities have gone about the process of reminding their staff, ongoing written reminders act as ready reference material, written trigger reminders draw academics' attention to material which they might have forgotten/overlooked/thrown away and face-to-face reminders should have the same affect on those who treat written triggers as "junk mail". The reasons for displaying the focus of the reminders are the same as those detailed above in relation to disseminating the information in the first place The reasons for displaying the onset and frequency of reminders should be self-evident

Accordingly, the scoring systems devised in respect of measures (g) and (h) weighted the focus of the reminders They also weighted the onset of the first reminder - on the basis of the norm described in respect of measures (e)-(f). Finally, they weighted the frequency of subsequent reminders, annual reminders, sent a year after the university received its letter of authorisation, were felt to be a reasonable norm, especially since the Research Councils required authorised universities to submit an annual report, this should have triggered an information-gathering exercise which provided a convenient "peg" on which to hang the appropriate reminders. Only written "trigger" reminders were weighted by timing and frequency; ongoing written reminders were weighted in terms of the timing of their introduction Face-to-face reminders were neither weighted nor scored in terms of the timing or frequency of reminders, unlike the face-to-face dissemination of information to new staff, which takes place in the context of the annual induction course and is therefore verifiable, the timing and frequency of these face-to-face reminders is neither predictable nor easily verifiable. However, the scoring system took account of whether the participating universities claimed to have employed one, two or all three mechanisms, weighting these equally

Notes [19]-[20] outline the scoring system employed, **Evaluations 8.6-8.8** show the scores achieved by the participating universities in respect of their thoroughness in formally reminding staff about the authorisation from the Research Councils and the government's wish regarding the role of the academic in the exploitation process, in respect of the focus of their efforts and their timing

EVALUATION 8.6: SCORE FOR THOROUGHNESS IN ISSUING REMINDERS - MEASURES (g)-(h)

University	(g) Score	%	(h) Score	%
Bristol	2	66	0	0
City	-	-	-	-
Durham	2	66	0	0
Glasgow	2	66	0	0
Hull	1	33	0	0
Kent	0	0	0	0
Liverpool	3	100	0	0
Strathclyde	2	66	0	0
York	3	100	0	0

EVALUATION 8.7: SCORE FOR FOCUS OF REMINDERS - MEASURES (g)-(h)

University	(g) Score	%	(h) Score	%
Bristol	2	40	0	0
City	-	-	-	-
Durham	2	40	0	0
Glasgow	2	40	0	0
Hull	1	20	0	0
Kent	1	20	0	0
Liverpool	4	80	0	0
Strathclyde	2 5	50	0	0
York	5	100	0	0

EVALUATION 8.8: SCORE FOR ONSET AND FREQUENCY OF WRITTEN REMINDERS - MEASURES (g)-(h)

University	(g) Score	%	(h) Score	%
Bristol	3	50	0	0
City	-	-	-	-
Durham	3	50	0	0
Glasgow	1	16	0	0
Hull	0	0	0	0
Kent	0	0	0	0
Liverpool	4	66	0	0
Strathclyde	2	33	0	0
York	2	50	0	0

If we aggregate the scores allocated to each university to create an indicator of information dissemination in relation to reminding staff, about the authorisation from the Research

Councils and the government's wish that, in practice, academics themselves should assume responsibility for the exploitation of their IP, if they are so minded, we obtain the following, descending rank order

	University	Indicator	Score
1	**York**	42	(250/600)
2	**Liverpool**	41	(246/600)
3	**Bristol, Durham**	26	(156/600)
5	**Strathclyde**	25	(149/600)
6	**Glasgow**	20	(122/600)
7	**Hull**	9	(53/600)
8	**Kent**	3	(20/600)

There is no obvious connection between performance in relation to measures (g)-(h) and university type or objective factors such as relative university size, relative size of the science base *etc*, though there may be an association between the relative severity of the cuts may be related to these universities' performance *vis-a-vis* issuing reminders to staff

8.3 Summary: Information Dissemination

Judging by the scores allocated in section 8 2, as a group the nine participating universities initially disseminated information about the removal of the BTG's monopoly, the Research Councils' offer and their subsequent authorisation with more thoroughness than they set about reminding members of staff in the years which followed - and with considerably more thoroughness than they set about informing staff appointed after they first publicised the Research Councils' authorisation As a group, they seem to have been somewhat less efficient about disseminating news of these three events quickly, nor were they particularly efficient about issuing reminders within a reasonable timescale, however, they were least alert to the need to inform new members of staff as quickly as possible after they first publicised the Research Councils' authorisation As a group, too, they were not particularly efficient about the focus of the information; they not only relied to a

considerable extent on selected academics to transmit news of the three events; they relied on them even more to remind staff about the Research Councils' authorisation.

These scores reveal considerable variation within the group, though. **Liverpool** and **York** were the most thorough when it came to disseminating news of these three events initially; they have both been the most thorough about issuing reminders, too, and, unlike **York**, **Liverpool** has also been thorough about informing new members of staff appointed after the authorisation from the Research Councils was first publicised. **City** was the least thorough about disseminating news of these three events initially but in 1989/90 it was one of only three universities apart from **Liverpool** to routinely inform new members of staff about its authorisation from the Research Councils.

Bristol, **Durham** and **York** were the most efficient about disseminating news of these three events quickly, but all three have issued reminders far less quickly than they might have done; **Liverpool** has been the most efficient in this respect, though it could have done so sooner, too. **Hull** and **Kent** stand out by virtue of having been completely inefficient in this respect. Only **City** seems to have grasped the need to tell new staff about the Research Councils' authorisation from the point that this news was first circulated around the academic community, though **Durham** apparently recognised this a year later. **Bristol**, **Glasgow**, **Hull**, **Kent** and **Strathclyde** do not seem to have recognised the need to tell new staff at all.

Only **Glasgow**, **Liverpool** and **Strathclyde** initially disseminated information about all three events to the whole academic community, rather than delegate this to selected academics; neither **Glasgow** nor **Strathclyde** have felt it necessary to remind the whole academic community, though, relying instead on selected academics to pass on the

message, only **York** has targetted its reminders on the whole academic community, rather than rely on selected academics, though **Liverpool** comes a close second Once again, **Hull** and **Kent** stand out by virtue of their inefficiency in this respect

If we aggregate the scores allocated to each university in the course of section 8 2 to create an overall indicator of information dissemination, we obtain the following descending rank order.

	University	Overall Indicator	Overall Score
1	**Liverpool**	42	(670/1600)
2	**York**	40	(637/1600)
3	**Durham**	33	(522/1600)
4	**Glasgow**	26	(422/1600)
5	**Bristol, City**	25	(397/1600) (249/1000)
7	**Strathclyde, Hull**	14	(231/1600) (218/1600)
8	**Kent**	10	(152/1600)

It is clear that none of the participating universities' performances even approximates to the minimum laid down for the purposes of this study Where **Liverpool, York** and **Durham** are concerned, this is due largely to the fact that they have neglected completely to convey to members of staff the government's wish with regard to the role of the academic in the exploitation process. However, the other six universities have also fallen down in terms of initially disseminating information about the removal of the BTG's monopoly, the Research Councils' offer and their subsequent authorisation to new and existing members of staff and in terms of issuing periodic reminders

Where information dissemination is concerned, then, none of the participating universities could be described as having encouraged academics to assume responsibility for the exploitation of their discoveries, if they were so minded In fact, it could be argued that -

wittingly or unwittingly - they actively discouraged academics in this respect It is pertinent to speculate on impact of these institutions passing on - albeit less efficiently than they might have done - news of the *university*'s assumption of the rights to and responsibilities for the exploitation of IP arising out of Research Council-funded projects but not news of the government's wish that, in practice, *academics* themselves could assume responsibility. This calls to mind the AUT's concern that individual academics might perceive the new arrangements as simply exchanging the BTG's monopoly for a monopoly held by their employer [21].

8.4 Response to External Policy Initiatives: Findings and Evaluation

(j) Does the university signal its moral support for academics assuming such responsibilities by means of appropriate policy statements; if so, how does it ensure that they are common knowledge?

(i) Background

All universities which wished to assume rights to and responsibilities for exploiting IP arising out of Research Council-funded projects were obliged to first satisfy the ESG with regard to the role of the academic in the exploitation process Chapter 5 described how failure to do so would have led to an exchange of correspondence between the ESG and the university and chapter 7 indicated that at least four of the participating universities received letters from the ESG asking for clarification on the role of the academic This meant that sooner or later, all the participating universities were forced to include in the documentation they sent to the ESG a statement indicating acceptance of the ESG's requirement concerning the role of the academic in the exploitation process - whatever they understood by that

As far as could be determined, only one of the participating universities made a copy of its response to the ESG available to the academic community at large. **York** quickly sent all HoDs a copy of its response and the letter of authorisation, together with a note asking them to circulate it to all members of staff. In **Glasgow** and **Kent**, only the most senior academics - a Vice-Principal, a Deputy Vice-Chancellor and two Pro-Vice-Chancellors respectively - formally saw their university's response to the ESG, by virtue of having helped draft it. In **Bristol**, only the Committee of Deans had detailed knowledge of it, for the same reason. At **Durham** and **Hull**, only a handful of senior academics - Deans and/or HoDs - knew the details of their university's response to the ESG, through membership of committees/working parties which were in the process of formulating a policy on IP. If senior academics at **City**, **Liverpool** or **Strathclyde** saw a copy of their university's response, they did so as the result of an informal rather than a formal process, as far as can be determined

If, for some reason, universities did not want to circulate a copy of their actual response to the ESG, that response nonetheless provided the basis for a dedicated policy document which could be circulated to all members of the academic staff

(ii) Findings

Figures 25-26 show whether the nine participating universities have, in fact, disseminated policy statements to existing and new members of staff, and if so, in which year and in which manner. They reveal that the participating universities fall into two distinct groups. Four of them - that is to say, nearly half - have not issued a dedicated policy statement which is aimed at the academic community at large **Bristol**, **Durham**, **Kent** and **Strathclyde** have certainly not signalled their moral support for academics assuming responsibility for the exploitation of their discoveries in this particular manner. It is

pertinent to consider whether they might have signalled it in any other context. This seems not to be the case in **Bristol, Durham** or **Kent,** despite the fact that **Bristol's** Vice-Chancellor is reputed to be strongly in favour of such activities. However, there is no doubt that **Strathclyde** has recently signalled its moral support for academic entrepreneurship, specifically. Following years in which the Principal made comments to this effect at meetings of Court, in 1989 it was given formal expression for the first time, not as a stand-alone policy, but as one of the Business Venture Group's stated objectives Members of the academic staff were duly informed that Strathclyde was committed to "*encourag[ing] staff to form spin-out companies and inculcat[ing] an enterprise culture*". A copy of the relevant document was circulated to all members of staff in the course of 1990

Only **City, Glasgow, Hull, Liverpool** and **York** have drafted and circulated/publicised dedicated policy statements on IP. However, these five universities vary considerably in the extent to which they could be said to signal the institution's moral support for academics assuming responsibility for the exploitation of their research discoveries. Two not only make no reference, even obliquely, to academics being able to assume responsibility for the exploitation of their research discoveries, they deal with the exploitation of IP in a way which suggests that it is not their concern One makes no reference at all to the respective roles of the university and the academic in the exploitation process; indeed, it makes virtually no reference to the exploitation process at all. One deals with the exploitation process but is rather enigmatic about the respective roles of the university and the academic. Only one deals unambiguously with the respective roles of the university and the academic, indicating that the two operate in partnership.

Liverpool's latest policy statement, although dated January 1990, is virtually identical to the policy statement which it has included in the staff handbook since the late 1970s; in other words, it is taken *verbatim* from the CVCP's 1978 report, with one or two modifications Accordingly, it deals exclusively with the exploitation of inventions, it is not made clear that the exploitation of other forms of IP is governed by the same procedures, even though **Liverpool's** response to the Kingman letter stated categorically that the provisions of the 1977 Patent Act are taken to apply to all types of IP. It is stated in the staff handbook that academics should consult the IL office on whether and how steps should be taken to protect and exploit their invention It emphasises that unless the university informs them it does not wish to participate in the development and exploitation of their discovery, it will be the university which undertakes responsibility for this Members of staff "*shall, as directed by the University*", refer the invention to the BTG for assessment and, if it thinks fit, exploitation under its auspices If not, members of staff are expected to enter into appropriate agreements for protecting the secrecy of the invention unless and until it is patented, join with the university in applying for patent protection and "*collaborate*" with the university in exploiting the invention in one of three specified ways, even though by that time they should be joint owners of it and should therefore have an equal say Those three ways are·

(i) direct assignment or licensing to an industrial company,

(ii) assignment or licensing to a company via a third party such as the university's own company, ULTRA, the Merseyside Innovation Centre or the BTG,

(iii) the establishment of a new commercial venture to market the service or product through ULTRA

There is no indication whether the term "*collaborate*" could mean members of the academic staff contacting potential assignees/licensees and negotiating with them. Nor is there any indication, despite **Liverpool's** unambiguous response to the ESG's queries, that the establishment of a new commercial venture to market services/products though ULTRA could take the form of a joint venture between ULTRA and the academic(s) concerned, in which the academic(s) would be offered an equity stake Indeed, it is not at all clear what role academics might play, if any, in such new commercial ventures. Moreover, **Liverpool's** policy statement appears to preclude altogether the formation of independent academic spin-off companies to exploit research discoveries under license, even though this is one of the exploitation options explicitly outlined by **Liverpool** in response to the Kingman letter The impression which the policy statement gives concerning the role of the academic in the exploiation process is significantly different to the role described by the university in its response to the Kingman letter and the ESG's follow-up queries. It also gives the impression of being far less amenable to the academic's wishes than the policy outlined verbally during the course of the fieldwork and detailed in section 7 2. The references to ULTRA were, of course, out of date within a few months of this edition of the staff handbook being circulated, it will be interesting to see how the next edition deals with the respective roles of the academic and the university in the exploitation process

Hull's first policy statement, circulated in 1987, also relies on the relevant section of the CVCP's 1978 report, quoted *verbatim* As such, it, too, focusses on inventions. Accordingly, it emphasises that the university undertakes responsibility for the development and exploitation of inventions and that members of staff shall do as the university directs, both in respect of protecting their invention and exploiting it - even though they are supposed to be joint owners of the patented IP and should therefore have

at least an equal say. Hull's policy statement indicates that assigning to the BTG or assigning/licensing to existing companies are possible exploitation routes, however, it makes no mention of the university company, nor does it say anything about joint ventures with members of staff or academics exploiting their research discoveries via independent spin-off companies. This section of the CVCP's 1978 report has been retained in the latest document, too, circulated at the end of 1989/90. Moreover, this second policy statement indicates that the university will also undertake responsibility for the exploitation of other forms of IP and that members of staff are expected to collaborate with the university in exploiting this, too, if asked Like **Liverpool's**, **Hull's** written statement of policy sounds far less amenable to the academic's wishes than the policy outlined verbally during the course of the fieldwork and detailed in section 7 2

Glasgow's latest dedicated IP policy statement, circulated to every member of staff in October 1989, does not discuss the respective roles of the university and academics; indeed, it makes no reference to the exploitation process at all This contrasts with its earlier IP policy statement, in force between 1982 and 1989, which went into considerable detail. It appeared to allow academics to assume responsibility for much of the exploitation process - indeed, it relied on them to do so Academics were asked to describe the companies likely to be interested in exploiting their discovery, to estimate the annual volume of gross sales, the value of those sales and the cost of development prior to production. They were also asked to research the possibility of obtaining funding for development The university saw its role as engaging legal assistance, paying for patent protection, where appropriate, and determining the return to be levied in exchange for a license. The policy statement explicitly encouraged academics to consider setting up in business to exploit their research discoveries themselves, preferably in the science park

York's IP regulations, circulated to all members of staff in 1990, may well allow for the possibility of academics making decisions about the exploitation of their IP; they are sufficiently enigmatic as to prevent us from being certain about this, however. They note that if the university does wish to become involved in the exploitation process, it will want to ensure that "*mutually acceptable provision*" is made for patenting and exploiting IP of any sort; it is not clear whether this means mutually acceptable to the university and the academic(s) concerned, mutually acceptable to the university and potential exploiters, or what. The regulations list possible actions which might then be taken, including the formation of a limited liability company They indicate that "*interested parties*" will jointly determine which action to take after discussing the options, again, it is not clear whether these "*interested parties*" include the academic(s) concerned, or not The phraseology employed is open to a variety of interpretations. However, it could be argued that, although the regulations do not explicitly signal the university's moral support for academics assuming responsibility for the exploitation of their discoveries, they do not explicitly rule it out

City's code of practice, circulated to every member of staff in mid-1989, is the only policy statement to unambiguously address the question of the respective roles of the university and members of staff It describes the relationship as "*a partnership*" - reflecting the fact that the university and the academic are deemed to be joint owners of all forms of IP

(iii) Evaluation

When evaluating these universities' performance against measure (j), it is obviously appropriate to take account of whether they have drafted a policy statement on IP - and if so, when it was disseminated and in what manner Policy statements disseminated before

the university was authorised by the Research Councils may demonstrate support for a different approach to the exploitation of IP to the one advocated by the ESG; if they were not modified and disseminated again soon after authorisation was given, they could perpetuate an out-of-date approach. Policy statements drafted and disseminated after the university was authorised by the Research Councils should not, one would imagine, exhibit that problem but if they were not disseminated soon after authorisation was given, they would not be as effective in achieving the desired objective. The reason for taking account of the manner in which policy statements were publicised is that if universities rely on one-off, trigger information alone, once several years have passed, it may be regarded as out-of-date Moreover, one-off, trigger information may only be kept for reference if the recipient sees a reason for doing so, if he regards it as relevant to his situation at the time, if not, it may well be consigned to the waste paper bin or mislaid Thus, there is a strong argument for the university providing ready reference material by supplementing one-off, trigger information with ongoing information, such as an entry in the staff handbook.

It is not difficult to devise a scoring system which takes these two factors into account. However, the scoring system also needs to take into account something which **Figures 25-26** do not show, namely the content of these policy statements, where they exist Clearly, a policy statement which is issued in the optimum manner at/from the appropriate time has little value from the perspective of this study if it does not convey to the academic community the university's support for these externally-inspired policy initiatives - in particular, support for the concept of academics assuming responsibility for the exploitation of their IP, if they wish Since it is not within the scope of this study to undertake a rigorous content analysis, this presents a problem The best we can do is to make a rough and ready stab at evaluating these policy statements from this perspective

We might categorise policy statements which make no reference to the exploitation process or the respective roles of the university and the academic as neutral, those which suggest that decision-making is the prerogative of the university and that academics may carry out only those procedures they are instructed to we might categorise as negative or very negative; finally, those which indicate potential for the academic to make decisions/carry out procedures we might categorise as positive or very positive The scoring system also has to take account of the fact that issuing a "negative" policy statement is probably more harmful than issuing none at all.

Notes [22]-[24] outline the scoring systems employed. **Evaluation 8.9** shows the scores achieved by the participating universities in respect of the timeliness of one-off and ongoing policy statements; **Evaluation 8.10** shows the scores which they achieved in respect of the content of those policy statements - *ie* the extent to which they convey their support for these externally-inspired policy initiatives - and in particular, support for the concept of academics assuming responsibility for the exploitation of their IP, if they wish; **Evaluation 8.11** shows their scores for the combined effect of the content and timing of their IP policy statements These scores give an indication of universities' performance with regard to existing members of staff With one exception, the scores would be the same with regard to issuing IP policy statements to new members of staff, of those universities with dedicated IP policy statements, only Hull does not seem to issue its statement as part of the package for new appointees, this would give Hull a score of zero instead of -8, were we to score this separately

EVALUATION 8.9: SCORE FOR TIMELINESS IN ISSUING POLICY STATEMENTS

University	Trigger Score	%	Ongoing Score	%
Bristol	0	0	0	0
City	5	100	0	0
Durham	0	0	0	0
Glasgow (1)	1	20	0	0
Glasgow (2)	2	40	0	0
Hull	4	80	0	0
Kent	0	0	0	0
Liverpool	0	0	5	0
Strathclyde	0	0	0	0
York	2	40	0	0

EVALUATION 8.10: SCORE FOR CONTENT OF POLICY STATEMENT

University	Score	%
Bristol	0	0
City	1	50
Durham	0	0
Glasgow (1)	1	50
Glasgow (2)	0	0
Hull	-2	-100
Kent	0	0
Liverpool	-2	-100
Strathclyde	0	0
York	0 5	25

EVALUATION 8.11: SCORE FOR THE COMBINED EFFECT OF THE CONTENT AND TIMING OF IP POLICY STATEMENTS

University	Trigger Score	%	Ongoing Score	%
Bristol	0	0	0	0
City	5	50	0	0
Durham	0	0	0	0
Glasgow (1)	1	10	0	0
Glasgow (2)	0	0	0	0
Hull	-8	-80	0	0
Kent	0	0	0	0
Liverpool	0	0	-10	-100
Strathclyde	0	0	0	0
York	1	10	0	0

If we aggregate each university's score to create a policy initiative indicator in relation to issuing a policy statement, we obtain the following, descending rank order:

	University	Indicator	Score
1	**City**	40	(200/500)
2	**Glasgow (1)**	16	(80/500)
3	**York**	15	(75/500)
4	**Glasgow (2)**	20	(40/500)
5	**Bristol, Durham, Kent, Strathclyde**	0	(0/500)
9	**Hull, Liverpool**	-20	(-100/500)

There is no obvious connection between performance against measure (j) and university type or objective factors such as size of university, size of the science base or the severity of the cuts imposed by the UGC in the early 1980s

(k) Does the university signal its moral and practical support for academics assuming such responsibilities by creating appropriate frameworks/structures; if so, which - and does it ensure their existence is common knowledge?

(i) Background

There are a number of frameworks/structures which a university could create which would signal its moral and practical support for academics who assume responsibility for exploiting their research discoveries, particularly those who wish to do so in a more entrepreneurial way The principal examples are

* a dedicated IL/IP structure,
* a holding company,
* joint ventures with academics,
* a university company/companies,
* a science park.

(ii) Findings

Dedicated IL/IP Structure

As indicated in section 8 1 (ii), for many academics, assuming responsibility for the exploitation of their discoveries is *terra incognita* Universities could signal the provision of practical support of various kinds by establishing a central office where academics could obtain assistance/be referred to appropriate sources of assistance

Figure 27 shows whether the participating universities support the concept of having a dedicated IL/IP structure, whether they have put the concept into practice - and if so, when; it also shows whether they have publicised the concept of a dedicated IL/IP structure, as well as the actual example, finally, it indicates the number of publicity items relating to dedicated IL/IP structures which could be found in university newsletters [25] and the year(s) of publication

Holding Company

Generally, organisations only set up a holding company if they intend to create wholly-owned subsidiary companies or joint ventures with other parties, or acquire existing companies. UK universities are highly unlikely to acquire existing companies, so, from the point of view of academics with an interest in exploiting their discoveries entrepreneurially, a holding company could provide a potent signal of the university's interest in or acceptance of the first two activities - provided its existence and function is publicised It also has the advantage of keeping entrepreneurial ventures of all sorts at arms' length from the university, legally and financially

Figure 28 shows whether the participating universities support the concept of setting up a holding company, whether they have put the concept into practice - and if so, when, it

also shows whether they have publicised the concept of a holding company, as well as any actual examples; finally, it indicates the number of publicity items relating to holding companies which could be found in university newsletters and the year(s) of publication

Joint Ventures with Academics

Although it may be the recommended *modus operandi* in some quarters, setting up a holding company is not the only framework within which a university can undertake entrepreneurial ventures. It has the option of participating directly in joint ventures with third parties, members of staff or a combination of the two If it is prepared to participate in/does participate in joint ventures with members of staff and publicise the fact, this, too, could provide a potent signal to academics with an interest in exploiting their discoveries entrepreneurially.

Figure 29 shows whether the participating universities support the concept of participating in joint ventures with members of staff, whether they have put the concept into practice - and if so, when, it also shows whether they have publicised the concept of a holding company, as well as any actual examples; finally, it indicates the number of publicity items relating to holding companies which could be found in university newsletters and the year(s) of publication

University Companies

Universities also have the option of creating university companies In the context of this study, the term "university company" is used to refer to companies wholly-owned by a university, or jointly owned with one or more third parties, excluding members of staff, in the case of joint ownership, the university would have more than a token share of the equity and executive representation on the board. Academics could play a part in the day

-to-day running of the company - either on a part-time basis or by being temporarily seconded, eventually, of course, they might work for the company on a full-time basis. Academics might also hold a position such as technical director or even managing director in such companies

Figure 30 shows whether the participating universities support the concept of setting up university companies to exploit IP generated by members of staff, whether they have put the concept into practice - and if so, when, it also shows whether they have publicised the concept of a university company, as well as any actual examples, finally, it indicates the number of publicity items relating to university companies which could be found in university newsletters and the year(s) of publication.

Science Park

Figure 31 shows whether the participating universities are in favour of the concept of having a science park, whether they have put the concept into practice - and if so, when, it also shows whether they have publicised the rationale for having a science park, as well as details of actual examples, finally, it indicates the number of publicity items relating to science parks which could be found in university newsletters and the year(s) of publication

It should be noted that actual developments which have been characterised for the purposes of this study as a science park exhibit considerable variation in name [26], mission and size [27]. In some cases, differences in size are a function of age [28], with further phases due to be built in due course

(iii) Evaluation

The reason that **Figures 27-31** distinguish between approval-in-principle and actual practice is that it is inappropriate for any university to create certain frameworks/structures for the sake of it University companies/joint ventures with members of the academic staff clearly fall into this category, this should only be done when the right opportunity presents itself On the other hand, there is no reason why they should not indicate their approval-in-principle of such initiatives, rather than limit their publicity efforts to actual examples, when they happen

It is not difficult to construct a series of scoring systems which take account of whether universities approve-in-principal or have actually created these various frameworks/structures - and if so, when It is difficult, though, to construct a series of scoring systems which take account of the size and transparency of publicity items. These vary tremendously For instance, publicity relating to science parks which was identified in the course of the fieldwork ranged from references-in-passing to dedicated, full-page or even page-and-a-half articles The content ranged from items which make an explicit connection between the science park's objective of attracting start-up companies and the idea that those companies could be set up and possibly run by members of the academic staff, exploiting their research discoveries or expertise Even the number of publicity items creates a problem with regard to evaluation. what constitutes a reasonable number of publicity items?

In order to evaluate universities' performance with regard to measure (k) in a meaningful way, we first need to construct a reasonable minimum expectation with regard to the number of publicity items If a university is in favour, in principle, of certain frameworks/structures (*eg* university companies, joint ventures with members of staff *etc*)

but has not, for one reason or another, translated approval-in-principle to practice, it is reasonable to expect it to indicate their approval-in-principle periodically It is reasonable to expect a university to publicise any move from approval-in-principle to practice and to explain the purpose of any frameworks/structures it creates Having created a framework/structure, it is reasonable to expect it to publicise its activities and achievements at least once a year. The end of a company's financial year provides a trigger for informing the academic community about its purpose and achievements, including, where appropriate, its profitability

Evaluating the size and transparency of publicity items posed a more intractable problem. Newsletters differ in page size, font size and format, so that a page in one may amount to considerably less than a page in another This could possibly be overcome by undertaking a comparative word-count, but this was felt to be inappropriate in view of the fact that, as has already been remarked, it is not within the scope of this study to undertake a rigorous content analysis It was felt that evaluating the size of publicity items had little value without a corresponding evaluation of the transparency of the content. Accordingly, publicity items were not evaluated in this more detailed manner, the scoring systems took account only of the number of publicity items and the year(s) of publication For similar reasons, the scoring systems did not evaluate the extent to which publicity items explained and promoted the concept of the various frameworks/structures, as well as actual examples of them.

Notes [29]-[33] outline the complex scoring systems employed **Evaluations 8.12-8.16** show the scores achieved by the participating universities for setting up and publicising an IL office, founding and publicising a holding company, participating in and publicising joint ventures with members of staff, setting up and publicising university companies and

creating and publicising a science park

EVALUATION 8.12: SCORE FOR SETTING UP AND PUBLICISING A STRUCTURE TO HANDLE INDUSTRIAL LIAISON/INTELLECTUAL PROPERTY

University	Setting Up		Publicity	
	Score	%	Score	%
Bristol	0.80	80	0 33	33
City	0 00	0	-	-
Durham	0 00	0	-	-
Glasgow	0.10	100	0 83	83
Hull	0.10	100	0	0
Kent	0 80	80	0 50	50
Liverpool	0 10	100	0 17	17
Strathclyde	0 10	100	0 17	17
York	0 75	75	0 20	20

EVALUATION 8.13: SCORE FOR PUBLICISING THE UNIVERSITY HOLDING COMPANY

University	Score	%
Bristol	0 25	25
City	-	-
Durham	0 00	0
Glasgow	-	-
Hull	0 00	0
Kent	-	-
Liverpool	0 20	20
Strathclyde	-	-
York	-	-

EVALUATION 8.14: SCORE FOR APPROVAL-IN-PRINCIPLE FOR PARTICIPATING IN JOINT VENTURES WITH MEMBERS OF STAFF AND FOR PUBLICISING APPROVAL-IN-PRINCIPLE AND/OR ACTUAL EXAMPLES

University	Principle Score	%	Publicity Score	%
Bristol	1	100	0	0 0
City	1	100	0	0 0
Durham	0	0	-	-
Glasgow	1	100	2	14 0
Hull	1	100	1	17 0
Kent	1	100	0	0 0
Liverpool	1	100	4	19.0
Strathclyde	1	100	1	2 5
York	1	100	0	0 0

EVALUATION 8.15: SCORE FOR APPROVAL-IN-PRINCIPLE FOR SETTING UP UNIVERSITY COMPANIES AND FOR PUBLICISING APPROVAL-IN-PRINCIPLE AND/OR ACTUAL EXAMPLES

University	Principle Score	%	Publicity Score	%
Bristol	1	100	1	17
City	1	100	7	78
Durham	1	100	0	0
Glasgow	1	100	1	17
Hull	1	100	2	20
Kent	1	100	0	0
Liverpool	1	100	0	0
Strathclyde	0	0	-	-
York	1	100	2	67

EVALUATION 8.16: SCORE FOR SETTING UP AND PUBLICISING A SCIENCE PARK

University	Setting Up Score	%	Publicity Score	%
Bristol	0	0	2	33
City	1	100	2	67
Durham	1	100	3	50
Glasgow	1	100	4	67
Hull	1	100	1	17
Kent	1	100	0	0
Liverpool	1	100	0	0
Strathclyde	1	100	4	50
York	0	0	3	60

The scores relating to the publicity items were difficult to allocate, since - despite the commments above about the inability to undertaken content analysis - this nonetheless involved a certain amount of judgement about the likely impact of the publicity items in question. So, for instance, articles which detailed joint ventures but which failed to indicate that they were joint ventures were not scored for the purposes of this exercise Conversely, **Bristol** and **York** scored for publicising their efforts over a number of years to create a science park, notwithstanding the lack of a science park during the period in question The very specific definition of this period had the effect of penalising **City,** where there is little doubt that the academic community is well aware of the university's approval-in-principle of university companies - and its translation into practice. It was felt that **City's** use of the newsletter to publicise the setting up and ongoing activities of its university companies represented a model which other universities would do well to emulate if they are serious about wishing to encourage members of the academic staff to assume responsibility for the exploitation of their research discoveries **City's** newsletter provided regular updates on the university's companies - often using the annual accounts as the "peg" on which to hang news of their activities However, much of this publicity preceded the period defined for the purposes of this exercise

If we aggregate each university's score to create an indicator in relation to setting up and publicising appropriate frameworks/structures, we obtain the following, descending rank order

	University	Indicator	Score
1	**Glasgow**	73	(581/800)
2	**City**	64	(445/700)
3	**Kent**	54	(430/800)
4	**Strathclyde, York**	53	(370/700)(422/800)
6	**Liverpool**	51	(456/900)
7	**Hull**	50	(454/900)
8	**Bristol**	43	(388/800)
9	**Durham**	36	(250/700)

There is no apparent connection between performance against measure (k) and university type - except to note that all three civic universities performed badly - or objective factors such as size of university, size of the science base or the severity of the cuts imposed by the UGC in the early 1980s, *etc*

8.5 Summary: Policy Initiatives

Judging by the scores allocated in section 8 4, as a group those participating universities which did disseminate policy statements have not thought out their approach as well as they might have done With the exception of **Liverpool,** they have all concentrated on "trigger" information and neglected altogether to provide "ongoing" information. Moreover, they have paid considerably more attention to timeliness when it comes to issuing policy statements than they have to the content of those policy statements - that is to say, the message which those policy statements convey in relation to encouraging members of the academic staff to assume responsibility for the exploitation of their research discoveries These scores also reveal considerable variation within the group **City** and **Hull** paid far more attention the timeliness of their policy statements than **York** or **Glasgow** However, the message conveyed by **Hull's** - and **Liverpool's** - policy statement was considered to be sufficiently negative from the perspective of encouraging members of staff to assume responsibility as to be counter-productive

It is obvious from **Evaluations 8.12-8.16** that there is a marked discrepancy between the approach which the nine universities claim to have adopted to joint ventures, university companies *etc* and the extent to which they have communicated their approach to their respective academic communities through the university newsletter There is less of a discrepancy between intentions/attitudes to science parks than the other frameworks/structures under consideration The greatest discrepancies are exhibited in relation to company start-up of one form or another. It is not really surprising that **Durham** encountered no exploitation projects which could be progressed via companies founded as subsidiaries of its holding company in view of the fact that it did not publicise the existence and objective of the holding company in its newsletter

Clearly, the policy of the newsletter editor could play a part in this, it is possible that some newsletter editors regard this kind of activity as not of academic interest and therefore not worthy of coverage However, this is clearly not the case in some of the participating universities It was noticeable, for instance, that at **Strathclyde** the newsletter contained seven items on the activities of Strathclyde Technology Transfer Ltd (set up to exploit "soft" IP via consultancy) and only one on the activities of the RDS during the same period This suggests a lack of attention on the part of the ILO to publicising the IP-related role of the IL office, it may be inappropriate to assume that because research-active academics are bound to encounter the research-related activities of the IL office, they will also grasp the IP-related activities Even if the newsletter editor is not sympathetic to coverage of such activities, this is an issue which should be addressed if a university is serious about encouraging academics to assume responsibility for the exploitation of their research discoveries It seems more likely, though, that the lack of publicity results from inattention on the part of the policy-makers or policy-implementer(s), rather than obstruction

If we aggregate the scores allocated to each university in the course of section 8 4 to create an overall indicator, we obtain the following descending rank order

	University	Overall Indicator	Overall Score
1	City	54	(645/1200)
2	Glasgow	49	(641/1300)
3	York	38	(497/1300)
4	Kent	33	(430/1300)
5	Strathclyde	31	(370/1200)
6	Bristol	30	(388/1300)
7	Liverpool	27	(356/1300)
8	Hull	25	(354/1400)
9	Durham	21	(250/1200)

It is clear that none of the participating universities' performance even approximates to the minimum laid down for the purposes of this study This is due largely to the fact that, although most of these universities claim to have adopted at least a positive in-principle approach to some if not all of these frameworks/structures, and although some have translated approval-in-principle into practice, they have signally failed to communicate this to their respective academic communities In some instances, they have omitted to publicise the setting-up of the framework/structure in question, let alone its ongoing activities Moreover, it was noticeable that examples identified of publicity regarding, say, spin-off companies from the university, almost invariably failed to use the opportunity to convey a message concerning the university's view of such activities, or even its involvement in such activities It was interesting to note, however, that items relating to these frameworks/structures were often included in the annual reports of some of these universities - particularly those relating to company start-up in one form or another. This suggests that the universities concerned perceive them to be of non-academic as opposed to academic interest. If this is not the case, the universities concerned would be wise to adopt a more considered and coherent approach to publicity concerning such frameworks/structures

8.6 Incentives: Findings and Evaluation

(I) Are academics whose IP is successfully exploited rewarded financially; if so, what is the size of that reward and how is it determined?

(i) Introduction

In seeking to establish the answer to this question, it is helpful to consider first what is meant by IP which is "successfully exploited". At the very least, the phrase implies technology which has been successfully transferred - *ie.* it is used/marketed by at least one company in the form of novel or improved processes/products *etc.* The value of transferred technology may be measured in a number of different ways, some more easily quantifiable than others. Examples include the profit to the companies concerned, economic regeneration of the region, economic regeneration of the industries concerned - or, indeed, several different industrial/commercial sectors It can also be measured in terms of the revenue which it has generated - or promises to generate - for the university It may also be helpful to remember that technology can realise these various values only if it has first been identified, evaluated, protected in one way or another and its transfer duly arranged. Bearing this in mind, it is evident that in theory, at least, universities could reward academics for their contribution to the various stages of the exploitation process - *ie* for their effort, alternatively, or in addition, they could reward academics for the value which they have helped create.

(ii) Findings

All the participating universities financially reward academics whose IP is successfully exploited; most introduced a formula to govern the division of revenue some years before the ESG urged them to do so, as Figure 32 shows However, this reward has nothing at all to do with their contribution to the various stages of the exploitation process and it is

certainly not commensurate with the the degree of responsibility which they have assumed, as the DES recommended Instead, the participating universities reward academics for the value they have helped create, or rather one manifestation of that value They are rewarded only if their IP yields an income for the university. Despite that common approach, there are considerable variations in the size of that reward and in the manner in which that size is determined - though the nine exhibit a fairly uniform approach to certain questions With the exception of **Strathclyde**, for instance, all the participating universities recoup the direct costs incurred in protecting and exploiting the IP in question before making any payment to the academic/research team [34] Since April 1990, however, **Strathclyde** has treated these costs as a first charge on just 80 per cent of any income received, it immediately distributes the remaining 20 per cent

All the participating universities specify the size of the reward at the outset, before it is clear how large a return might be made from exploiting the IP in question Not one has formally instituted a mechanism for reviewing that reward in the light of the actual return. However, since they all express the size of the reward in terms of a percentage of the overall income, rather than a fixed sum, this may not present a problem

Seven of the participating universities employ a single, standard revenue-sharing formula based on a percentage of the overall net income The eighth employs not one but several standard revenue-sharing formulae - and the ninth deals with every case on an *ad hoc* basis **Glasgow** and **Liverpool** simply allocate 50 per cent of the income to the academic(s), irrespective of the amount of income received This is also how **Strathclyde** operated until April 1990, when it introduced a sliding scale, like **Bristol, City, Kent, York,** and, in certain situations, **Hull** The sliding scales employed by these last six universities vary in that they incorporate anything from two to five income bands In four

universities, these are "fixed" income bands *ie* it has not occurred to **Bristol, City, Strathclyde** or **York** that it might be necessary to adjust their income bands in line with inflation **Kent** has found it necessary in the past to make this kind of adjustment, but does so after quite arbitrary periods, rather than employ a regulatory mechanism. Only **Hull** has formally linked its income bands to the index of retail prices for all items excluding food, with February 1987 as the base-line, the income bands are supposed to increase annually [35]. There is, however, no reference to this in the proposed new policy document circulated in draft form in the summer of 1990, this may be an oversight.

Durham alone has steadfastly refused, despite what it perceives as considerable pressure from the ESG, to employ a standard revenue-sharing formula At **Durham** the level of the reward is determined on a case by case basis, taking into account who contributed most of the background IP, who contributed most of the foreground IP, to what extent university facilities were used, whether the academic/research team received a university equipment grant - and the projected income Accordingly, academics might be rewarded with as much as 95 per cent of the revenue, or they might receive as little as 10 per cent, though the average is probably closer to a 50 50 split In this calculation no account is taken of the number of academics involved

Of all the participating universities, only **Hull** takes any account of the number of academics involved. In certain situations [36], **Hull** rewards a team of four or more academics on a different basis to a smaller team/an individual academic **Hull** is the only university to employ not one but several standard revenue-sharing formulae, expressed in terms of algebraic equations, these are highly complex compared to the formulae employed by the other seven universities [37] The choice of formula may be determined by who paid the patenting costs, even though **Hull** recoups direct costs incurred prior to

distributing the revenue. It may also be determined by the extent to which the university contributed in other financial ways to the exploitation process, and the extent to which it contributed administratively The choice is also influenced by who paid for the research and who exploits the IP arising from it Curiously, some of **Hull's** revenue-sharing formulae operate on the basis of annual income, whereas others operate on the basis of absolute income - as they do in all the other participating universities

Figure 33 shows the size of reward which academics would receive in eight of the participating universities at a variety of income levels, **Durham's** *ad hoc* approach to assessing financial rewards prevents us from making a similar comparison; the various formulae which operate at **Hull** account for the four different figures for **Hull** under each income band.

(iii) Evaluation

Measure (l) is particularly interesting to evaluate, since each participating university can be evaluated relative to the others in the study, and relative to the CVCP's and the AUT's suggested figures. In addition, we can evaluate the nine participating universities as a group, relative to a much larger group of UK universities and relative to the CVCP's and the AUT's suggested figures.

Figure 34 shows the standard deviation of these universities as a group for each income band, excluding **Hull** (4), which was not taken into account since it applies only to >3 researchers, it also shows the percentage width of the standard deviation [35]. This indicates that as a group these universities exhibit greatest variation in the size of the reward they give at very low and very high income levels, they exhibit least variation in the £50,001-100,000 income band - though there is still considerable variation. This does not tell us

anything about the generosity of individual universities, relative to the others in the group, of course We might perhaps discover this by ranking them in order of generosity under each income band. If we do this, we see that certain patterns do emerge: for example, **City** is the most generous on incomes upto and including £100,000, but the second least generous if a discovery generates a larger income, whereas **Kent** is consistently the least generous. However, it is the inconsistency of universities' rankings which is the most striking thing to emerge from this ranking exercise This makes it difficult to allocate scores directly on the basis of the numerical data presented in **Figure 33.** It makes it imperative to devise a scoring system which expresses the consistency of these universities' generosity across all these income bands

Note [39] outlines the scoring system employed, **Evaluation 8.17** shows the scores achieved by the participating universities for the consistency of their generosity, relative to other members of the group, in financially rewarding academics whose IP is successfully exploited

EVALUATION 8.17: SCORE FOR CONSISTENT GENEROSITY IN REWARDING ACADEMICS (ON BANDED INCOMES RANGING FROM £1-1,000,000)

University	Score	%
Hull (3)	56 5	81
City, York	54 0	77
Hull (2)	49 0	70
Strathclyde	43 0	61
Bristol	37 0	53
Glasgow, Liverpool, Hull (1)	26 0	37
Kent	13 5	19

These scores are interesting in that they reveal the 50 50 split which **Glasgow, Liverpool** and **Hull** (1) favour to be considerably less generous to the academic(s) concerned - over this range of income bands - than the formulae employed by every other university except

Kent; this would seem to contradict the commonly repeated adage that a 50.50 split is

treated fairly leniently by the UGC at the time of the cuts in the early 1980s (as defined for the purposes of this study) occupy bottom but one position in this rank order, whereas two of the universities which were treated most harshly by the UGC occupy the top positions in the rank order. Those which were treated neither particularly harshly nor particularly leniently occupy the middle ground, a phenomenon which has been observed on several occasions in the course of this study

Figure 34 also shows the size of the reward which CVCP and AUT guidelines suggested academics should receive at these seven different income bands Underneath this it shows, for each of these income bands, the direction in and extent to which the participating universities, as a group, have deviated from the CVCP's guidelines (Discrepancy 1) [40]. It is clear that as a group, the reward these universities give is lower than the CVCP's suggested figure for every income band The greatest discrepancy occurs at lower income levels - upto and including £30,000 There is less of a discrepancy where IP generates an income of £50,001-100,000, though as a group these universities are still substantially less generous. There are only a couple of instances of individual universities giving a reward which is greater than or equal to the size suggested by the CVCP Two of the formulae employed at Hull do this, at higher income levels, otherwise, it is only City which occasionally exceeds the CVCP's suggested figures at low income levels. We should remember, though, that the sums listed in Figure 34 represent the size of reward given by the participating universities in 1989/90, whereas the CVCP circulated its suggested formula in 1985/86. The CVCP's figures should presumably be adjusted to take account of compound inflation running at 17 8 per cent by the end of 1989, 29 per cent by the end of 1990 [41]. However, since we would also need to adjust the income bands, it is not

practicable in the context of this study to arrive at the true extent to which the participating universities deviate from the CVCP's suggested figures.

Figure 34 also shows for each income band the direction in and extent to which the participating universities, as a group, have deviated from the AUT's guidelines (Discrepancy 2) [42] It is clear that as a group these universities financially reward academics less generously than the average of the AUT's suggested figures for every income band, too. Again, the greatest discrepancy occurs at lower income levels, particularly the £10,001-30,000 income band There is much less of a discrepancy where the IP generates a substantial income - £0 5m or more, in fact, the discrepancy at these higher income levels is negligible It is not surprising, therefore, to find that there are quite a few instances of individual universities giving a reward which is greater than or equal to the average size of the reward suggested by the AUT **Glasgow, Liverpool and York** do this at the two highest income levels, as does **Hull** with all three of its formulae. **York** exceeds the AUT's suggested figures at several lower income levels, too, as do **City** and **Bristol.** Again, though, we should remember that the sums listed in **Figure 34** represent the size of reward given by the participating universities in 1989/90, whereas the AUT circulated its two formulae in 1985/86 The AUT's figures should presumably be adjusted to take account of compound inflation running at 17 8 per cent by the end of 1989, 29 per cent by the end of 1990, too

Having established that the participating universities reward academics whose IP is successfully commercialised considerably less generously than the CVCP suggested and somewhat less generously than the AUT suggested, it is appropriate to consider whether, as a group, these universities are particularly stingy or whether their rewards are largely in line with the financial rewards which other UK universities make to inventive

academics. Since the data for all UK universities are not available, this study has only one means of of ascertaining this: using figures derived from a survey of universities which UDIL presented at its autumn meeting in 1989. UDIL's findings were presented anonymously, but it is known that at least one of the participating universities is included in this group, judging by the figures derived from UDIL's findings, another two could be included. Although 42 universities were surveyed, only 31 responded in a way which allowed the reward they make to be calculated in a compatible way Even then, there are gaps in the data, owing to the fact that some universities negotiate the reward on an individual basis above specified income bands, the averages have been adjusted accordingly **Figure 35** shows the size of reward which academics would receive in these 31 universities at a variety of income levels, together with the standard deviation for each income band and the percentage width of the standard deviation. It is evident that with one exception - the £30,001-50,000 income band, this larger group exhibits greater variation within each income band than the group of nine participating universities. **Figure 35** also shows for each income band the direction in and extent to which the participating universities, as a group, deviate from this larger group of UK universities. It is clear that the participating universities are consistently stingier than this larger group, particularly at higher income levels. However, the discrepancy is negligible compared to the discrepancy between the CVCP's suggested figures and the rewards made by the participating universities. This suggests either that, as a group, UK universities are not prepared to reward academics whose IP is successfully commercialised as generously as the CVCP suggested - or they have forgotten to adjust their income bands to take account of inflation, or a combination of the two Finally, **Figure 36** shows for each income band the direction in and extent to which the rewards given by this larger group of UK universities deviate from the CVCP's and the AUT's suggested figures.

(m) Are departments which generate successfully commercialised IP rewarded financially; if so, what is the size of that reward and how is it determined?

(i) Background

The idea that universities should share the financial rewards accruing from the exploitation of IP with the department which generated it was mentioned by neither the CVCP nor the AUT, neither the DES nor the Research Councils - nor even the ESG

(ii) Findings

Nonetheless, eight of the participating universities now reward departments financially if they generate IP which is successfully commercialised - though one is a very recent convert to this practice. In six, a department's reward is a function of the institution's standard revenue-sharing formula. In **Glasgow** and **Liverpool**, departments receive a fixed percentage of the income, irrespective of the amount received. In **Bristol, City, Hull, York** and now **Strathclyde**, departments receive a percentage which varies according to the amount of income received In the eighth, **Durham**, the department's reward is a function of an *ad hoc* agreement, reached after taking into account the factors outlined in the preceding section. Thus, a department's contribution to the creation of a discovery should be reflected in the size of its reward

In 1989/90 **Kent** was the only participating university which did not financially reward departments if they generated IP which is successfully commercialised. This is due more to failing to get to grips with this question than to an in-principle decision not to reward them

(iii) Evaluation

The failure of the CVCP, AUT, DES, Research Councils and ESG to suggest that universities should split the residue of IP income between the centre and the Department which generated it means that there is less scope for evaluating measure (m), there are no suggested figures or formulae to use as a baseline. However, UDIL's 1989 survey tried to establish whether UK universities share the residue with the department which generated it; it would appear that of the 31 universities which responded in a way which allowed the reward they make to be calculated in a compatible way, 19 (61%) do <u>not</u> reward the departments which generated the IP. There is evidence to suggest that respondents did not provide the information required with the greatest care, however, so perhaps we should be wary of placing too much faith in these particular findings, especially since eight (89%) of the nine participating universities <u>do</u> distribute part of the income from IP to the department which generated it

Figure 37 shows the size of the reward which departments would receive in eight of the participating universities at a variety of different income levels [43]; **Durham's** ***ad hoc*** approach to assessing financial rewards prevents us from making a similar comparison.

(iii) Evaluation

Figure 37 also shows the standard deviation for each income band and the percentage width of the standard deviation This indicates that as a group these universities exhibit tremendous variation within each income band They exhibit the greatest variation in the size of the reward they give at very low income levels and the least variation in the income bands above £100,000 This does not tell us anything about the generosity of each university, relative to the others in the group, of course Again, we might discover this by ranking them in order of generosity under each income band. If we do this, we see that

quite a few patterns emerge. for example, two of Hull's formulae are consistently ranked in the top or next to top position, Strathclyde is more or less consistently ranked in the penultimate position and Kent is consistently ranked in the bottom position Nonetheless, there is considerable movement from one position to another Again, this makes it difficult to allocate scores directly on the basis of the numerical data presented in Figure 37; in order to express the consistency of these universities' generosity to across all seven income bands, we need to use the scoring system employed in evaluating measure (l) (see [39] for details).

Evaluation 8.18 shows the scores achieved by the participating universities for the consistency of their generosity, relative to other members of the group, in financially rewarding departments which generated successfully commercialised IP

EVALUATION 8.18: SCORE FOR CONSISTENT GENEROSITY IN REWARDING DEPARTMENTS (ON BANDED INCOMES RANGING FROM £1-1,000,000)

University	Score	%
Hull (1)	68 0	97
Hull (2)	56 5	81
Hull (3)	46 5	66
Glasgow, Liverpool	44 5	64
Bristol	42 0	60
City	34 0	49
York	26 0	37
Strathclyde	15 0	21

Without a doubt, Hull is consistently the most generous of the nine participating universities when it comes to rewarding departments which generate successfully exploited IP, irrespective of which formula it employs to govern the distribution of the income Moreover, Hull (1) which, like Glasgow and Liverpool, gives 50 per cent of the net income to the academic(s) who generated the IP, is significantly more generous to

departments than Glasgow and Liverpool. Once again, a university which was treated harshly by the UGC in the early 1980s has been demonstrated to be consistently more generous than universities which were treated leniently, these occupy the middle and lower ground in this descending rank order On the other hand, the other two universities which were treated harshly also occupy the middle and lower ground in the rank order, so perhaps it is a question of individual ethos However, it is just possible that university size plays a part in this, it is noticeable that the three small universities are the least generous to departments - along with Strathclyde With the exception of Strathclyde, the medium-sized and large universities seem to be more generous

(n) Are academics whose IP is successfully exploited rewarded in terms of career progression?

(i) Background

As outlined in section (l), it is evident that in theory at least, universities could reward academics for their contribution to the various stages of the exploitation process - *ie.* for their effort, alternatively, or in addition, they could reward academics for the value which they have helped create As far as can be gauged from the responses elicited, it does not seem as though the participating universities distinguish as clearly as they might between these two different bases for rewarding academics Accordingly, it is more appropriate to simply present the data in terms of whether it is policy to reward academics whose IP is successfully commercialised in terms of career progression - whatever the basis of the reward - or whether such a policy is likely to be formulated in the near future

(ii) Findings

On this basis, the participating universities seem to fall into four groups Kent, Liverpool and City belong to the first group It is Kent's policy to take account of patents, licenses

and possibly spin-off companies when considering applications for promotion; this policy was formally endorsed by Council in 1989. Since 1985, it has been policy at **Liverpool** to treat patents, collaboration with industry and technology transfer activities as criteria for promotion, this was endorsed by the Staffing Committee in 1985 and was reiterated in **Liverpool's** response to the Kingman letter At **City**, it has been policy for some years to tell members of the promotions committee that if an applicant has created exploitable IP, notified the university management and helped evaluate and protect it, this should be taken into account; however, it is left to individual members of the committee to decide how much weight to attach to this activity, relative to others

Hull and **Bristol** belong to the second group, whose members are moving in the same direction as the first group, but have not made this a matter of formal policy. Whatever the basis of the reward, it is believed that in practice, IP which has been protected does now count as a criterion for promotion at **Hull** Contributions to the process of exploiting IP, particularly entrepreneurial contributions, may also be rewarded, since these same people exhibit "*get up and go*" in all aspects of their working life, however, the respondent felt it is difficult to be sure about which precise manifestation of this "*get up and go*" has been rewarded It is believed that **Bristol** is in the process of ensuring that academics who spend time identifying, evaluating and protecting IP will not be penalised in the promotion stakes because they have had less time to disseminate their findings in more traditional ways. No consideration seems to have been given to rewarding entrepreneurial attempts to exploit IP, however.

York, Durham and **Strathclyde** have neither a formal policy, nor have they consiously started to move in this same direction in practice Some academics at **York** cite evidence of having created, evaluated and/or protected IP on their application for promotion, some

do not; some cite evidence of having exploited/arranged for the exploitation of such IP, some do not It is entirely upto individual members of the promotions committee how they handle this. Similarly, if the creation of IP which is successfully protected counts as a criterion for promotion at **Strathclyde,** it will be because those particular members of the promotion believe it should be. The university itself has neither a policy on this nor plans to formulate one, there is a feeling in some quarters that academics' contributions to the exploitation process should not be rewarded in this way At **Durham** a recent application for promotion triggered a discussion of this and related questions, although the promotions criteria are reviewed annually, no decision has yet been made, however

The only member of the fourth group is **Glasgow,** where there is considerable resistance to the idea of rewarding academics whose IP has been successfully exploited in terms of career progression

It is worth noting, *en passant*, that in 1989/90 the nine participating universities had a fairly divergent approach to rewarding academics in terms of career progression for the exploitation of "soft" IP - *eg* via consultancy The nine fall into four groups. Members of the first group - **City** and **Kent** - had taken a formal decision to treat consultancy activity as one of the criteria to be considered by the promotions committee In both universities the decision was formally minuted and in **Kent** there was a paper by the Financial Secretary which argued the case However, in 1989/90 it was not overtly mentioned in the promotions criteria of **Kent** **Hull** is the sole member of the second group, by 1989/90 an informal decision had been taken at **Hull** to include consultancy activity among the criteria to be considered by the promotions committee However, nothing seemed to have been committed to paper on this subject **Bristol, Glasgow, Liverpool** and **York** had a very traditional approach to consultancy, in 1989/90 it had not really been discussed in relation

to promotion and there was no edict that it should be taken into account. The only member of the fourth group, Durham, reported that counting consultancy activity as a criterion for promotion was a subject which had been raised, but that it had caused considerable controversy in some faculties, in 1989/90 this issue was unresolved, though there was a suggestion that the solution might be to devolve promotion down to the faculties and to permit different promotion criteria in each faculty, if this was well argued

(iii) Evaluation

It is not difficult to devise a scoring system in respect of measure (n) Universities would score points for treating each of the four stages of the exploitation process - identification, evaluation, protection and exploitation - as a criterion for promotion Their score for protection would reflect whether they treated copyright, designs and secret know-how as a criterion, as well as patents, their score for exploitation would reflect whether they treated the founding of university companies, joint ventures with members of the academic staff and independent academic spin-off companies as a criterion, as well as licensing/assigning to third parties The scoring system would be weighted, furthermore Universities which also took into account an academic's contribution to each of the four stages of the exploitation process would score more than those which concentrated on the outcome alone, taking no account of an academic's contribution This is in line with the DES' suggestion in its 1985 statement that any reward should be commensurate with the contribution made by the academic(s) in question

Given the paucity of detail in the data elicited, however, it is impossible to allocate scores to the participating universities in this way. This paucity of detail was not occasioned by careless fieldwork, but by an operational difficulty in ascertaining exactly how promotions committees handle research output which is not manifested in publications, or not only in

publications (*ie* in the form of patents/copyright/designs/secret know-how), similarly, it is difficult to ascertain whether they see the exploitation of research (as manifested by licenses/assignments/company start-up) as the other end of the spectrum from writing a research proposal, but nonetheless part of that same spectrum, or whether they regard it as a separate activity altogether There might have been some value in interviewing the chairman of the 1989/90 promotions committee in each of the nine participating universities, to try to ascertain this However, the chairman is only one member of a committee which may encompass as many as a dozen people with fairly divergent views, moreover, at least part of that membership changes every year or so For that reason, it was seen as preferable to elicit this data from the person whom each university initially nominated to provide policy information, in the hope that this respondent had an overview of policy and practice. It is worth noting that in four of the participating universities, the respondent in question was the most senior university officer below the Vice-Chancellor; since all the participating universities but one have a unitary administrative structure [44], these particular respondents were responsible for the academic affairs of their university as well as its financial affairs In the fifth university, the respondent was this officer's deputy, in the sixth, the respondent occupied one level below this, with responsibility for academic affairs In the other three universities, it is difficult to categorise the respondents in this manner, two were not formally part of the administration and reported directly to the Vice-Chancellor; one was part of the administration but had a complex reporting structure involving different levels for different activities All three had an interest in the promotions criteria, but probably a less comprehensive grasp of how the promotions process operates than the other six informants [45]

Given the paucity of detail, it was felt that it is better to treat these data as having anecdotal value, rather than attempt to evaluate them against the scoring system outlined

above - or, indeed, any other scoring system

(p) What other incentives has the university devised to encourage academics to assume responsibility for exploiting their research discoveries?

(i) Background

All the participating universities were asked whether they employed any other incentives to encourage academics to assume responsibility for exploiting their research discoveries.

(ii) Findings

In **Bristol, City, Liverpool** and **York**, the question met with a blank response. **Kent** claimed to have considered the question but decided that rewards in the shape of "*money and glory*" were all the incentives required **Durham** took a similar view, but felt that involvement in the exploitation process - principally in the form of additional consultancy opportunities - offered a further reward which had both intrinsic and extrinsic value

Strathclyde is the only university which has consciously tried to create intrinsic as well as extrinsic rewards **Strathclyde** believes that the flexible way in which its IL/IP office operates acts an incentive in itself The IL/IP office is prepared to shoulder most of the responsibility for the exploitation process, if that is what an academic wants. Equally, it will involve academics in any/every stage of the exploitation process, if that is what they want. Moreover, as indicated in section 7 2, academics are under no obligation to use the IL/IP office if they themselves want to assume complete responsibility for the exploitation of their IP.

Hull is the only university to employ what we might call a "negative" incentive. **Hull** planned to introduce income generation targets for each School in 1990/91, if targets are

not met, Schools will forfeit some of the discretionary income to which they might otherwise be entitled **Hull** believes that the five Schools comprising the science base should be able - in the future, if not immediately - to generate a proportion of that target income from the exploitation of IP. In **Hull's** view, the threat of forfeiture should act as an incentive for Deans and HoDs to encourage members of staff to do everything they can to ensure that their discoveries are exploited.

Measure (p) is concerned primarily with incentives, positive or negative, rather than disincentives However, it is pertinent to note that two of the nine participating universities have created disincentives which could discourage academics from assuming responsibility for exploiting their IP entrepreneurially.

Towards the end of the 1989/90 session **Hull** proposed to "tax" academic entrepreneurs the sum of £125 for every day [46] that they devote to their business activities - *ie.* to "tax" them for time spent on activities other than the university's primary activities of teaching, research and administration. Since they are allowed to spend a maximum of 45 days per year on outside work, this means the maximum "tax" they will have to pay is £5,625 p a. per person **Liverpool** has been "taxing" academic entrepreneurs for several years already, but on a different basis. **Liverpool** "taxes" their income - whether it is earned or unearned in terms of time. Academic entrepreneurs are given permission to set up in business by the outside work committee on the proviso that they make their annual accounts available to the university, to allow it to assess how much "tax" they should pay Sole proprietors have a choice of two "taxation" regimes they can either pay 15 per cent of their company's annual profits to the university, or they can pay 25 per cent of their personal income from, say, director's fees, dividends, consultancy income *etc* Joint proprietors have no choice they are expected to pay 25 per cent of their personal income.

None of the other seven universities expects academics exploiting their research discoveries entrepreneurially to contribute anything to the university except the return on the IP which was agreed during the license negotiations and incorporated into the contract.

It is worth noting *en passant* that three of the participating universities - **Bristol, Hull** and **Liverpool** - also expected members of the academic staff to pay to the university a proportion of their income from the exploitation of "soft" IP via personal consultancy. **Bristol** and **Liverpool** charged a fixed percentage (5% and 25% respectively) of the income earned, irrespective of the nature of the personal consultancy. **Hull** did not levy a "tax" on consultancy during the 1980s - unless earnings from consultancy in any one year exceeded 25 per cent of an individual's gross salary, whereupon the excess was supposed to be covenanted to the university However, from 1990/91 **Hull** proposed to levy a flat-rate charge of £125 per day spent on personal consultancy, irrespective of the nature of the consultancy or the fee charged

(iii) Evaluation

Whereas it was easy to devise an appropriate scoring system for measure (n) but not feasible to employ it, it is difficult to devise a scoring system in respect of measure (p) How should we evaluate the *modus operandi* of **Strathclyde's** IL/IP office compared to **Hull's** use of a stick, as well as carrots, with its negative incentive? It seems quite likely that **Hull's** negative incentive will encourage academics to "flag" potentially exploitable IP, it also seems likely to encourage them to leave the exploitation of that IP to the IL/IP office to arrange, rather than assume responsibility for it - while they devote their time and energy to trying to generate another piece of exploitable IP to boost their department's coffers in years to come, or better still, running short courses or undertaking contract research, which will boost their department's coffers now, as opposed to at some uncertain

point in the future. (Conversely, those academics motivated more by personal reward than the health of their department might be attracted by Hull's generous revenue-sharing formulae to assume as much responsibility for the exploitation of their IP as possible). The flexible *modus operandi* of Strathclyde's IL/IP office sounds like a much more effective way of encouraging academics to assume responsibility for the exploitation of their IP. But even if this relative assessment of these two incentives is fair, which it might not be, how can we translate this into a score which reflects their relative weight? Or should we give these two universities a point each for trying? And if so, where do we draw the line? What constitutes a valid incentive and what does not? In view of these difficulties, the best we can do, probably, is to treat these data as having anecdotal value, too

It is also difficult to evaluate the disincentives which could discourage academics from assuming responsibility for exploiting their IP entrepreneurially at Hull and **Liverpool.** How does Hull's "tax" on academic entrepreneurs compare to **Liverpool's?** It seems likely that academic entrepreneurs at **Liverpool** could legitimately avoid the "tax" imposed by their university by dint of paying themselves little or nothing or paying their spouse instead, whereas Hull's entrepreneurs may find it impossible to licitly avoid their "tax". Even if **Liverpool's** entrepreneurs did not think of this or chose not to avoid the "tax" imposed by their university, they would have to pay themselves £22,500 net p a in order to incur the same amount of "tax" which Hull's entrepreneurs would incur if they devoted every one of their 45 days per year outside work entitlement to their company. Once again, though, even if this is a fair assessment of these two disincentives, how can we translate this into a score which reflects their relative weight? Or should we simply allocate these two universities a negative point each for creating any form of disincentive, *etc etc*? Once again, the best we can do, probably, is to treat these data as having anecdotal value

(q) Does the university ensure that academics and their departments are aware of the incentives it has created; if so, by what means?

(i) Findings: Financial Rewards

As Figure 38 shows, where financial rewards are concerned, the nine participating universities fall into three distinct groups those which have informed staff how they distribute the income from IP by means of one-off publicity, one which prefers to inform staff by means of "ongoing" documentation, and one which may not have formally informed its staff at all. This reveals that the majority of universities belong to the first group. **City** used its code of practice to do this, circulating it to every existing member of staff in July 1989, it has been routinely given to every new member of staff since then. **Glasgow** used its policy statement on IP for same purpose, this was distributed to every existing member of staff in October 1989 and is routinely given to every new appointee. At **Hull** the formula for distributing income is laid down in the university's patent policy, this was sent to every existing member of staff in 1987, but it has not routinely been given to new members of staff Once the proposed new policy statement has been approved, it, too, should be circulated to every existing member of staff, it remains to be seen whether it will be routinely given to new members of staff **York**'s formula is laid out in the new IP regulations, these were distributed to every existing member of staff at the end of the 1989/90 session and are routinely given to new members of staff Since March 1989 **Bristol** has laid out its revenue-sharing formula in the standing orders of Council governing the appointment of full-time members of non-professorial academic staff, existing staff received a copy at the time and new staff are routinely given a copy upon their appointment. **Strathclyde** has taken a slightly different approach: rather than mail-shot every member of staff, the new revenue-sharing formula was publicised in the university newsletter in April 1990 **Durham** does not employ a fixed revenue-sharing formula, of course, preferring to determine the distribution of any income on an *ad hoc*

basis. Since 1987 this has been conveyed in paragraph 8 of its standard terms and conditions of employment for lecturing and research staff, which states.

> *"It is . . the policy of the University to ensure that whenever the terms of the grant or contract so permit, any financial rewards are appropriately and equitably shared with those responsible for the work and/or with those responsible for directing the work and/or with those responsible for its exploitation"*

The only member of the second group, **Liverpool**, prefers to inform staff how the income from IP is distributed by means of "ongoing" documentation - *ie* its staff handbook. There is no indication that members of staff are generally given 50 per cent of the income received by the university from the exploitation of their IP, irrespective how much that is. Under the heading "*Procedure for the Exploitation of Patents*", the staff handbook states.

> *"The University will . share any returns on the invention in such a way as to ensure that, after it has been reimbursed its costs, the member of staff obtains a fair share (whether in a lump sum, by periodical payments, or both) having regard to all the circumstances . ".*

It then lists nine criteria which will be taken into account, quoting from the 1977 Patents Act

The only member of the third group is **Kent**, where it is not clear whether the latest revenue-sharing formula, adopted in 1989, has been publicised at all It is questionable whether the formula adopted in 1988 was ever formally publicised, either

As we have seen, several of the participating universities have, within the last year or so, publicised the financial rewards which they make to academics whose IP is successfully exploited. However, most of these universities were authorised by the Research Councils as long ago as 1986 It is pertinent, therefore, to enquire whether they publicised these

financial rewards prior to these more recent dates

By one means or another, four of the participating universities have publicised these rewards for several years, starting some time before being authorised by the Research Councils. **Glasgow** has given academics 50 per cent of the income which their IP brings into the university since 1978, this information has been conveyed to existing members of staff since 1982, by means of its IP guidelines, new members of staff were routinely sent a copy of these guidelines. **Liverpool's** allocation of 50 per cent of the income from IP to the academics who created it dates from the same year, for a decade or so the staff handbook has conveyed the information in much the same manner as it does now. **York** has employed a revenue-distribution formula since the end of the 1970s, this, too, has been detailed in the staff handbook for many years **Kent** appears to have been more efficient at publicising its revenue-sharing formula in the past than it is today· there is some evidence that the original formula, introduced in 1982, was committed to paper by the Registrar and circulated to existing members of staff, at least some new members of staff were also sent a copy **City** has used a formula to distribute the income from IP since the mid-1970s, but it did not formally circulate this information to members of staff until April 1989, shortly before it received its authorisation from the Research Councils. **Hull** did not publicise its revenue-sharing formula until shortly after it was authorised by the Research Councils. **Hull** did not have a formula governing the distribution of income from IP prior to 1986; due to lengthy negotiations with the local AUT, it was not able to circulate this information until February 1987 No evidence could be found that **Strathclyde** publicised its original revenue-sharing formula, however, either in one-off publicity or "ongoing" publicity such as the staff handbook

(ii) Evaluation Financial Rewards

As **Figure 38** showed, the nine participating universities have gone about publicising the financial reward which they make to academics whose IP is successfully exploited in different ways. Again, the question arises: how should we evaluate these differences? Is there a basis from which to devise a scoring system? **Figure 32** showed that seven of the nine participating universities first introduced a revenue-sharing formula some years before they were authorised by the Research Councils - in some cases, a good number of years before. **Figure 38** showed that even though some of them had sent out reminders in the intervening years, most of these did so some time before they were authorised by the Research Councils Given that the ESG made it clear it saw the academic's share of the income generated by the exploitation of their IP as an important incentive, it is not unreasonable to expect universities to have publicised their revenue-sharing arrangements - once more, if necessary - at the same time that they publicised the fact that they had been authorised by the Research Councils The scoring system devised in respect of publicising financial rewards therefore weighted the timing of such publicity; moreover, it assumed that the most effective form of publicity would probably have been one-off, "trigger" information However, relying on the impact of "trigger" information every few years has its drawbacks For one thing, once several years have passed, it may be regarded as out-of-date. For another, "trigger" information will only be kept for reference if the recipient sees a reason for doing so, if not, it will probably be consigned to the waste paper bin or mislaid Thus, there is a strong argument for the university providing ready reference material by supplementing "trigger" information with "ongoing" information, such as an entry in the staff handbook Accordingly, the scoring system took account of whether universities employed just one or both methods of publicising this incentive.

Notes [47]-[48] outline the scoring system employed, Evaluations 8.19-8.20 show the scores achieved by the participating universities for the speed and thoroughness with which they disseminated details of this financial incentive to existing members of staff after being authorised by the Research Councils

EVALUATION 8.19: SCORE FOR SPEED WITH WHICH DETAILS OF FINANCIAL REWARDS WERE DISSEMINATED TO EXISTING STAFF FOLLOWING AUTHORISATION FROM THE RESEARCH COUNCILS

University	Score	%
Bristol	2	40
City	5	100
Durham	4	80
Glasgow	2	40
Hull	4	80
Kent	0	0
Liverpool	0	0
Strathclyde	1	20
York	1	20

EVALUATION 8.20: SCORE FOR THOROUGHNESS WITH WHICH DETAILS OF FINANCIAL REWARDS WERE DISSEMINATED TO EXISTING STAFF FOLLOWING AUTHORISATION FROM THE RESEARCH COUNCILS

University	Score	%
Bristol	1	50
City	1	50
Durham	1	50
Glasgow	1	50
Hull	1	50
Kent	0	0
Liverpool	1	50
Strathclyde	1	50
York	2	100

Once "trigger" information has been sent out to existing members of staff, new members of staff, appointed even a day later, should receive the same information Details of this financial incentive might be contained in a dedicated IP document, in another, relatively short document, or in a lengthy, more general document, such as a staff handbook, the

prominence of the information will probably vary accordingly The scoring system devised in respect of measure (q)(ii) therefore weighted both the timing - when this information on the financial rewards made to academics whose IP is successfully exploited started to be sent to new members of staff, and the prominence of that information

Notes [49]-[50] outline the scoring system employed; Evaluations 8.21-8.22 show the scores achieved the the participating universities for the speed with which they disseminated details of this financial incentive to new members of staff and the prominence of that information.

EVALUATION 8.21: SCORE FOR SPEED WITH WHICH DETAILS OF FINANCIAL REWARDS WERE DISSEMINATED TO NEW STAFF FOLLOWING AUTHORISATION FROM THE RESEARCH COUNCILS

University	Score	%
Bristol	2	40
City	1	100
Durham	4	80
Glasgow	5	100
Hull	0	0
Kent	0	0
Liverpool	5	100
Strathclyde	0	0
York	5	100

EVALUATION 8.22: SCORE FOR PROMINENCE OF FINANCIAL REWARD DETAILS, AS DISSEMINATED TO NEW STAFF FOLLOWING AUTHORISATION FROM THE RESEARCH COUNCILS

University	Score	%
Bristol	2	66
City	3	100
Durham	2	66
Glasgow	3	100
Hull	0	0
Kent	0	0
Liverpool	1	33
Strathclyde	0	0
York	3	100

These scores suggest that very few of the participating universities have devoted sufficient thought to publicising these financial incentives, with one or two exceptions, these scores signal a marked lack of coherence Only one university, City, disseminated details to existing staff within a timescale which this study proposed as a reasonable one, though Durham and Hull came close to it The other six performed lamentably - if, that is, they performed at all Only one university, York, set about disseminating this information as prominently as this study proposed, seven set about it in a very half-hearted way and one did not bother to disseminate any information at all, as far as can be established. However, these universities were marginally more clued up about informing new staff, five disseminated details to new staff within the time scale proposed by this study as a reasonable one - or almost within it Only three disseminated this information as prominently as this study proposed they should, however - though another two did reasonably well

If we aggregate each university's scores to create an indicator of effective publicity in relation to publicising its financial incentives, we obtain the following rank order·

	University	Indicator	Score
1	City	88	(350/400)
2	York	80	(320/400)
3	Glasgow	73	(290/400)
4	Durham	69	(276/400)
5	Bristol	49	(196/400)
6	Liverpool	46	(183/400)
7	Hull	33	(130/400)
8	Strathclyde	18	(70/400)
9	Kent	0	(0/400)

(iii) Findings Career Progression

The situation is less clear-cut where career progression is concerned. If academics in the nine participating universities are rewarded in terms of career progression for the effort

they put into creating, identifying and helping protect IP and into helping exploit it and/or for the resulting value, they can only deduce this from close scrutiny of the criteria listed in the promotions material of their respective institutions - or by seeking the advice of their HoD Not even those universities which claim to have a policy on this, **City, Kent** or **Liverpool,** seem to have drafted and circulated to the academic community a statement detailing that policy [51].

Based on the current promotions material from eight of the participating universities (**Kent** was unwilling to make its promotions material available), academics in every one of them might conclude that the first two stages of the exploitation process - identification and evaluation - are not recognised as criteria for promotion, with the possible exception of three. **Hull** includes in its criteria the construction of apparatus and instruments, which could perhaps be interpreted as a readiness to reward people who create this particular form of IP, notify the university and mention the fact on their application for promotion. **Glasgow** and **York** list among their promotions criteria the provision of technical advice within the university, helping to evaluate a discovery could possibly be construed as providing technical advice within the university.

The next stage of the exploitation process - protecting a discovery - is formally recognised as a criterion for promotion in the material of two of the participating universities, but not in the other seven. **Hull** is alone in explicitly including "*patent applications*" and "*patenting*" in its promotions documentation It is **Kent's** intention to give "patenting" the same weight as research grants and publications from 1989/90 (see [51]), it was not possible to discover whether this is made explicit in the promotions material Neither makes any reference to copyright or design rights, however At **Bristol, City, Durham, Glasgow, Liverpool, Strathclyde** and **York,** there is no explicit reference to patents, copyright or

designs The decision of the Staffing Committee at **Liverpool** concerning patents, collaboration with industry and technology transfer activities has not been noted in the guidance provided for applicants, which emphasises research activity and specifies that this should be demonstrated by refereed publications and work in professional organisations. In all seven universities, applicants are left to decide for themselves whether their efforts to protect a discovery are intended to be listed under other headings, such as "*innovation*" in research (**City**), or whether the observation that research is disseminated in increasingly diverse ways includes dissemination via patents, copyright or designs (**Bristol**)

Judging by the criteria listed in the promotions material, contributions to the last stage of the exploitation process - locating and negotiating with potential licensees/assignees or entrepreneurially exploiting the IP in some framework or other - is not rewarded by many of the participating universities. Again, it is **Kent's** intention to reward "*licensing*", giving it the same weight as research grants, publications and patents from 1989/90 (see [51]); it was not possible to discover whether this is made explicit in the promotions material. **Bristol's** promotions criteria list "*entrepreneurial activities*" under the heading of management and administration, though it is clear that this should be interpreted in the widest possible sense. **Glasgow** is more explicit in that its promotions criteria list secondment to a university company, contributing to the management of a university company and "*industrial liaison*". None of the other universities refer explicitly to activities connected with the last stage of the exploitation process, though **York** mentions "*industrial liaison*".

In most of the participating universities, it would be even more difficult for academics to establish whether their university is likely to reward them in terms of career progression for the value they have created by the transfer of their technology into the economy.

However, at **Bristol**, the promotions criteria specify that income generation and activities designed to aid the economic development of the region will be counted **Hull's** list includes services to industry and commerce and contributing to the development of a school or the university **Liverpool** claims to reward activities which enhance the well-being or the reputation of the university Most of these are vague phrases, ill-defined and probably difficult to quantify

(iv) Evaluation Career Progression

Where rewarding academics in terms of career progression is concerned, in many cases there appears to be a discrepancy between the policy described verbally by the informant and written information contained in promotions material Sometimes written promotions material suggests that certain, IP-related activities would be rewarded although the informant thought not; conversely, written promotions material sometimes omits to mention certain IP-related activities which the informant felt would be taken into account. Short of observing the workings of each institution's promotions committee over two or three years, there is no way of resolving the truth behind these discrepancies For this reason, it was felt that trying to score the promotions material to take account of the criteria outlined in respect of measure (n) would be a spurious exercise

(v) Findings Other Incentives

Only **Hull** and **Strathclyde** employ any other incentives. Since every School at **Hull** has participated in lengthy discussions about the basis on which its income generation target has been set, no Dean or HoD can be unaware of the importance of encouraging members of staff to do everything they can to ensure that their discoveries are exploited It is unlikely, either, that individual members of staff are unaware of this, documentation relating to the new procedures has been in circulation for some time, in any case, as soon

as the working party's recommendations are endorsed by Council, a copy will be sent to every member of staff.

In the light of the academic community's negative response to previous arrangements, **Strathclyde** sets considerable store by the fact that use of its IL/IP office is purely on a voluntary basis Curiously, however, this is not formally articulated anywhere.

(vi) Evaluation. Other Incentives

Given that these other incentives themselves have not been evaluated, it was felt it would be a superfluous exercise to try to evaluate how effectively they have been publicised. Once again, the best we can do, probably, is to treat these data as having anecdotal value

(vii) Findings· Disincentives

Details of the £125 per day "tax" which **Hull** intends to levy from the start of the 1990/91 session are given in the same document as the one dealing with income generation targets for Schools As indicated, this has been in circulation for some time and it is unlikely that **Hull's** academic entrepreneurs are unaware of it, in any case, as soon as the working party's recommendations are endorsed by Council, a copy will be sent to every member of staff.

Liverpool is less explicit about its "tax" on academic entrepreneurs The staff handbook gives details of the regulations governing outside work, updated in January 1990, the relevant section states that outside work is defined as "*work which is not authorised by the member's contract with the University and which is undertaken for an organisation or individual outside the University*" It adds that the university would normally expect a member of staff to make a charge for outside work related to the fee that would be

charged by a professional firm in private practice - and that the outside work committee will determine what amount of payment will be credited to departmental expenses, the university's general funds and the persons(s) carrying out the work Academic entrepreneurs may or may not deduce that this refers to their activities, too, there is certainly no explicit indication of the two possible "tax regimes" outlined above, nor any indication of the percentages involved

(viii) Evaluation· Disincentives

Given that these disincentives themselves have not been evaluated, it was felt it would be a superfluous exercise to try to evaluate how effectively they have been publicised Once again, the best we can do, probably, is to treat these data as having anecdotal value

(r) Does the university employ any other means of encouraging academics to assume responsibility for the exploitation of their discoveries?

No other means of encouraging academics to assume responsibility for the exploitation of their research discoveries was identified in the course of the fieldwork

8.7 Incentives: Summary

It is not possible to create an overall indicator of the incentives which each university has created and the efforts each has put into publicising them The difficulty of establishing whether these universities reward academics whose IP is successfully exploited in terms of career progression and the resulting impossibility of rigorously evaluating their performance in this respect means that we have no comparable scores in respect of career progression to contribute A similar difficulty was experienced in relation to other incentives and disincentives.

We shall have to be satisfied, therefore, with an indicator which relates to financial incentives alone In fact, we need two separate indicators, the first relating to the consistent generosity of the participating universities' financial incentives, the second relating to the speed and thoroughness with which they publicised these financial incentives and the prominence of that information. We cannot combine these into a single indicator, due to incompatibility we have no comparable figures for the financial incentives which **Durham** has created, but three different sets of figures for **Hull** - yet we have comparable data for all nine when it comes to publicising financial incentives

The simplest way to create an overall indicator of the consistent generosity of these universities' financial incentives is probably to rank them in ascending order according to the consistency with which they reward the centre most generously **Figure 40** provides the raw material. We can use the same scoring system employed in evaluating measure (l) (see [39] for details), **Evaluation 8.23** shows the scores achieved by the participating universities in ascending order

EVALUATION 8.23: SCORE FOR CONSISTENT GENEROSITY IN REWARDING THE CENTRE (ON BANDED INCOMES RANGING FROM £1-1,000,000)

University	Score	%
Hull (3)	12 0	17
Hull (2)	20 0	29
City	22 5	32
York, Hull (1)	29 0	41
Bristol	42 5	61
Glasgow, Liverpool	49 5	71
Strathclyde	59 0	84
Kent	70 0	100

Upto this point in the analysis, it has been possible to assert that none of the participating universities has performed as well as it might have done with regard to certain measures - and to justify that assertion. This is not the case where the financial incentives created by the participating universities are concerned. Unless the CVCP/ESG is prepared to make this kind of judgement - and perhaps we should intepret its guidance on the division of income from IP in this light, who is to say where the ceiling on universities' generosity should be? Clearly, universities are not expected to distribute all the net income from a discovery to the academic(s) and the department which generated it The DES' 1985 statement stated unequivocally that universities themselves - by which was presumably meant the centre - should expect to get some return on the public monies expended to create the IP being exploited. In the absence of more specific guidance on this, we can do no more than note that there is a significant difference between **Hull's** performance in this respect, and **Strathclyde's** or **Kent's** - and to try to establish the reasons for this.

The second overall indicator of incentives, which relates to the efforts each has put into publicising its incentives, has already been constructed at the end of section 8.7(q). Here we have no difficulty in asserting that none of the participating universities informed/reminded existing and new members of staff as quickly *and* thoroughly/prominently as they might have done about the rewards which they could expect if their discoveries were successfully exploited However, it is clear that **City** and **York** performed significantly better in this respect than most participating universities, whereas **Strathclyde** performed significantly worse, and **Kent** seems to have paid no attention to this whatsoever.

8.8 Discussion

(i) Information Dissemination

As indicated in section 8.3, there does not seem to be a connection between university type or objective factors such as university size *etc* and a university's performance against measures (a)-(h), relative to the other participating universities It is clearly not the case that small universities have paid less attention to formally disseminating this information in the belief that it is unnecessary in a small community or that, conversely, large universities have paid more attention to formally disseminating this information because their size makes it difficult to communicate it informally; there is no correlation between ranking and size Nor is there a correlation between ranking and the relative size of the science base, though it is true that those with a very small science base are ranked lowest, equally, though, **Glasgow**, the university with proportionately the largest science base, is ranked fairly low. Type of university does not provide an explanation, either; again, there is no correlation between ranking and university type Nor does the existence/absence of a separate IL/IP office in itself appear to provide an explanation There may be an association between a university's performance and the number of people sequentially responsible for implementing IP policies, such as they were, during the 1980s Universities ranked 1-4 averaged 2 75 people sequentially responsible during the 1980s, whereas those ranked 6-9 averaged 3 25; **Kent** - which ranks lowest of the nine - had the greatest turnover in personnel of all the participating universities· at least five during the 1980s. One could imagine that there might be an association between a university's performance and the timing of personnel changeovers; in fact, two universities in the top half of the rank order on p398 experienced a change of key personnel in the critical period of 1985-86, as did two in the bottom half of the rank order

Even if there was an association between a university's performance and these two factors, we should not conclude that the focus, thoroughness and speed with which the participating universities disseminated news of these three events was determined entirely by chance - the chance of personnel staying in post for a reasonable length of time or leaving at inopportune moments. In **Glasgow**, **Kent** and **York**, there was a change of personnel during 1985/86 because each had appointed an ILO whom they felt, with the benefit of hindsight, was simply not suitable **Glasgow** and **York** had both recruited as ILO an industrialist who was surplus to their company's requirements; **Kent** recruited as its first ILO a former industrialist who had worked for one of the Research Councils in the intervening years Nor should we attribute this entirely to bad luck; **Kent** and **York** admit that they made the appointment and cast the appointee adrift to make his own way without benefit of policy or policy guidelines, similarly, although **Glasgow** had an IP policy, it provided neither guidelines nor a fully-fleshed remit for its appointee We may excuse this as part of the learning curve in a novel situation - or we may regard the provision of policy, policy-guidelines and remit as a standard management procedure, to which these universities devoted insufficient attention The other two universities were not hostages to chance, either; both chose to make a change in the crucial period 1985/86. At **Hull** the administration had been reluctant to appoint an ILO for a number of years, despite pressure from the academic community Ironically, once it began to appreciate the benefits of having one, the severity of the cuts imposed by the UGC in the early 1980s prevented it from recruiting one until the mid-1980s, **Hull** duly acquired its first ILO a couple of months before the Kingman letter arrived Thus, the change in personnel was occasioned by the shift of responsibility for IP from an administrator to the newly-appointed ILO.

There is evidence to suggest we should be wary of explaining away the participating universities' widely differing scores in terms of the changeover of key personnel. This comes to light if we examine the information relating to each of the three events separately, rather than treat it collectively Circumstantial evidence suggests that it was not upto the policy-implementer to decide whether and when to publicise news of the first two events. At **City**, for example, we can be fairly sure that this information was not formally disseminated at the time, or over the next 24 months, because the policy-maker had resolved not to be pushed by the ESG into making a quick decision, moreover, when **City** did eventually decide to assume the rights and responsibilities being offered, the policy-maker himself made that decision without recourse to a committee or a working party - in keeping with **City's** managerial approach The other eight universities allowed themselves to be pushed into responding to the Kingman letter relatively quickly but most of them chose not to reach their decision in the traditional way - by setting up a sub-committee/working party and inviting senior academics or those with a particular interest or knowledge to particpate in that process We may speculate whether this was influenced by the timetable which the Kingman letter imposed upon them or by the impact of the Jarratt Report, published just two months earlier, or a combination of the two - or by other factors altogether. Whatever the reason, at **Bristol, Glasgow, Kent, Liverpool** and **Strathclyde** the decision was made by senior administrators/senior academics or an *ad hoc*

and informal group composed of both Three of these five universities did not publicise news of these two events until after they had been authorised by the ESG; **Kent** informed the board of KSIP before it had been authorised but after it had submitted its response to the ESG. It was only at **Bristol** that news of these two events was publicised within six months of them happening; news of both was passed to the Deans because the Committee of Deans, **Bristol's** equivalent of a policy and resources committee, was asked to make the decision, news of the removal of the BTG's monopoly may have been inadvertently disseminated to the whole academic community - as a result of the newsletter's habit of reporting on the deliberations of the Senate and Council Only **Durham, Hull** and **York** reached a decision concerning the Research Councils' offer in the traditional way - by handing the matter over to a sub-committee/working party In two of these universities, news of these two events was formally disseminated only to academics who were members of these sub-committees/working parties, rather than to the whole academic community. Only **York** chose to tell the whole academic community about the removal of the BTG's monopoly before the university was authorised by the ESG, this was publicised through the newsletter by the Finance Officer, whose motivation was evidently to indicate that commercialisation routes other than the BTG were now available and academics should notify him of their discoveries, rather than the BTG

It would seem, then, that we should not attribute the participating universities' scores in respect of disseminating news of these two events to the turnover of policy-implementers, the timing of that turnover or even the inattentiveness of policy-implementers. It seems more likely that senior administrators are responsible for those scores by virtue of having withheld or embargoed the information. If this was the case, it also seems that - with the notable exception of **York** - those administrators were more concerned to control the

decision-making process than they were to take immediate advantage of the Research Councils' offer by publicising it and getting the academic community to report their discoveries to the university, rather than contact the BTG direct, as many were used to doing On the other hand, perhaps these senior administrators simply did not pay sufficient attention to the task at hand

Having made their decision and contracted with the ESG to adhere to certain arrangements, most of the participating universities publicised news of their authorisation from the Research Councils relatively quickly In those which did not, it is difficult to know where to lay the blame Evidence has already been presented of a certain lack of communication between policy-makers and the policy-implementer at **Hull** and an even greater lack of communication between the two at **Kent**, this may account for it Policy-makers at these two institutions should possibly have guided their policy-implementers with regard to this information, **Hull's** policy-implementer and the two policy-implementers in post one after the other at **Kent** during this period were recruited from industry and may not have fully appreciated the significance of the change which had taken place **Strathclyde's** failure to publicise this foi nearly 18 months is more puzzling; the policy-implementer was fully aware of the significance of the change, having been party to the decision The fact that **Strathclyde's** newly-created IL/IP office was trying to encompass more activities than IL/IP offices in other participating institutions at the time may provide an explanation, the policy-implementer may simply have had things on his mind which he regarded as more pressing

It may also be inappropriate in some cases to attribute universities' scores for telling <u>new</u> staff about the authorisation from the Research Councils to the turnover of policy-implementers, the timing of that turnover or the attentiveness/inattentiveness of policy

-implementers The most cost-effective way to to tell new staff about this on a face-to-face basis is by making a presentation at a compulsory staff induction course **Liverpool's** policy-implementer has recently been able to arrange this and at **Durham** the Treasurer is believed to have covered this since 1988 in her presentation to new members of staff. **Bristol's** policy-implementer has proposed to the personnel office, which organises the induction course, that he should make a presentation on IP, during which he could alert new staff to the Research Councils' authorisation His offer has not been taken up; clearly, this is outwith his control At **York** the annual induction course is for all types of staff, not just academics, and is obviously unsuitable, accordingly, the newly-appointed policy-implementer is in the process of considering alternative face-to-face contexts. At **Glasgow** the policy-implementer has only recently thought of addressing new staff at the annual induction course and is in the process of arranging it It is only at **City, Hull, Kent** and **Strathclyde** that policy-implementers do not seem to have thought of this at all.

The most cost-efficient way to tell new staff about the Research Councils' authorisation in writing is probably to include this information in the package which is sent to new staff by the personnel office. **Bristol, Durham, Kent** and **Strathclyde** have no such documentation at all, this is a drawback which policy-implementers might consider addressing The other five universities have produced documentation, at four - **City, Glasgow, Liverpool** and **York**, this is routinely included in the package routinely sent to new members of staff, only **Hull** has failed to do this, apparently because **Hull's** policy-implementer is sceptical about the value of "*junk mail*" The documentation at **City, Liverpool** and **York** explicitly mentions the fact that the university has been authorised by the Research Councils, this information was omitted from **Glasgow's** documentation as the result of an oversight

In seven of the participating universities, it is undoubtedly the policy-implementers' responsibility to remind staff about the authorisation from the Research Councils, the two exceptions are **Bristol** and **City**. At **Bristol** the policy-implementer's remit specifically excludes responsibility for research grants, until such time as they actually generate IP; to date, therefore, reminders have been left to the Vice-Chancellor to organise; at **City**, the question has not yet arisen in practice, since the university received its authorisation so recently Policy-implementers at **Durham** and **Liverpool** have been alert since 1987 to the need to send annual, "trigger" reminders, both recognised that the need to make an annual return to the ESG provided a convenient "peg" from which to hang their reminders. Those at **Glasgow, Strathclyde** and **York** have started sending reminders more recently - indeed, very recently in **York's** case It is difficult to account for the delay at **Glasgow.** The delay at **Strathclyde** was probably due to the fact that a dedicated IPR officer was not appointed until the end of 1987; prior to that, **Strathclyde's** principal policy-implementer presumably felt he had more pressing things on his mind. The delay at **York** cannot entirely be explained in terms of the change of personnel in 1988, though the fact that **York's** policy-implementer works part-time may explain the delay in getting to grips with this after 1988. **Hull's** policy-implementer has not sent out "trigger" reminders at all - again because he is sceptical about the likelihood of academics reading "*junk mail*". Two of the three policy-implementers which **Kent** has had since the end of 1985 did not send out formal reminders, either; this could be because they did not appreciate the significance of the Research Councils' authorisation; alternatively, it could result from the fact that although KSIP was responsible for the evaluation, protection and exploitation of IP which had already been identified, irrespective of who funded the project which generated it, further upstream KSIP was primarily responsible for research contracts, not research grants, which were handled by the administration This separation of funding sources is one of the reasons why responsibility for IP was transferred from KSIP to the

administration. Once the relevant administrator became responsible for IP in 1989, he proposed to issue a "trigger" reminder; that reminder was vetoed by an informal group of senior administrators on the grounds that it was not "*punchy*" enough. As a result, the newsletter carried a short note which failed to indicate the rationale for asking academics to report IP discoveries to the administration; it generated a very negative response from at least one member of staff The need to tell staff - and keep reminding them - about the rationale - *ie.* the terms on which the Research Councils give grants and the university's commitment to the ESG - was underlined by **Strathclyde's** policy-implementer, as the case study narrative in Appendix F describes

"Ongoing" reminders may be more difficult - or even impossible - for policy-implementers alone to organise The two obvious vehicles for "ongoing" publicity are the staff handbook and the research handbook By 1989/90, two of the participating universities, **Bristol** and **Kent**, had never produced a staff handbook or anything akin to it. In fact, both planned to circulate something akin to a staff handbook for the first time during the 1990/91 session, but whereas **Kent** succeeded, **Bristol's** plans to circulate a head of department's handbook had to be revised in order to include details of the Management & Administrative Computing (MAC) Initiative **Hull** used to have a staff handbook in the 1970s, but in the 1980s it became a victim of successive cuts in the university's recurrent grant; it was **Hull's** intention to circulate a research handbook in the 1990/91 session, however. The other six universities have a staff handbook, or something of equivalent status, but they vary tremendously in terms of their scope and content Whereas **Liverpool's** and **York's** are intended to be an all-embracing compendium, **City's** deals only with the organisation of the university and basic services, for example, and contains no references to IP. Even if a university has a staff handbook and IP-related matters are deemed to be an appropriate item for inclusion, few universities update their

staff handbook annually or even bi-annually, it may be several years before a new edition is brought out. Policy-implementers are obviously obliged to work to someone else's timetable and agenda where this is concerned, this explains why the section on IP in the staff handbooks of several participating universities is so out-of-date This is not the explanation in the case of **Durham**, though, which issues a staff handbook-cum-diary every academic session The fact that no-one at **Durham** has got around to preparing a dedicated document on IP, which could simply be included wholesale, may explain the dearth of information there, on the other hand, it is evident that most topics are dealt with fairly briefly, often concluding with details of where to get more information. This may simply be a matter of house style

The failure of some participating universities to publicise the government's wish with regard to the role of the academic in the exploitation process is perhaps less surprising If **Glasgow, Liverpool, Hull, Bristol** or **Durham** interpreted this wish in the way that this study has, it would conflict with some - and in the case of **Bristol** and **Durham** - pretty much all aspects of their own policy on the role of the academic However, while **Glasgow** and **Liverpool** may have interpreted it in this way, this is not what happened at **Hull, Durham** or **Bristol,** in practice As section 7 1 indicated, **Durham** interpreted the ESG's requirement in the traditional way - that academics should become involved in the exploitation process in a scientific or technical capacity, rather than in an enterprising or entrepreneurial capacity, since **Durham's** academics had always been involved in this capacity if they wished to, the university probably saw no reason for publicising what it understood to be the government's wish **Hull's** policy-makers claim that the ESG's requirement in this respect made no impact on them, of course, accordingly, they did not communicate the government's wish to the policy-implementer, he, in turn, was not in a position to communicate it to the academic community **Bristol's** policy-implementer has

quite simply never seen the documents in question, of course This does not explain, though, why the administrator responsible for IP prior to his appointment in 1987 did not publicise the government's wish with regard to the role of the academic in the exploitation process

City's, Strathclyde's and **York's** failure to publicise this is more surprising, since it does not conflict unduly with their policies in this respect In view of the impact which the government had on UK universities during the 1980s, perpetrated indirectly through the medium of the UGC, perhaps we should not be too surprised if UK universities omitted to publicise any aspect of the government's wishes, unless they were absolutely forced to.

(ii) Policy Initiatives

Policy Statements

It is pertinent to consider why four of the participating universities have not bothered to produce a dedicated policy statement on IP, whereas five have done so, albeit very recently in a couple of cases (City's tardiness was deliberate, motivated by the fact that it wished to shape its policy in the light of experience, rather than pluck one out of the air, this was also the reason for City seeking authorisation from the ESG much later than the other participating universities **York's** tardiness was occasioned by different concerns. The Commercial Activities Sub-Committee did not draw up a policy document once it had drafted the university's response to the Kingman letter because it would entail amending academics' terms and conditions of employment, a process which the university kept putting off In 1988 the Sub-Committee was wound up, leaving the university with no policy-makers until the Registrar created an informal policy-making group the following year. This group duly drafted a policy statement, which the AUT rejected on the grounds that it was not sufficiently cohesive, nor did it address certain key issues The university

had not considered how to resolve disputes over the ownership of IP, relative contributions to discoveries *etc* - presumably because none of the guidance produced by the CVCP, the Research Councils, the DES or the Kingman letter addressed this question. Guidance produced by the AUT for the local associations did address this question, of course, but for some reason **York's** local association was unaware of this and came up with a solution independently. This whole process took over a year)

It is evident from the rank order displayed at the end of section 8 5 that there does not seem to be an association between a university's performance against measures (j)-(k) and university type or objective factors such as university size, or the extent to which the participating universities were victims of financial cuts imposed by the UGC in the 1980s. There may be an association between a university's performance in this respect and the sequential number of policy-implementers since 1985. universities which have a policy statement on IP average 1 6 incumbents since 1985, those with none average 2 25. The relationship between policy-implementers and policy-makers, in so far as there are any, may provide a more convincing explanation, in some cases at least Universities with no policy statement on IP are **Bristol, Durham, Kent** and **Strathclyde** We have already seen that **Bristol** seems to have no policy-maker other than the ILO - apart, perhaps, from the Vice-Chancellor However, the ILO's remit specifically excludes responsibility for research grants, except for cases where they yield potentially exploitable IP, it may well be that the ILO regards it as exceeding his remit to draft a global IP policy document We have also seen that **Kent's** two consecutive groups of policy-makers have been conspicuous by their inactivity, policy, in so far as the university has one, has been left largely to **Kent's** policy-implementers to devise Not one of the previous three policy-implementers took it upon himself to commit his policy to paper, however, possibly they felt it was not their place to do this, or possibly their policy amounted to little more than a

series of *ad hoc* reactions to situations, as they arose The current policy-implementer did not circulate a policy statement during the 1989/90 session, either, this may be because he had too many other things to do or because he was still getting to grips with the topic - or because he did not perceive a need for one Explaining the absence of a policy statement on IP in terms of the degree to which policy-makers engage with policy-implementers does not apply to **Strathclyde**, however, where the relationship between policy-maker and policy-implementer seems to be particularly close. However, it is only in the case of **Strathclyde** . . . - - - - - - - - - -

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- - **Strathclyde** felt that any policy statement, no matter how carefully it is written, would be liable to suggest to the reader that the exploitation of IP must follow one of the patterns described, thereby excluding innovative and interesting proposals which the university has not thought of

Where those universities which have IP policy statements are concerned, it is pertinent, too, to consider why, in one or two cases, the policy statement issued to academics differs so markedly from the policy which the university outlined to the ESG in response to the Kingman letter - and the policy described by informants during the course of the fieldwork for this study. This is particularly noticeable in the case of **Liverpool** and **Hull** As we have seen, **Liverpool's** Research Committee voted in 1978 to adopt *verbatim* the relevant section of the CVCP's 1978 report as the university's policy statement In a way, it could be said that they were taking the easy option, they certainly avoided the need to nominate an official group of policy-makers at the time - indeed, they do not seem to have nominated an official group of policy-makers at any point since This is probably why, over the years, **Liverpool** has modified its policy statement by adding in a sentence or two here and inserting an option or two there, rather than start from scratch or drastically

revise it in the light of significant changes such as the removal of the BTG's monopoly and the creation of ULTRA as a framework for joint ventures between the university and members of the academic staff. This is doubtless why, with the exception of one or two ambiguous phrases, the policy statement refers exclusively to inventions, even though the university claims ownership of all other forms of IP, too It is probably why, in 1985/86, the policy statement gave a quite different impression about the role of the academic in the exploitation process to the one which **Liverpool** outlined to the ESG in response to its queries that same year On the other hand, in view of **Liverpool's** current disenchantment with the concept of joint ventures with members of staff/independent academic spin-off companies and its enhanced concern about risk, it could be argued that the policy statement is less misleading today than it was then **Hull** also chose to construct its policy statement around the same section of the CVCP's 1978 report This decision was made by a group of officially nominated policy-makers and is rather surprising, in view of the fact that these people had access to the Kingman letter, the DES statement and all the guidance produced by the CVCP on behalf of the ESG over the preceding months It would be interesting to know whether the tone and content of **Hull's** and **Liverpool's** policy statements have deterred academics from trying - spontaneously, in view of both universities' failure to publicise the ESG's wishes in this respect - to assume responsibility for the exploitation of their research discoveries, particularly entrepreneurial responsibility

As we have seen, the policy statement in force at **Glasgow** between 1982 and 1989 appeared to give academics scope to assume responsibility for several stages of the exploitation process, whereas the latest policy statement makes no reference to the exploitation process, let alone to the role of the academic This change was not an oversight, but a deliberate omission, motivated by the belief that it is more effective to

outline the possibilities in the course of face-to-face discussion than by means of a written policy statement, particularly as the possibilities will depend on the exigencies of each individual case. Glasgow is the only participating university to have completely revised its policy statement on IP since it was authorised by the Research Councils; again, it would be interesting to know whether this change of policy statement had any affect on academics who had been thinking of assuming responsibility for the exploitation of their IP

City's is the only policy statement to unequivocally and accurately indicate - albeit very briefly - the role of the academic in the exploitation process Both the details of City's policy and its written policy statement were formulated by one person, the Secretary. It may be significant that only one person had a hand in this, rather than a group of people, or that the person concerned was the most senior administrator - or, indeed, that this person had considerable experience of IP-related affairs at another university prior to taking up this appointment

IL/IP Offices

As we have seen, six of the participating universities currently have a dedicated IL/IP office and three do not. Given that setting up and running an IL/IP office with a minimum number of staff doubtless entails certain, fixed costs irrespective of the size of the university, it would not be surprising if it were the three small universities which did not have an IL/IP office, those fixed costs would consume a higher proportion of a small university's recurrent income than a medium-sized or large university's In fact, this is not the case The relative size of a university - measured either in terms of student FTEs or staff FTEs - does not seem to explain the distribution of IL/IP offices Two of the smallest universities in this study either have or have had an IL/IP office - and cost was not the

reason for **Kent** transferring responsibility for IP to the administration, as the case study narrative in Appendix F reveals, one of the two universities which has never had an IL/IP office is small, it is true, but the other is medium-sized. Nor does the extent to which the participating universities were victims of financial cuts imposed by the UGC in the 1980s explain the distribution of IL/IP offices, two of the worst-afflicted universities have/have had an IL/IP office, one has not, two which were treated neither particularly harshly nor particularly leniently have an IL/IP office, one has not. Nor does the relative amount of external research grant and contract income earned provide an "explanation", whether this is expressed in £ or as a percentage of the institution's total recurrent income As we can easily deduce from **Figures 41a** and **41b**, both in 1984/85 and in 1988/89 the percentage of their total recurrent income which their external research grant and contract income represented places **Durham** and **City** in rank order positions seven and eight respectively In both years, though, **Hull** ranked ninth - and **Hull** has an IL/IP office If we narrow our focus down to the external research grant and contract income earned by the science base alone in those two years, we see that **City** ranked joint seventh in 1984/85 and ninth in 1988/89; in 1984/85, **Hull** ranked equally with **City**, and **Kent** ranked below the two of them - yet both had an IL/IP office. On the same basis, **Durham** ranked sixth in 1984/85 and fifth in 1988/89, in 1984/85, **City**, **Hull** and **Kent** ranked below **Durham** - yet **Hull** and **Kent** had an IL/IP office; similarly, in 1988/89 **Kent**, **York**, **Hull** and **City** ranked below **Durham** - yet three of them had an IL/IP office

The explanation for why some participating universities have an IL/IP office and some do not seems to be more complex than this, though it appears to be related to some of the factors explored in the preceding paragraph This comes to light if we examine these universities individually, rather than collectively The two universities which have never had an IL/IP office have taken this decision advisedly, the absence of a dedicated IL/IP

office is not due to failing to get to grips with the question at all or putting off making a decision Neither **City** nor **Durham** believe that they generate sufficient potentially exploitable IP to justify setting up an office dedicated in part, at least, to providing guidance and support on its exploitation As we have seen, though, their science bases actually attract as much as or more funding than two or three other universities participating in this study, universities which have an IL/IP office. However, these particular universities - principally **Hull** and **Kent** - have quite different expectations to **Durham** and **City** concerning the likely yield of that research funding. **Durham's** administration believes that the research bias in the various departments of the university is liable to generate less exploitable IP than departments in other universities which are nominally the same In the course of the fieldwork, informants at **Durham** repeatedly stressed the predominantly blue-sky or non-applied nature of the research undertaken, even to the extent of lamenting the fact that the academic community was not closer to "*the hot end*". In contrast, **Hull's** administration believes that the research bias in the various departments of the university is liable to generate more exploitable IP than departments in other universities which are nominally the same In the administration's view, the output of **Hull's** academics is "*surprisingly applied*" Similarly, **Kent's** administration believes that the research bias in the various departments of the university is liable to generate more exploitable IP than departments in other universities which are nominally the same. In **Kent's** view, a conscious decision was taken at the time the university was founded to go for "*forward-looking*" aspects of the various disciplines . "*it's all microbiology and biochemistry ... none of them are dealing with geraniums*" **City's** administration does not feel that its research bias is liable to generate any more or any less exploitable IP than similar departments in other universities, regarding this as rationalisation after the event. However, the fact that **City** is currently more preoccupied with boosting its ratings in research selectivity exercises than generating IP probably colours its outlook *vis-a-vis*

exploitable IP and IL/IP offices.

City and **Durham** both reported that their outlook is coloured by what could be described as a critical incident in the recent past Earlier in the 1980s, **Durham** appointed someone to market the university's computing facilities, an appointment which cost considerably more than the profits which the appointee managed to generate **City** had a similar experience after it set up CUBIE [52] in 1985 CUBIE was run by an experienced, full-time, non-academic director whose remit was to promote "*mutually profitable activities*" between academics and industry/commerce "*with the object of generating profit for the University, additional income for members of staff and furthering the reputation of the University with companies, industrial bodies and Government*" [53]; far from generating profits, CUBIE was wound up a couple of years later, having cost **City** a six-figure sum.

In five of the participating universities, the IL/IP office was set up either because the university itself came to view the idea with favour (**Glasgow, Liverpool, Strathclyde** and **York**), or because it had no objection to the idea when it was proposed by leading academics (**Kent**). In the other two, the university was against the idea and prevented the establishment of an IL/IP office for many years, despite pressure from the academic community Academics at **Bristol** and **Hull** did not get the IL/IP office they lobbied for until the cuts imposed by the UGC obliged the university to identify other sources of income **City** did not undergo this kind of "conversion"; it was already making an income from exploiting IP when the cuts were imposed - without benefit of an IL/IP office **Durham** did not undergo any such conversion, either - for quite different reasons· **Durham** does not believe that IP will ever yield it a significant income Moreover, there is no evidence that academics at **Durham** or **City** have exerted such pressure on their

respective institutions, perhaps **Durham** is right in believing that most members of the academic community have developed contacts with industry on their own initiative, thereby obviating the need for an officer to promote such contacts We may probably conclude from this that an IL/IP office is unlikely to be established in either of these two universities unless there is a significant change of circumstances

It remains to be seen whether **Kent** will continue to place responsibility for IP in the hands of an administrator who has many other responsibilities, rather than set up an office which is dedicated or at least partly dedicated to this KSIP's third managing director declined to renew his contract in mid-1990, with the result that this same administrator is now managing director of KSIP, a research and development company, despite his complete lack of training or experience and his own, long-standing misgivings it is worth noting that in 1985 he felt sufficiently concerned about being appointed Company Secretary that he contacted the AUT for guidance [54]

Holding Companies

As we have seen, only four of the participating universities have ever founded a holding company It is noticeable that three of these universities are civic and one, **Durham**, though classified as an "ancient" university for the purposes of this study, tends to align itself with other civic universities for purposes of comparison Let us consider now whether these factors are relevant or whether it is just coincidence

Durham's holding company was set up on the initiative of certain lay members of Council. Their motivation was to provide a framework within which the university could adopt a more entrepreneurial approach to exploiting its IP, while keeping such activities at arms' length from the university itself It was also felt that if subsidiary companies were

formed, this would provide a mechanism for overcoming the constraints of having to pay university staff on university salary scales One gets the impression that the lay members were trying to nudge the university into joining the so-called enterprise culture - unsuccessfully, in view of the fact that **Durham** wound up its holding company just two years later, having created no subsidiaries at all It did so because it found no IP which might have lent itself to being exploited by a start-up company and felt that it was not justifiable to continue paying the costs of maintaining the company It is tempting to conclude, given **Durham's** avowed risk aversion, that the university might not have looked too hard for suitable opportunities

Liverpool's holding company was founded at the instigation of one or two fairly senior members of the administration, against the wishes of lay members of Council, who felt there were safer ways of generating additional income - for instance, an appeal Despite its CEO scouring the university for IP opportunities which might lend themselves to being exploited via joint ventures with members of staff, only two groups of academics were persuaded to embark on joint ventures in this way Moreover, one of these joint ventures was soon spun-off as an independent company on the grounds that it was exploiting "soft" rather than "hard" IP, as originally anticipated As a result, the holding company soon metamorphosed into a university company As has already been observed, **Hull's** holding company is the result of a converse metamorphosis it evolved from a university company, founded to attract a DTI development grant which could not be given to the university, once the development was completed, future university companies were founded as subsidiaries of this first company, in order to keep such activities at arms' length from the university itself. **Bristol's** holding company was founded on the recommendation of a working party, set up by the Senate

The impetus for a holding company clearly came from four quite different sources - in **Durham**, the lay members, in **Liverpool**, senior members of the administration, in **Bristol**, senior academics and in **Hull**, the DTI It is surely coincidence that these are all civic/quasi-civic universities - and probably coincidence, too, that three of these universities, **Bristol, Durham** and **Liverpool**, are particularly concerned about risk. **York's** lay members are also known to have been concerned about risk, they urged the university to put as many of its "*risky*" activities as possible at arms' length from the university; they did not recommend establishing a holding company, however.

Joint Ventures

Durham is the only participating university which has doubts about the concept of joint ventures, let alone specific proposals, because it is so concerned about putting itself - or its IP - at risk **Bristol** and **City** are the only two which approve of the concept, but have not yet translated this into practice Obviously, universities can only participate in joint ventures with members of staff if a suitable opportunity presents itself, if either the university or the academics concerned suggest the idea and both parties agree it is a viable project Five universities expressed considerable doubt about proposing a joint venture to academics, whom they see as hard-pressed in terms of their conventional workload, these universities preferred to leave it to academics themselves to take the initiative, if they feel able to take on board the extra work In several of the universities which have actually embarked upon such joint ventures, the initiative has invariably come from the member(s) of staff, not the university This is not always the case in the other three universities In the mid-1980s, **Liverpool** promoted the idea of joint ventures fairly heavily, getting round the problem of academics' workloads by having the staff of ULTRA - *ie* the CEO and his secretary - undertake most of the "*dross*" connected with setting up and running joint ventures, leaving the academics to concentrate on the scientific and technical aspects of

product development and manufacture Liverpool's current disenchantment with the concept of joint ventures stems largely from the fact that ULTRA did not achieve what it set out to achieve. Various explanations for this have been evinced, the most common encapsulating the belief that academics - or, certainly, Liverpool's academics - are not particularly entrepreneurially inclined Glasgow and Strathclyde have no qualms about proposing a joint venture to an academic/a research team, either, they feel they get around the problem of academics' workloads by recruiting an experienced entrepreneur to set up and run each individual joint venture, if necessary, the SDA helps them to find suitable candidates None of the other universities participating in this study are in a position to elicit the support of an agency like the SDA, with the possible exception of City, which could presumably call upon LENTA or GLEB, this was often remarked upon with some envy by informants south of the border

University Companies

It is not entirely clear why those institutions which have set up university companies to exploit "hard" IP have chosen to operate on this basis, rather than a joint venture with members of staff, given that such companies often require an extensive scientific/technical contribution from those members of staff, if not a managerial/entrepreneurial contribution. Indeed, the scientific/technical contribution which a start-up company requires from an academic may often be more extensive than the contribution required, were the technology licensed to a third party with the relevant manufacturing experience This is precisely why Strathclyde would not contemplate setting up a university company, as defined in section 8 4(k)(iv). In Strathclyde's view, if academics are not prepared to put in the extra effort required to start up a company, it is not worth pursuing this as an exploitation route; if they are prepared to, that effort should be rewarded by a share in the company. Strathclyde's feelings are reinforced by its views on the moral ownership of IP generated

by members of the academic staff, views which were outlined in chapter 7

Science Parks

As we have seen, only seven of the participating universities currently have a science park, though the other two are in the process of organising theirs It would be wrong to imagine that these two universities have been less interested in this than the other seven. Establishing a science park is a major undertaking which requires the co-operation of local authorities and the participation of private and possibly public sector finance The two Scottish universities were fortunate in being able to create a joint science park - and, once again, in having the assistance of the SDA Not only is there no comparable agency with responsibility for the area encompassing **York** or **Bristol**, neither is situated in an area of special need, either **York**, in particular, seems to have found it difficult to attract the right kind of financial partners Moreover, both **York** and **Bristol** have had difficulties in obtaining planning permission, since the science park conflicts either with green belt protection or with county structure plans **York** should get full marks for trying, since it has been pursuing its plan for a science park for over ten years

From the perspective of academics involved in start-up companies of one kind or another, these science parks provide a resource of varying value **Glasgow's** and **Strathclyde's** joint science park is some miles away from either campus, as **Bristol's** will be in due course. At **Glasgow** and **Strathclyde**, certainly, that distance is believed to deter some academics from locating their companies there, this is partly why **Strathclyde** has converted an on-campus building into a dedicated incubator unit, and why **Glasgow** would like to do the same The other six science parks are/will be either on campus or immediately adjoining the campus and should avoid this problem However, incubator accommodation will still be a problem for academics at **City**, where the units are

exclusively for the use of growing companies, not start-up companies, this was not the original intention, but the cost of converting the building has made it impossible to offer accommodation at rents commensurate with start-up companies' cash-flow.

Publicity

None of the universities participating in this study have publicised these various frameworks/structures to the extent that they might reasonably have been expected to, though some have clearly done better than others This must surely diminish the value of these frameworks/structures as a signal to the academic community concerning the university's moral and practical support for academics assuming responsibility for the exploitation of their IP, particularly entrepreneurial responsibility, so why has there been so little university-wide publicity, using the medium of the newsletter? Perhaps we should start by examining the fundamental assumption underlying this question and consider whether it is, in fact, the function of the newsletter to publicise information of this ilk The newsletter in several participating universities describes itself as "*an informal publication*", indeed, one or two stress that they are "*not the voice of the administration*" and City's newsletter editor recently lamented the fact that, due to a shortage of other material, the newsletter was rapidly becoming the voice of the administration, although this was not its primary purpose The newsletters at Bristol and Strathclyde seem to be exceptional among the participating universities', in that they include detailed inserts on the deliberations of Senate and Council/Court, in Bristol's, this seems to have the status of an official report, in Strathclyde's, the report is written by a different member of the academic staff on each occasion and is explicitly presented as a personal view. It could be that the predominantly informal character of these newsletters deters policy-makers/policy-implementers from submitting items for inclusion, or that they submit items, only to have them included/excluded at the whim of the editor Close examination of these newsletters

suggests that this last explanation is unlikely; many of them regularly carry items of a similar nature For instance, **Durham's** newsletter has carried an item on commercial applications of the university's research into genetically-engineered, insect-resistant crops; **York's** newsletter frequently carries items on the activities of its commercially-oriented Electronics Centre, **Liverpool's** newsletter has carried an item on the creation of its Industrial Affiliates Club, described as a technology transfer mechanism which exploits academic expertise whilst maintaining the intrinsic integrity of university research; several newsletters have detailed the university's participation in Techmart *etc etc.* In some cases, of course, these could have been submitted by the academics involved, rather than by an official like the policy-implementer, in others, though, they are unlikely to have emanated from any other source

Geographic location may play a part in the extent to which policy-implementers submit items relating to the kind of frameworks/structures under discussion At **Glasgow,** the newsletter editor and the IP policy-implementer are situated in the same small building; this was a deliberate move, with the stated objective of cultivating a close relationship between the two This may account, in part at least, for the fact that between 1985 and 1989/90, **Glasgow's** newsletter has carried considerably more IP-related items than any other newsletter examined in the course of this study It is noticeable that at **Strathclyde,** the policy-implementer and the newsletter editor are situated in adjoining buildings - as they were at **Kent,** too, when the managing director of KSIP was responsible for IP; at **Bristol,** the two are at opposite ends of a street, at **York** - and **Kent** now that an administrator is responsible for IP - the two are located at opposite ends of the campus. On the other hand, at **City, Durham, Hull** and **Liverpool,** the newsletter editor and the policy-implementer are situated in the same building, mostly within a few doors of each other, so geographic proximity alone probably does not account for the publicity record of

these universities where these frameworks/structures are concerned It may well require a conscious decision to cultivate a close relationship between the policy-implementer and the newsletter editor, as has happened at Glasgow. There are several good reasons why policy-implementers should cultivate a close relationship with newsletter editors, the most obvious being to prevent careless disclosure of research discoveries which might otherwise have been successfully protected and exploited.

It is possible, of course, that neither the character of the newsletter, the proximity of the policy-implementer and the newsletter editor nor the quality of their relationship have a bearing on the extent to which the participating universities have publicised these kinds of frameworks/structures. It could simply be that it has not occurred to some policy-implementers/policy-makers to do this, or that it has not occurred to them to publicise certain frameworks/structures, or certain aspects of those frameworks/structures This may explain the dearth of publicity concerning the *raison d'etre* of the IL/IP office, as opposed to concrete examples of its various activities, in many cases that *raison d'etre* has evolved slowly over time, rather than been created in a manner analogous to the "big bang"; gradual evolution is probably less likely to raise awareness of the need for publicity. In other cases, it could simply be that policy-implementers discount the value of the exercise, at least where certain frameworks/structures are concerned. In universities with a dedicated IL/IP office, the policy-implementer publicises the existence of the office and at least a part of its *raison d'etre* and concomitant activities by virtue of contact with various sub-groups in the university in the course of his/her work; even though they come into contact with only a minority of the academic community in any given year, some policy-implementers - most notably Hull's - clearly feel that this form of face-to-face publicity is more effective than generally-targetted, written publicity

In some cases, there are clearly externally-imposed constraints on publicity, several policy-implementers mentioned that they are often unable to publicise license deals which they have negotiated/helped negotiate, due to restrictions imposed by industrial partners who do not wish their interest in a certain area to be become public knowledge (most university newsletters are circulated outside the university as well as inside) In others, there are self-imposed constraints Where joint ventures and university companies are concerned, for instance, informants from several universities - most notably City and Glasgow - indicated that they would be loathe to promote the concept, lest academics interpret this as the university applying pressure for them to take on another onerous burden. One or two informants were hesitant about publicising details of actual joint ventures, too, particularly financial details, lest the academics concerned suffer at the hands of colleagues envious of the personal gain it is imagined they are making Significantly, perhaps, most of the items on joint ventures which were identified seem to have been submitted by the academics concerned and focussed on their company's scientific/technical achievements rather than their financial achievements; perhaps this helps them to justify their entrepreneurial activities to colleagues

Informants at some universities clearly felt the same concern about promoting the concept of university companies, too It is less obvious, though, why universities should not publicise the achievements of actual university companies Every participating institution which has a university company appears to include such details in its annual report; since annual reports are not routinely circulated around the academic community, this means that outsiders often have a better grasp of the activities and achievements of university companies than academic members of the university itself It is not clear whether this is deliberate, motivated perhaps by someone's belief that academics would not be interested in such details or would not understand them, or whether this is simply an oversight on

someone's part. Only City has consistently publicised the activities and achievements of its university companies in its newsletter, using the three successive Queen's Awards which CTL won as a platform for giving balance sheet details as well as details of technical advances made by the company; City has also published financial details of its other companies, without waiting for a platform such as a Queen's Award It was noticeable that publicity items identified in other newsletters in the course of this study were more concerned with the scientific/technical achievements of university companies than with their financial achievements

Although newsletters in most of the participating universities have carried one or more items about the science park, only Durham's explicitly made the connection between the creation of the science park and the hope that academics would consider establishing companies there to exploit their research discoveries Research revealed that the initiative for this came from the manager of the science park, not the university itself This only serves to reinforce the conclusion that, even allowing for certain externally-imposed/self-imposed constraints on publicity, most of the participating universities could benefit from developing a more coherent strategy when it comes to publicising the kind of frameworks/structures which have been the focus of this chapter Each university should decide who is responsible for developing that strategy, policy-makers or policy-implementers Whoever is made responsible, the strategy needs to be developed in co-operation with other key players, such as the newsletter editor, the manager of the science park, whoever is responsible in the university for monitoring the progress of university companies *etc etc* It could be helpful to establish targets in terms of the annual number of publicity items about each kind of framework/structure It could also be helpful to consider not just the number of publicity items, but their content, too, to ensure that the concept underlying each framework/structure is publicised, as well as actual examples

(iii) Incentives

Financial Incentives

The ascending rank order (Evaluation 8 23) shown on p453 does not suggest an association between university type or objective factors like university size and the fact that some universities have created significantly more generous financial rewards than others. Nor does there seem to be an association between this and the extent to which these universities' recurrent block grant was cut by the UGC during the 1980s. Nor is there an association, apparently, between this and the percentage of the recurrent grant which external research grant and contract information represents, nor even the percentage of the recurrent grant which the science base contributed through external research grant and contract work There is no association between ranking and the relative size of the science base, either. It seems more likely that we shall have to look at each university individually to seek an explanation, starting with two key questions. who decided on these revenue-sharing formulae, and how did they arrive at those particular formulae?

The formula employed by **Strathclyde** until April 1990 dates from so long ago that today nobody knows the answer to that question Successive policy-makers and policy-implementers inherited it, apparently without question until recently In fact, a 50 50 split between the academic and the centre is fairly characteristic of universities which first decided upon a revenue-sharing formula in the 1960s or 1970s, as demonstrated by **City, Glasgow** and **Liverpool** In those days, when departments were not expected to generate income over and above their share of the UGC block grant, distributing a share of the income from IP to the department which generated it does not seem to have been an issue Universities which wanted a share of the income from IP generated by members of staff seem to have regarded a straight 50 50 split as the fairest distribution, this is certainly why **Glasgow** and **Liverpool** opted for a 50 50 split between the academic and the centre.

At Hull a formal revenue-sharing formula was first proposed by one of the HoDs who sat on the Sub-Committee on Patents; it is not known whether he based his proposal on guidance provided by the CVCP/ESG or whether it was influenced by the arrangements at his former university - or whether he simply plucked it from the air On the recommendation of a fellow committee member - an academic who has earned considerable sums from exploitation of IP he has generated - the formula was adjusted to give a greater share to the academic and less to the university Ironically, according to a key AUT official at the time this was not acceptable to the AUT at Hull, for the following reason:

> *"I've always had a fairly robust view, which is not necessarily precisely that of the union, that if people do a job and do it full-time, they shouldn't be doing a lot of outside work ..."*

The local association called on a member of the AUT's IPR Working Party for guidance, and ended up arguing for a greater share for the university

> *" . On one or two points, [we] actually [said] - do you really want to give all this away? They didn't seem to understand the basic principles What we were concerned with was - we weren't primarily concerned with making our members into millionaires We wanted our members to get a fair reward for what they were doing and therefore we concentrated heavily in the division of royalties on making sure that the first £40,000, or £80,000 if it was more than [four] people, goes heavily towards the individual, and when it becomes a money-spinner, then the university starts gaining "*

Given that one of Hull's revenue-sharing formulae is the most consistently generous of all the participating universities in rewarding academics, it would be interesting to know what the university originally envisaged and how that compared with the CVCP's 1986 guidance on the subject At York, the AUT took the opposite view when the university

sought to change the revenue-sharing formula which had been in force since the beginning of the 1980s, a formula guaranteeing academics at least a third of the revenue from the exploitation of their IP and possibly more, depending on the merits of the case It is not known who was the instigator of this change, which was in the university's favour, though it is thought to have been somebody in the Registry However, after protracted negotiations, the AUT managed to get for its members a revenue-sharing formula which it believes to be one of the most generous in the UK, as **Evaluation 8.17** showed, it is certainly one of the more consistently generous among the nine participating universities At **City**, the latest revenue-sharing formula was determined by the Secretary, *ie* **City's** policy-maker/policy-implementer Despite reducing the academic's share as well as the centre's, relative to the share they would have got under the previous formula - in order to give a share to the department, too - City intended to reward academics generously, to make sure they did not have the feeling that the university would "*screw every last penny out of them*"; as **Evaluation 8.17** showed, City is indeed one of the more consistently generous among the nine participating universities. The same cannot be said of **Kent**, where it appears to be the Finance Committee which determines the revenue-sharing formula - though it was on the recommendation of the Board of KSIP that the Finance Committee adjusted the various income bands to allow for the affects of inflation It was not possible to establish why, having agreed on new income bands in 1988, in 1989 the Finance Committee then decided to adjust the revenue-sharing formula itself - and to adjust in the university's favour a formula which was already considerably less generous to the academic than that employed by the other seven participating universities Nor was it possible to discover whether the Finance Committee plucked this new formula - or, indeed, the previous formula - out of the air, or whether members decided upon these formulae on the basis of some form of guidance or comparison It would be interesting to know whether **Kent** is aware that its financial incentives are significantly less generous

than many other universities', and if so, why It would also be interesting to know what affect that has on the academic community It would be difficult to design an objective test to establish whether **Kent's** stinginess acts as a disincentive to academics, dissuading them from bringing potentially exploitable discoveries to the university's attention However, **Bristol's** experience suggests that this can happen In the early 1980s, after decades of taking no more than 5 per cent of the net income generated by any discovery, **Bristol** sought to boost its earnings by splitting the income from IP equally between the academic, the department and the centre. This was perceived by many academics as a definite disincentive and several conveyed this perception to the ILO following his appointment in 1987 In due course, he was able to persuade the university to adjust its revenue-sharing formula in favour of the academic, an adjustment which he believes has had the requisite affect **As Evaluation 8.17** showed, in fact **Bristol** is still consistently less generous in rewarding academics than many of the participating universities, it is unlikely, though, that **Bristol's** academics - or indeed, many academics - have the wherewithal to make such comparisons, unless the AUT decides to provide its local assocations with such information If **York's** and **Glasgow's** administrations are typical enough to permit extrapolation, it seems likely that people with responsibility for IP - policy-makers, policy-implementers - will always have a battle on their hands when it comes to creating and maintaining effective financial incentives A senior member of **Glasgow's** administration confided.

> *"If somebody has discovered something and they make £100,000 I would like to see it ... I'm not saying that this attitude will continue There are one or two of my colleagues who are much more generous than I am and most of them say - oh, no, we can't allow this to go on I say - well, all you are going to do is frighten somebody off. They are not going to make £100,000 And if one of them does, it is going to encourage a hell of a lot more"*

It is clear that the financial incentives created by these universities reward the financial value to the university and take no account of the value to the company exploiting the discovery, or the industry, or the region. Indeed, it is difficult to see where universities would get the funds to do otherwise However, it is also clear that none of the participating universities has acted upon the DES' recommendation that the size of the reward should be commensurate with the responsibility which an academic has assumed for the exploitation of his IP, something which would not be impossible to incorporate into a revenue-sharing arrangement. Given **Durham's** and **Bristol's** views on the role of the academic in the exploitation process, this is not surprising. However, it is more surprising in the case of **Hull, Glasgow** and **Liverpool,** which allow academics to make some of the decisions and carry out certain procedures, and it is most surprising in the case of **City, York** and **Strathclyde** This is especially so where **Strathclyde** is concerned, given that an academic there could freely assume responsibility for every decision and every procedure, if an academic felt that licensing his IP to a particular existing company was the most appropriate way to exploit his discovery, he would get the same reward as a fellow academic who left this entirely to the IL/IP office to arrange, moreover, in that situation he could not benefit in another way - for example, by having an equity stake in a joint venture with the university. It could be said that **Hull** has done the opposite of what the DES recommended, in so far as the choice of revenue-sharing formula is dictated by the extent to which the university has contributed to the exploitation process If an academic decides to start up a company to exploit his discovery, this is still likely to entail a considerable amount of work for the university - guiding the academic through the process, vetting the viability of his business plan *etc*, it will entail even more work for the academic concerned - yet this does not seem to be reflected in the revenue-sharing formula employed.

The diverse revenue-sharing formulae in use at Hull - detailed in **Appendix G** - are of interest for another reason, too. These diverse formulae introduce considerable variations into the financial rewards which might accrue to academics there, according to the way in which their IP is protected and exploited. Irrespective of the number of "inventors", in terms of personal income, it would seem, from the perspective of the academic, to be most advantageous for a discovery to be exploited via the BTG or a similar "middle man". If the discovery brought, say, £10,000 into the university, a single inventor would receive **£7,500** if it had been exploited by the BTG, compared to only **£5,000** if the university had paid patenting costs and licensed the discovery to a company - or **£6,000** if the university had not paid patenting costs but had "*given official support*" and "*made a substantial administrative input into negotiations for commercial exploitation*" of a discovery. If there were, say, four "co-inventors" and the discovery brought £10,000 into the university, each would receive **£1,875** if the discovery had been exploited by the BTG, compared to **£1,250** if the university had paid patenting costs and licensed the discovery to a company - or **£1,500** if the university had not paid patenting costs but had made a substantial administrative input. Personal advantage in having the BTG exploit a discovery holds true at higher income levels, too. If the discovery brought £100,000 into the university, a single inventor would receive **£60,000** if the BTG had exploited it or if the university had not paid the patenting costs but made a substantial administrative input If the university had paid the patenting costs, however, even though it would recoup them *in toto* before distributing any income, the single inventor would receive only **£50,000** Four co-inventors would receive **£17,500** each if the BTG had exploited their discovery, but only **£12,500** if the university had paid the patenting costs and licensed it to a company, or **£15,000** if its contribution was limited to a substantial administrative input.

There is an additional incentive for academics at Hull to favour the BTG or a similar "middle man", particularly if it looks as though their discovery might generate a reasonable income over a number of years Where the university pays patenting costs, or makes a substantial administrative input to arranging the exploitation of the discovery, the resulting income is dealt with on an aggregate basis. Where it pays no patenting costs and an external organisation assumes responsibility for arranging its exploitation, the resulting income is dealt with on an annual basis This means that if a discovery brought, say, £15,000 a year into the university, after five years the single inventor would receive £56,250 if it had been exploited by the BTG - that is to say, 50 per cent more than the £37,500 he would receive if the university had paid the patenting costs - even though it would recoup those costs first If the university had paid no patenting costs but made a substantial administrative input, he would receive only £45,000 Similarly, four co-inventors would each receive £14,060 if their discovery had been exploited by the BTG, compared to £9,375 if the university had paid patenting costs or £11,250 if it paid no costs but made a substantial administrative input

For those academics for whom their personal share of the income is a strong incentive, the manner in which their discovery is exploited may influence their preference, whichever university employs them, of course If the BTG arranges exploitation, it retains 50 per cent of the resulting income in perpetuity, but it has considerable experience in negotiating generous license deals with companies which should maximise the IP's potential The MoD generally retains 66 per cent of the resulting income in perpetuity, so that a discovery exploited by the MoD would have to generate considerably more income before it yielded the same level of return for the inventor Exploitation via an established company might yield the same level of return considerably sooner, given that there is no external "middle man" taking a substantial cut, on the other hand, the university might not

negotiate such a good license deal as the BTG might have achieved and the licensee(s) might not maximise the IP's potential Exploitation via one's own or a university start-up company might yield the highest income in the long-term, but none at all in the short-term; equally, however, there is a risk it might yield nothing at all in the long-term, either. These considerations are a feature of every IP opportunity, both inside universities and outside However, Hull has reinforced these considerations by subjecting the resulting income to different revenue-sharing formulae, a situation which is quite unique among the participating universities This is presumably a side-effect of Hull's philosophy of "taxing" its academic inventors in relation to the amount of effort and money which the university expends on protecting and arranging the exploitation of their discovery The BTG or a similar "middle man" represents little or no direct cost and the least direct effort; other options involve direct costs and/or greater direct effort

As section 8 6 noted, as a group these universities reward academics for successfully exploited IP substantially less generously than the CVCP/ESG appeared to recommend, particularly at low income levels If we take account of compound inflation, running at 17.8 per cent by the end of 1989, 29 per cent by the end of 1990, the discrepancy is even more glaring It is not clear whether these universities have been knowingly and wilfully less generous, for some objective or subjective reason, or whether they did not pay sufficient attention to the guidance which was given, whatever the explanation, several of the participating universities clearly believe that they are rewarding academics generously With the exception of Hull and Kent, institutions which have incorporated a sliding scale into their revenue-sharing formula do not seem to have realised that their generosity has been diminishing annually in line with inflation Kent dealt with this in 1988 by making a one-off adjustment to the income bands, on the recommendation of its third policy-implementer Only Hull incorporated a mechanism to deal with this from the outset, but

then, apparently, forgot to employ it. Hull has never adjusted the income bands of its various revenue-sharing formulae in line with the retail price index, despite a commitment to do so in its 1987 policy statement, Hull's AUT does not appear to have noticed this. By accident or design - it is not clear which - there is no sign of this commitment in its latest policy statement. One of the greatest discrepancies between the size of the reward actually given to academics whose IP is successfully exploited and the size of the reward recommended by the CVCP is exhibited by those universities which have kept the straight 50 50 split they opted for in the 1970s, namely Glasgow and Liverpool A 50 50 split gives academics a far smaller share of the income at lower income levels than the other formulae employed It is not until much higher income levels (>£100,000) that academics at Glasgow and Liverpool would begin to see an advantage - and, of course, a discovery may never net that kind of income It would be interesting to know whether these two universities took any notice of the CVCP's/ESG's recommendation that the reward should be biased in favour of academics at lower income levels - and if they did, whether they actually sat down and plotted the consequences of a 50 50 split so that they could make a comparison.

Universities are not obliged to reward departments which generate successfully exploited IP. The ESG made no demands where this was concerned and the CVCP made no mention of rewarding departments in the guidance which it distributed to universities on its own and the ESG's behalf (though it did distribute details of the revenue-sharing formulae of a number of (anonymous) universities, which included examples of departments benefitting) Presumably the ESG was not in a position follow the UGC's example by creating externally-imposed incentives to encourage departments to identify and help exploit IP [55] Nonetheless, given the pressure on departments to generate revenue over and above their share of the block recurrent grant, many universities have

opted to give departments a share of the income from IP, as Figure 37 showed. Some of the participating universities - Glasgow and Liverpool, for instance - have allocated the department a percentage out of the centre's share, while others - like City and Strathclyde - have adjusted their revenue-sharing formulae in a way which has reduced the academic's share, too At Strathclyde, though, the department's share is at the expense of the centre on income upto £100,000, on income greater than this sum, it is at the expense of the academic. from an income of £500,000, academics will now get 45 per cent less, and on an income of £1m, 68 per cent less For reasons which are not clear, it seems to have taken considerable time and effort on the part of the policy-implementers and HoDs to persuade Strathclyde to include the departments in the revenue-sharing process, efforts which eventually succeeded, however As a result, Kent is the only participating university which does not distribute a share of the income from IP to the department which generated it This seems to be because the university has simply not got around to making a decision and committing itself to a percentage split, not because it is against the idea in principle

As Evaluation 8.18 showed, the participating universities attracted very widely divergent scores for the consistent generosity with which they financially reward departments for generating IP which is successfully exploited It was not possible to establish why Bristol, Durham, Glasgow, Liverpool and York decided to split the residue of the income from IP equally between the centre and the department or why the centre keeps four times as much as it gives the department at Strathclyde. City and Hull split the residue of the income from IP in the same way that they split the income from overheads. This leads to the centre taking a considerably smaller share than the department at both universities. However, it is worth noting that late in the 1989/90 session, Hull decided to stop returning 70 per cent of overheads to Schools, having ascertained that in 1988/89 78 per

cent of non-indirect costs were attributable to the centre and only 22 per cent to the Schools From 1990/91 **Hull** planned to return only 50 per cent of overheads to Schools; if it continues to split the residue of income from IP on the same basis, this will probably topple **Hull** from its position as the participating university which consistently rewards departments the most generously.

If we look now at the speed and thoroughness *etc* with which the participating universities disseminated details of these financial incentives to new and existing staff, once again a cursory glance at the rank order given at the end of section 8.7 indicates that we are unlikely to find a unifying "explanation" based on objective factors. Once again, it seems more likely that we shall have to look at each university individually to seek an explanation In fact, the explanation is probably much the same as the explanation for their scores for the speed and thoroughness with which they issued IP policy statements, and so will not be repeated here.

Career Progression

Finally, we should consider the question of incentives in the form of career progression There is no obvious objective constraint preventing universities from rewarding academics in terms of career progression either for their contribution to the various stages of the exploitation process and/or for the various manifestations of value they have helped create - apart, perhaps, from their failure to analyse this issue as rigorously as they might If we take the promotions material at face value and ignore certain discrepancies between this and the policy outlined verbally by informants, we find a noticeable lack of consistency in some cases. **Durham** and **Strathclyde** are consistent in that they take no account of either the effort academics put into protecting IP - or the end product (*ie.* a patent/design right/registered design *etc*) Neither do they take account of the effort

academics put into locating licensees/assignees and, in **Strathclyde's** case, into negotiating deals with candidate companies or into company start-up - or the end product (*ie.* a license, a spin-off company). **Hull** explicitly takes into account the end product of protecting IP - or one manifestation of it (*ie.* patents but not, apparently, design rights/registered designs or copyrights) - but not, it seems, the effort academics put into this. However, **Hull** does not take into account the end product of the exploitation process (a license/assignation, a spin-off company) or the effort academics put into achieving it **City, Bristol, Liverpool** and **Glasgow** make no mention of the effort involved in protecting IP, or the end product. Yet **Bristol** explicitly takes into account the effort which academics put into entrepreneurial activities and **Glasgow** explicitly takes into account the effort which academics put into helping manage "*university companies*" [56], whether seconded or not **Kent** might be more consistent than the others, in so far as it seems to want to take into account both the end product of academics' efforts to protect IP - or one manifestation of it (*ie.* patents, but not, apparently, design rights/registered designs or copyrights) and the end product of the effort academics put into the exploitation process - or one manifestation of it (*ie* licenses, but not, apparently, spin-off companies) However, this study has no way of knowing whether **Kent** has made this explicit in its promotions material

It is interesting that all references to the end product of academics' efforts to protect IP relate to only one manifestation of this - *ie.* to patents, not design rights/registered designs or copyright, despite the fact that copyright in some forms of computer software, certainly, has the potential to generate as large an income as a patent Possibly these universities tacitly recognise that the effort required to draft a patent specification is incomparably greater than the effort required to protect IP by copyright - and probably greater than the effort required to produce a design.

City's failure to make any mention of patents is quite surprising, given their role in its own, internal equivalent of the UFC's research selectivity exercise Each year **City** awards ratings to departments, ratings which are arrived at by adding up the points scored by various activities. In this scoring system, patents granted score the same as refereed journal articles, patent applications the same as non-refereed journal articles **Bristol's** failure to mention patents is also surprising, given that they are now included in an academic's record of achievement The absence of references to any of these activities in **Liverpool's** promotions material is surprising, given that the Staffing Committee ruled in the mid-1980s that collaboration with industry and technology transfer would be taken into account when undertaking promotion reviews - something which **Liverpool** confirmed in its response to the Kingman letter However, it was remarked upon by informants at several institutions - including **City** and **Liverpool** - that their university is deliberately economical in its approach to defining promotion criteria of all sorts, preferring to let members of the promotions committee interpret and weight the various possible activities In other words, failing to make certain criteria explicit does not necessarily mean they will not be taken into account in practice These universities are not intentionally signalling greater or lesser commitment to encouraging academics to assume responsibility for exploiting their discoveries; it is appropriate to wonder, though, what they are unintentionally signalling. In other cases, though, this is clearly not the explanation

Some universities may feel they have thought about this issue with due rigour, if they have, they did not explain in the course of the fieldwork why their promotions material gives the impression of rewarding certain aspects of the technology transfer process but not others. It seems far more likely that most of the participating universities have not analysed this issue as rigorously as they might Indeed, some ILOs - **Glasgow's**, for instance - have recognised this and put it on the agenda for further discussion **Glasgow's**

ILO will have to contend with the prevailing view that an academic should not be rewarded twice for the same activity, a view which senior members of the administration expressed more forcefully than at any other participating university.

Publicity

It is worth noting that there appear to be constraints on policy-implementers reinforcing the impact of the institution's financial incentives by publicising in the university newsletter examples of academics who have actually benefitted from them These constraints are not written down anywhere, they are simply "*in the air*" They ensure that publicity in relation to IP never includes details which could lead to colleagues deducing an individual academic's personal gain from the exploitation of his discoveries, however they were exploited According to an informant at Durham

> "*That is regarded, rather like salary, as confidential. It may be that we are tying our hands unnecessarily On the other hand, it is only fair to the individual. It could create jealousy But also, why should anybody know how much X is getting?*"

This same delicacy seems to apply to the gain made by individual departments, too. When Glasgow's Veterinary School received a quarter of the £3m or so which its vaccine, "Dictol", generated in royalties, for instance, it used a substantial part of this royalty stream to purchase a farm to assist its undergraduate teaching programme This was never publicised within the university It is very unlikely that many academics outside the Veterinary School itself are aware of this concrete example of the benefits which exploitation of IP can bring An informant at Glasgow reported

> "... *I don't think we have ever highlighted anything which says - well done, Department of X! They have made the following amount of money and that has gone into the Departmental discretionary fund* . "

in a tone of voice which suggested that they are not likely to do so in the forseeable future, either. This delicacy means that for the greater part of the academic community, a university's financial incentives may remain largely hypothetical. It is only when a university makes a highly significant gain - like the £8m plus in royalties which Strathclyde has received in less than a decade from its drug "Atracurium", that this becomes public knowledge - by virtue of the grapevine. In this particular case, the grapevine was fuelled by controversy over the fact that the department where the drug was created was not receiving a penny of this royalty stream; this was before Strathclyde's revenue-sharing formula was amended to include a share for the department