COMETT
THE TRAINING NEEDS OF STAFF IN THE COMMUNITY'S HIGHER EDUCATION SECTOR ENGAGED IN COOPERATION WITH INDUSTRY

DEADLINE 92

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FINAL REPORT PREPARED BY EUROPEAN RESEARCH ASSOCIATES

Document

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CONTENTS

List of Appendices

1. A list of the institutions, organisations, and individuals, in the Community countries who gave:
   (a) Interviews, both personal and telephonic, and also supplied information
   (b) Supplied answers to a Questionnaire

2. A copy of the questionnaire forwarded to relevant institutions in the Community's H.E. Sector

3. (a) Summary of the responses received to the questionnaire
   (b) Details upon which the above summary is based

4. An "A-Z of University/Industry Linkage Mechanisms" in Ireland produced by the Higher Education Authority, Dublin

5. Standard job specification for I.L.Os appointed under the Industrial Liaison Programme by the National Board for Science and Technology (NBST), Ireland.

6. Extract from The Development of Higher Education in the 1990's (HMSO, CMND. 9524, May 1985)

7. Details of the University Spin-out and Interface Companies assisted by the Scottish Development Agency

8. Policy on Higher Education - Industry Interface (Higher Education Directors of External Liaison (HEDEL), Ireland)

9. The role and functions of UDIL and University Industrial Liaison Services (University Directors of Industrial Liaison Services, U.K.)

10. Information regarding "Cellules de Valorisation" issued by the Ministry of Education, France

11. Details on the policy and funding for the exploitation of research generated in the H.E. Sector in France, Ministry of Education, France

12a Details of the arrangements for the distribution of monies received by CNRS for the exploitation of inventions arising in the H.E. Sector

12b Example of a CNRS convention with an H.E. institution

13. Copy of a Memorandum, dated 1st July 1986, from the Bundesverband der Deutschen Industrie c.V. (BDI) to relevant institutions in West Germany setting out the basis of future cooperation

14. An outline of structures dealing with technology transfer based on U.S. practice

15. Training programme for "Transferbeauftragte" in Germany

16. An Example of an Institutions Research Organisation in France

17. "Gruenderzentren" and similar structures in Germany (aus "Technologietransferinrichtingen in der Bundesrepublik Deutschland, Bochum 1986)

18. Science Parks and similar structures in Germany (source: J.M. Gibb (ed.), "Science Parks and Innovation Centres: their economic and social impact", Commission of the European Communities, Oxford, 1985).

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INTRODUCTION

This Study considers the development of cooperation between the Higher Education (H.E.) Sector and Industry in the European Community to-date. It surveys the work of the present staff and structures in the H.E. Sector engaged in cooperation with Industry. It considers the future development of cooperation, and the training needs of the relevant staff to deal with this development. Finally it makes specific proposals on these training needs and how they should be effected.

The Study was prepared by European Research Associates. The project team consisted of Mr. Keith Sellar Solicitor and Technology Transfer Consultant, Aberdeen, Scotland - (Principal consultant), and Mr. John Robinson and Miss Maria Brindlmayer of European Research Associates.

This Study consists of five parts:

Part I Purpose, approach and method: sets out the approach adopted in dealing with the Scope of the Study.

Part II The development of cooperation between the H.E. Sector and Industry to-date: surveys and summarises developments in cooperation between the H.E. Sector and Industry in the four designated Community countries, Belgium, France, Ireland and the United Kingdom, and summarises the present state of cooperation in the other Community countries, and also in the US and Sweden.

Part III A survey of the present structures and staff undertaking cooperation with Industry in the European Community: considers the existing objectives, policies, procedures and structures utilised for (a) general cooperation and (b) technology transfer, and looks at the qualifications, expertise and duties of the relevant staff. The four designated countries are dealt with and a summary is made of the other Community countries. The U.S. and Swedish experience is outlined for comparative purposes.

Part IV The future basic requirements of the H.E. Sector needed for beneficial cooperation with Industry: covers the perceived future development in the H.E. Sector, and the structures and staff which will be required to provide beneficial cooperation with Industry.

Part V: Proposed methods of training for, and assistance to, staff cooperating with Industry to provide the required skills: makes proposals for the training and assistance required by the relevant staff, other academic staff, students and Industry.

A list of the institutions and organisations interviewed and those who replied to the distributed questionnaire, are set out in Appendix 1. This, together with other Appendices, are set out at the back of this Study.

References, in relation to the particular section to which they refer, come at the end of the text proper, i.e. before the Appendices.

The advice and considerable assistance which was received from all concerned is greatly appreciated. In particular the authors would like to thank:

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* * *

SUMMARY OF THE STUDY
followed by its
MAIN RECOMMENDATIONS

This section, after a page setting the context for the Study, summarises its Parts consecutively. In the final pages of this Summary (pp. 19-22) are set out the Study's main recommendations. These are outlined in full in Parts IV and V, which are themselves based on the survey conducted in Parts II and III.

Setting and Rationale

The need to exploit fully the potential of the H.E. Sector's resources is widely accepted throughout Community countries as a key requirement for technological growth and economic prosperity.

However, to obtain the desired technological growth, the required linkages between the institutions of the H.E. Sector and Industry must be developed and strengthened in every possible way.

These linkages will not occur automatically given the present attitudinal and other divides that separate the two Sectors. And if they are to be effectively established, the precise purposes which these Liaison structures serve need to be fully understood.

These structures can not be established in a haphazard manner. The personnel staffing them must possess the expertise required to forge the necessary linkages by undertaking cooperation and technology transfer on a planned and systematic basis.

This Study has therefore dealt with the training requirements which will be needed to ensure that the staff directly responsible for cooperation, in particular technology transfer, have the needed expertise. The proposed methods to be utilised for this training have also been set out.

PART I: PURPOSE APPROACH AND METHOD

Part I sets out the Study's Scope, the interpretation of certain key terms used throughout it, and its approach and methodology.

The main methods used for assembling the core information relating to four designated EC countries (Ireland, the U.K., France and Belgium), which is set out in Parts II and III of this Study, have been: interviews, written information, and the responses received to a questionnaire. For other Community countries the information is based on answers to a questionnaire and other relevant material. The development and present background in Sweden and the U.S. have also been reviewed by way of a literature search.

In Part IV consideration has been given to the future structures in which an industrial liaison officer (ILO) may have to work and the role that he or she should play in developing cooperation. This has been carried out by reference to the information received during the Study, both oral and written.

Part V concludes by making proposals as to how the training needed to develop the ILO's required expertise should be carried out. This was undertaken by reference to past and present training methods and the identification of the requirement for a coordinating and advisory body in the Community.

PART II: THE DEVELOPMENT OF COOPERATION BETWEEN THE H.E. SECTOR AND INDUSTRY TO DATE

The development of general cooperation and technology transfer between the H.E. Sectors and Industry in the four designated Community countries, Ireland, United Kingdom (U.K.), France and Belgium has been considered. A summary of the situation in other Community countries is then given. To supply as much comparative material as possible the developments in Sweden and the United States of America (U.S.) have also been surveyed.

Ireland

It has been generally recognised that there has been the establishment of beneficial cooperative links with Industry at several institutions. However, the development of technology transfer in the H.E. Sector has not been given the priority envisaged by Government at the beginning of the 1970's, and recommended in several authoritative reports to date. The National Board of Science and Technology (NBST) has commissioned two Studies dealing (a) with the impediments to general cooperation and (b) advising on the structures required for technology transfer. One major impediment identified is that as academics are classified as civil servants, they technically cannot retain consultancy or other fees generated by commercial work.

Institutions have been urged to carry out an audit of their resources applicable to cooperation and to define their objectives for this H.E./Industry interface. The training of industrial liaison officers to deal with technology transfer has also been recommended, together with the dissemination of information about the benefits of cooperation and technology transfer to staff and students.

The application of science and technology for the benefit of the economy and the development of cooperaton between the two Sectors is one of the main functions of the NBST.

United Kingdom

There has been an interface between the staff of the H.E. Sector and Industry for many years. The first government scheme to assist this cooperation was the establishment of Industrial Liaison Centres in 1964. This scheme was abandoned in 1973 but some of the I.L.O's continued with their work in their institutions. This scheme and one instituted by the University Grants Committee (UGC) laid the foundation to the present network of Liaison offices throughout the country.

The need to increase government assistance to the development of cooperation and technology transfer has been recognised in a series of reports over the past two decades. This need has been specifically defined in a report by the main government advisory body on R&D - the Advisory Council for Applied Research and Development (ACARD) in 1983. Whilst recognising, in part, the terms of the ACARD Report, Government has not yet implemented its recommendations.

Although, over the past years government has introduced several beneficial support programmes assisting cooperation, it has not dealt with the basic need, for the provision of funding, to ensure that the proper cooperative and technology transfer structures have been established in institutions. Nor has it provided the facilities and funding to allow these structures to be properly staffed by suitably trained personnel.

To-date, although some institutions have established excellent links with Industry, there is still a great deal to be done to bridge the gap between the two Sectors. There appears to be a lack of comprehension throughout Academe and Industry of the benefits that cooperation and technology transfer can bring to teaching and research in institutions, and to growth in Industry.

France

Government has traditionally maintained its distance from the organisation by H.E. institutions of their links with Industry. As a result of this, and of the accompanying legal uncertainty about the permissible scope of the cooperation between the two Sectors, liaison structures and personnel, where they exist, have traditionally not always been operating in a systematic fashion.

However, this picture has begun to change as in recent years there have been significant developments in French law and policy. In particular, the Savary Law of 1984, by specifying as an H.E. objective the exploitation of its resources, has done much to encourage a more positive approach to cooperation and technology transfer. Many institutions now have liaison structures - most commonly called "cellules de valorisation" - which are a focal point for this process.

The growth of these liaison units within H.E. institutions has taken place in an existing framework of support for cooperation, in which the network of the Centre National de la Recherche Scientifique (CNRS) plays an important role. Assistance is also provided by national and regional agencies such as ANVAR (especially for patent search and risk capital) and ARIST (providing links with regional industry).

Belgium

Cooperation appears to have been a periodic factor in government policy since the immediate post-war years, but its consequences in H.E. institutions have been unevenly distributed. The country's great "free" institutions (the universities in Brussels and Louvain), in part because of their statute, have developed structures for cooperation and technology transfer on a much more extensive basis than their "state" counterparts.

Most institutions now have liaison units generally termed "cellules d'interface" which began to be introduced in the 1970's and expanded rapidly in more recent years. Their job of liaising with Industry, which is assisted by other structures within H.E. institutions, has been given positive encouragement by the government in early 1987, with the creation of a national "brokers fund".

The brokers fund provides financial assistance to H.E. institutions which, in order to optimize the transfer of their technology to Industry, need to enlist outside expertise or "technology brokers".

In addition to national measures of encouragement, regional initiatives are an important factor in this as in other aspects of the country's life. Examples of regional measures include data-banks for technology transfer, and support for links with local and regional businesses. A particular emphasis is put on the requirements of SMEs.

Other EEC countries

Less detailed information is available on developments in

H.E./Industry cooperation in the remaining Community countries, where the investigation was mainly limited to responses given to a questionnaire.

However, the situation is clearly very uneven. Countries like the Federal Republic of Germany and the Netherlands have considerale experience in both general cooperation and technology transfer. By contrast, the development of cooperation in countries like Greece and Portugal is embryonic.

Developments in Sweden and the U.S.

Since the 1960's it has been recognised that to maintain its position in the international market place, Sweden would have to make more investments in academic and other research projects. This led to the government approaching the development of science and technology in a planned and coordinated way leading to the establishment of the Swedish Board for Technical Development (STU). STU has been well supplied with funds to carry out its programmes to develop long term R&D projects in institutions which will eventually be directly beneficial to Industry. In the regions, specific financial assistance has also been given to institutions to enable them to transfer their technology to Small and Medium sized Enterprises (SMEs).

In the United States, the systematic approach to cooperation between the two Sectors has led to a realisation by both parties of the definite benefits which can arise from various linkages. This same level of awareness has not yet developed throughout the Community.

Through the National Science Foundation, the U.S. government has provided coordinating and facilitating programmes designed to remove barriers to the development of innovation.

Two internationally recognised geographic areas, synonymous with academic technology transfer, have been established in the U.S. - Route 128 round Boston and Silicon Valley near to San Francisco. The developments in both these areas have established the role that an academic research institution can play in transferring technology to ensure economic growth. It can also be noted that the institutions concerned had established research "centres of excellence" and had directly encouraged their staff to undertake consultancy work and generate technology which could "spin-off" in to Industry.

PART III: A SURVEY OF THE PRESENT STRUCTURES UNDERTAKING COOPERATION WITH INDUSTRY IN THE EUROPEAN COMMUNITY

Ireland

To-date there has been no apparent attempt to carry out an audit of the H.E. resources which are applicable to cooperation with Industry, as a basis of establishing the objectives for this cooperation.

To provide the required environment for beneficial cooperation and technology transfer the correct policies and procedures need to be established. This has not been done in the majority of institutions. Although Industrial Liaison "Committees" have been introduced they do not all contain the required outside representation. The work being carried out in the "Liaison Units" (ILU) is mainly for the direct benefit of the institution and not technology transfer for the benefit of the national economy. The National Board for Science and Technology (NBST) has already identified the need for the retraining of ILO's, and the introduction of new skills to carry out their future duties, in particular technology transfer. The NBST is giving some direct financial assistance to ILUs in order that their work can be maintained.

Consideration has been given to examples of structures in which or with whom the ILO will be working, including I.L.U's. The Higher Education Directors of External Liaison (HEDEL) which represents ILO's both in the Republic and Northern Ireland has provided a useful forum for the exchange of practical advice. To date, however, HEDEL has not undertaken any training of its members.

United Kingdom

Several institutions have not carried out an audit identifying their resources applicable to cooperation and in particular technology transfer. There appears to be a shortage of persons with direct experience and expertise to assist institutions in planning their cooperative development.

Although several institutions have developed the needed environment for cooperation, many have not and efforts should be made to deal with impediments to cooperation within relevant institutions.

The institutions now have the right to protect and develop their own Intellectual Property under certain provisos. As most do not have the trained staff outside expertise has been brought in and this expertise is now being supplied locally, as well as nationally.

Examples of established structures involved in cooperation have been given and it would appear that technology transfer, particularly through the vehicle of a limited liability company is growing in momentum.

At present no direct financial assistance is being given by Government to Industrial Liaison Units nor for the training of the required staff.

The objectives and work of both the University Directors of Industrial Liaison (UDILS) and the Association of Industrial Liaison Officers (AILO) have been reviewed. It has been noted that some in-house training on Intellectual Property has now been started by UDILS.

France

Most institutions contacted indicated they possessed a published policy outlining their objectives for cooperation with Industry. However, only in rare cases was evidence provided that this was based on a systematic audit of institutional resources. Other factors inhibiting a coherent statement of objectives include in particular the lack, until very recently, of legal clarity as to the extent of the institution's mission as regards cooperation and, more particularly, concerning technology transfer.

Despite this, a wide variety of structures, both internal and external to the institution, are being used for links with Industry. Alongside the central coordinating structure of the "cellule de valorisation" are innovation centres, "pépinières d'entreprises", technology parks, science parks, spin-off companies and institutional subsidiaries. This last type of structure is at the very initial phase of development, having been only introduced as a legal possibility in 1984.

These central structures may be used for consultancy and research contracts, even though in many cases it is the individual professor who gives the initial impulse for such arrangements. They also serve to exploit intellectual property rights on behalf both of the institution and the individual inventor.

Belgium

Less than half of the institutions surveyed said they had published policies stating their objectives for cooperation and technology transfer. Once again, as in other EC countries, few concerted attempts have been undertaken to assess accurately the transfer potential of the institution.

For all this, the "cellule d'interface", the main liaison unit in Belgian institutions, has generally a clearly defined view of its role in the transfer process. In the more progressive universities, these "cellules" are flanked by, and sometimes responsible for, other structures such as institutional companies and science parks. The use of these in Belgium is relatively widespread by comparison with the situation in France.

As regards intellectual property rights, the position appears to be in urgent need of clarification. Institutions have, indeed, been leading the demand for a official recognition which would clearly assign to them the exploitation of these rights. In the absence of such rules, institutions have tended to act as though these rights were effectively theirs already. By contrast, consultancy rights have been defined for some time in national law.

Other EEC countries

Liaison structures vary considerably from country to country, but all appear to have some channel for their links with Industry. The sophistication of these structures ranges from the German "Transfereinrichtungen" and Dutch "transfer points" to a situation where the liaison task, as one among many others, is undertaken by the institution's hierarchy (eg in Greece). Spain has traditionally been something of a special case, cooperation between the two Sectors having been largely in the hands of parity Foundations operating from outside the university structure.

Arrangements for intellectual property rights differ considerably. Unlike, for example, the practice in Belgium, in Germany the law confers on certain members of the teaching staff, rather than the institution where they work, the exercise of these rights.

Developments in Sweden and the U.S.

In Sweden, since the late 1960's Government support for cooperation between the H.E. Sector and Industry has steadily increased and liaison offices throughout the country are funded either through University budgets or with supplementary Government funding. Sweden has not only established offices but has also established schemes for academic personnel to be available to help companies directly and for the training of academic researchers in R&D management. Consideration has been given to the work at the Chalmers Technical University (CTH) in view of the international reputation it has established with development of spin-off companies involving its graduates, students and staff.

In the United States, the approach to policy on staff consultancy and Intellectual Property Rights is considered so as to ascertain the approach to establishing the needed environment for cooperation in the U.S. The main established structures have been reviewed i.e. Research Centres, Affiliate Programmes, Innovation Centres and spin-off companies. The work of the members of the Society for Research Administrators has been reviewed, in particular their qualifications, personality and training methods.

Identification of factors needed for effective H.E./Industry cooperation

Based on the comparative review, outlined above, concerning staff, structures and general developments in cooperation, the final section of Part III seeks to identify the factors needed for effective H.E./Industry links. The creation of these factors requires the input of three sources - the H.E. institutions, Industry and government.

The H.E. institution may contribute in the following ways:

* Wholehearted and continued support for cooperation
* Identification of the resources it has for cooperation and technology transfer and, based on this, the foundation of clearly stated objectives for cooperation
* Establishment of centres of research excellence
* Introduction of properly-managed and funded structures to carry out its cooperative objectives
* Identification and evaluation of its Intellectual Property followed by its development
* The provision of the required facilities to get its technology to the market place.

Industry's participation involves:

* An attempt to close the gap that exists between the H.E. Sector and itself
* Establishing formal and informal links with institutions
* Agreeing equitable terms for research and other contracts.

The role of Government should be:

* To provide the facilitating measures to forge the links between the two Sectors and ensure that these measures are implemented
* To identify the present impediments to cooperation and deal with them.
* To review and coordinate funding sources and to establish the relevant structures for cooperation in institutions and the training of their personnel
* To provide the required funding for academic technology transfer
* To review the present laws concerning the ownership of Intellectual Property generated by public funds
* To introduce tax reliefs which would assist in the transfer of academic technology to Industry

PRINCIPAL RECOMMENDATIONS
(PARTS IV & V)

Requirements for structures in H.E. institutions (Part IV.A)

1. The maximum use should be made of personal contacts through staff and students of institutions in the development of links with Industry. These contacts should be developed through officially recognised, student "clubs", social gatherings and Alumni Associations.

2. To enable institution to deal in the most practical way with inter-disciplinary, inter-institutional, and transnational research projects they should have all the necessary facilities and staff to set up any required "Research Centres" to coordinate and undertake these projects.

3. To identify, protect and develop institutional Intellectual Property, institutions should establish a basic flexible structure which could undertake these vital roles which should lead to beneficial transfer of technology.

4. To allow Industry to have regular formal access to consultancy and research it is proposed that institutions, with the necessary "centres of excellence", should consider the establishment of Industrial Liaison or Affiliation Programmes. These programmes not only allow Industry to monitor the progress of relevant technologies but also provide institutions with continuous information beneficial to teaching as well as research.

5. All relevant institutions should maintain an Industrial Liaison Unit either on a full time, or a part time basis,

to ensure that its basic link with Industry is forged. All links should be properly manned and funded, and contain sufficient staff with the required expertise.

6. Institutions should provide or make available all facilities for the development of the "ideas" and services generated by staff and students to ensure that they are brought to a state which would allow for their transfer to Industry.

7. Institutions should provide all necessary assistance and facilities to allow staff and students to spin-off their innovations on to the market place.

8. Institutions should have clear policies and procedures setting out their relationship with any spin-off, joint venture or other companies with which they are associated.

9. The establishment of "Science Parks" by institutions requires careful consideration, planning, and the fulfilment of basic criteria set out in the Study.

<u>Requirements concerning the duties of liaison personnel (Part IV B)</u>

1. It is essential that the duties of ILO's are specifically defined at the commencement of the appointment. If there are to be any alterations or additions to these duties they must be discussed fully by all parties and specifically agreed.

2. Careful selection of ILO's must be carried out based on the defined duties. The personality of the applicants must be considered as well as the qualifications, expertise and experience. Selection Boards should have the benefit of

industrialists if this is possible.

3. Institutions must also specifically define the duties of an ILO to identify the expertise required and upon which the appropriate rank and status can be conferred.

Training requirements for ILO's (Part V)

1. Training should be undertaken by ILO's throughout the Community to ensure that they attain the expertise required of them. The relevant courses should be undertaken at a national and at Community level. The national level should include training within the institutions.

2. The Commission should assist the training of the ILO's in every possible way including the establishment and funding of a Community-wide Association representing ILO's, H.E. institutions and other interested parties.

3. The Association should arrange and coordinate the training programmes throughout the Community in conjunction with national bodies if they exist, including the preparation of all necessary materials.

4. The Association should also ascertain the expertise which is available throughout the Community to assist institutions on matters pertaining to general cooperation and technology transfer.

5. The Association should arrange for Community-wide studies on such matters as inter alia:
   * closing the attitudinal gap between academe and Industry
   * the impediments to general cooperation and technology

transfer in the H.E. Sector.

* the establishment of a career structure for the institutional personnel engaged in cooperation, in particular technology transfer.

6. The Association should establish a library containing all relevant literature published on all matters concerning institution/Industry cooperation. Consideration should also be given to the setting up of a Community-wide data base dealing with academic research and expertise.

7. To implement the proposals of this part of the Study it is recommended that workshops be arranged to consider
   * the format, course subjects, the levels (basic and advanced) and venue of courses
   * the production of the materials required for training.

8. To ensure that the benefits of general cooperation and technology transfer are disseminated to the most influential persons both inside and outside the institution, regular information programmes should be presented to senior officers in H.E. institutions and industrialists.

9. Specially prepared training programmes should also be produced to cover the needs of researchers, faculty and departmental representatives.

10. Assistance should be provided to those ILU's who would offer on-the-job training in the form of traineeships combined with some courses for future ILO's. Training should be given, on all relevant aspects of cooperation, to personnel in Industry, particularly SME's.

PART ONE

PURPOSE APPROACH AND METHOD

A. SCOPE OF STUDY

The purpose of the Study is to ascertain the training needs of staff employed in the Higher Education (H.E.) Sector of the European Community who are directly concerned in cooperation with Industry, hereafter referred to as Industrial Liaison Officers.

Specific Scope of Study

(a) to consider the present qualifications and expertise of "industrial liaison officers/ILO's";

(b) to consider the effectiveness of ILO's and the structures within which they are presently working, particularly in relation to technology transfer from universities to Industry;

(c) to consider the qualifications and expertise of ILO's which are required for effective industry-university cooperation;

(d) to consider the most practical methods of training which would provide ILO's with the required skills.

B. INTERPRETATION

The following expressions used throughout the Study require interpretation :

"General cooperation/collaboration"

Refers to all the duties undertaken by staff in the Community's Higher Education Sector cooperating with Industry which are not directly concerned with the development of intellectual property and research leading to technology transfer.

"A 'hard' Company"

Refers to a company which has developed from undertaking consultancy and other *ad hoc* work, to carrying out manufacture, normally of standardised products. This could also be a "spin-off company".

"The Higher Education (H.E.) Sector"

Is to be taken to embrace all relevant third level academic institutions in the European Community unless specifically mentioned.

"Incubation Centre"

Is a centre which provides the physical needs for the gestation period required to bring innovative technology on to the market.

"Industry"

This word is utilised, unless otherwise stated, in its broadest sense to include manufacturing, service, business, and the professions.

"Industrial Liaison Bureau (I.L.B.)"

Refers to a structure established within an institution whose main purposes are to act as an information centre and contact point on collaboration with industry and other sectors of the economy, both internally and externally. Also to provide internal facilitating services.

"Industrial Liaison Centre (I.L.C.)"

Refers to a structure established within an institution whose main purposes are to deal with all forms of cooperation with industry and in particular solving the problems of industry by identifying and catering to its needs.

"Industrial Liaison Officer (I.L.O.)"

Refers to all staff in the Community's H.E. Sector or any other body who are directly engaged in academic cooperation with Industry.

"Industrial Liaison Unit (I.L.U.)"

Refers to either an I.L.B, or an I.L.C, or any combination of both, and where the context permits also includes an institutional company.

"Innovation"

In the economic sense utilised herein is accomplished with the first commercial transaction involving a new product, process, system or device.

"Innovation Centre"

Is a centre providing the innovation background for the identification and development of technology. It does not per se provide the physical needs.

"Institutional Company" - See "University Company"

"Institutions"

Refers to all universities, polytechnics, colleges or other academic bodies in the H.E. Sector.

"Intellectual Property"

The definition of the World Intellectual Property Organisaton (WIPO) has been followed, namely - "the rights relating to literary, artistic and scientific works; performances of performing artists, phonograms and broadcasts; inventions in all fields of human endeavour; scientific discoveries; industrial designs; trade marks; service marks; commercial names and designations; protection against unfair competition and all other rights resulting from intellectual activity in the industrial, scientific, literary and artistic fields."

"Joint Venture Company"

Refers to a company wherein the H.E. institution holds a minority of the equity.

"Science Park"

In the context of this Study these words are utilised to describe only a property development in which an institution has a property interest or direct links with the tenants situated on the development.

"Soft Company"

Refers to a company which is normally in its nascent stages of development, undertaking consultancy and ad hoc work, whilst it waits to find its niche in the market. When it does it becomes a "Hard Company"

"Spin-off company" or "spin-out company"

Refers to companies incorporated by present or former students and staff of the H.E. institution.

"Structures"

Refers to an organisation, method and group of persons.

"Technology transfer"

Is taken to be the process by which science and technology results are diffused, leading to transformation of the relevant information into an actual operation of some kind. It does not include in any detailed way "knowledge transfer" as seen in

programmes such as continuing and extension education.
"University Company" or "Institutional Company"

Refers to a company wherein the H.E. institution holds the total equity or the majority thereof.

C. APPROACH

As indicated in the Scope, this Study deals only with the training needs of staff in general cooperation and technology transfer as set out therein.

It has been accepted that there has been acknowledgement throughout the Community of the benefits which should accrue to the economic and social sectors of society from the input of applicable academic scientific and technical knowledge.

The terms of the relevant contract restricted physical visits to institutions in only four Community countries. The overall conclusions and recommendations are therefore based partly on personal interviews and partly on written information received, including a questionnaire forwarded to all relevant institutions in the Community.

D. METHODOLOGY

The Study was carried out as follows:

(1) An examination of government legislation, policies and procedures, concerning relevant aspects of the H.E. Sector's cooperation with Industry, both within and outside the European Community.

(2) An examination of the relevant publications, articles and other information dealing with aspects of the H.E. Sector's cooperation with Industry, both from inside and outside the European Community. Some of the items referred to are set out at the end of the Study under the heading of References.

(3) Individual and group interviews with members of Institutions, and other relevant organisations in the four Community countries selected by the Commission of the European Community namely:

(a) Ireland
(b) United Kingdom
(c) France
(d) Belgium.

(4) Interviews with individuals who have had personal experience of, or a direct interest in, the Scope and Terms of the Study.

(5) The collation of information received from questionnaire forwarded to all relevant institutions in the H.E. Sector, the representatives of the national governments in the Community, industrial and other organisations, companies and individuals. A copy of the Questionnaire to the institutions is annexed as Appendix No.2, together with a summary of responses received, and the detailed information upon which the summary is based. These are marked as Appendices 3 (a) and 3 (b) respectively.

(6) The preparation and finalisation of this Study and the relevant Appendices.

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PART TWO

THE DEVELOPMENT OF COOPERATION BETWEEN THE H.E. SECTOR AND INDUSTRY TO-DATE

The general background to the development of cooperation in the Community commences in this Part with a study of four designated countries, all of which have established Industrial Liaison posts in their Higher Education (H.E.) Sectors. These countries are considered in the order of the visits made during the compilation of this Study:

Ireland
United Kingdom
France
Belgium

The description of the situation in these countries is made by reference to various factors: the general development of H.E./business cooperation, including the place of the Industrial Liaison Officer (I.L.O) to-date; some relevant aspects of governmental policy and assistance, whether national or regional; the national and regional networks of quasi-public agencies which in some countries constitute an important part of the context in which cooperation is conducted or in which the I.L.O. operates; and developments in the legal framework germane to cooperation.

A survey of all the remaining Community countries is then undertaken based on replies to a questionnaire and other available materials.

In order that as much comparative material as possible is available to assist in identifying the future training needs of I.L.Os, relevant developments in cooperation between the H.E.

Sectors and Industry in two non-Community countries, Sweden and the United States of America (U.S.), are also surveyed. Both these countries have attained international recognition for the development, not only of general cooperation, but also the transfer of academic technology for the benefit of their national economies.

* * *

A. THE SITUATION IN EC COUNTRIES

1. IRELAND

(a) General developments in cooperation

Institutions considered and overview of cooperation

The H.E. Sector in Ireland considered in this Study consists of the National University of Ireland with its three constituent Colleges - University College, Dublin, University College, Cork, and University College, Galway. The six "recognised" Colleges of the National University have not been considered.

Dublin University - Trinity College and the National Institutes for Higher Education, Dublin and Limerick have also been considered. All these institutions are funded by the Higher Education Authority (H.E.A.) and are individual legal persona.

The H.E.A. was established under the Higher Education Act of 1972 with several general functions including the furtherance of the development of Higher Education and to promote the appreciation of the value of Higher Education and Research.

Although the H.E.A. has not taken a direct role to-date in the development of cooperation between institutions and Industry, its Development and Promotion Committee is presently considering relations between the two Sectors as a result, in the HEA's words, of "repeated calls from both public and private bodies for an extension of these linkages."

A list of the H.E. linkage mechanisms which are presently existing in Ireland has been supplied by the Authority and is annexed as Appendix N° 4.

The Dublin Institute of Technology - Kevin Street and Bolton Street; Regional Technical Colleges at Cork, Tralec, and Galway have also been considered. These institutions are operated by Vocational Education Committees (VECs) established in the relevant areas of the country. These institutions are at present not individual legal persona.

In 1971 the National Science Council (now the National Board for Science and Technology) recognised the need for the strengthening and maintaining of direct links between the Educational and Industrial Sectors. It therefore sponsored the funding and establishment of the post of an "Industrial Liaison Officer" at Trinity College, Dublin through its Industrial Liaison Offices Scheme. In 1973 it also introduced the University-Industry Cooperation Scheme to provide initial funding for the establishment of Industrial Liaison Offices within the H.E. Sector. In 1982 this assistance was extended to institutions operated by the VECs.

During the last sixteen years, the appointment of Industrial Liaison Officers (I.L.Os) has been the main vehicle in Ireland used to generate cooperation between the two Sectors.

There are now I.L.O's, or officers whose duties _inter alia_ deal with collaboration, both full time, and part-time, in the following institutions :

i)	University of Dublin, Trinity College
ii)	University College, Cork
iii)	University College, Dublin
iv)	University College, Galway
v)	National Institute for Higher Education (NIHE), Dublin
vi)	National Institute for Higher Education (NIHE), Limerick
vii)	City of Dublin Vocational Educational Committee
viii)	The Regional Technical College, Cork
ix)	The Regional Technical College, Galway.

The appointment of an I.L.O. is presently under consideration at the Regional Technical College, Athlone.

The National Board for Science and Technology (NBST), on its establishment in 1978, adopted the policy of its predecessor and has, over the above period, continued to give financial support, of varying amounts, to some of these posts, and also set down some years ago the basic duties which should be carried out by the staff. These included :

(i) The identification of the training needs of industry and the placement of students and graduates therein;

(ii) The promotion of commercially viable research and consultancy leading to technology transfer;

(iii) The promotion of the awareness of the benefits to both the Sectors from collaboration.

Full details of these basic duties are set out as Appendix N° 5.

The extent to which general cooperation with Industry has developed throughout Ireland has varied, but it is generally recognised that there have been some successful industry-sponsored projects on several campuses. Beneficial links have also developed, particularly with the local subsidiaries of multinational companies.

The training needs of Industry have also been responded to, and there have been significant results in student and graduate placements, despite the present economic climate in the country.

The need to acquire a technological identity, to supplement the country's agriculturally based economy, appears to have been one of the main governmental influences on the H.E. Sector leading to the establishment of the NIHEs at Dublin and Limerick, and the development of the Regional Technical Colleges.

In its implementation of government policy, the H.E. Sector would appear to have gone a long way toward fulfilling its role in the production of the personnel required to staff a national technological base.

<u>The situation as regards the H.E. Sector's transfer of technology</u>

The picture as regards the H.E. Sector's performance in technology transfer is markedly different. It is apparent that the identification, protection and development of intellectual property generated on the campus and its subsequent transfer to industry has not been given the priority by the Sector which the Ministers of Finance and Industry had intended when the I.L.O. Scheme was launched in 1971.

As an indication of the position there were no basic details available of the transfer of technology owned by institutions and providing income prior to 1985. No details of income from this source has been supplied by any of the institutions.

The Institute for Industrial Research and Standards (IIRS) through its Inventions Service recorded that out of 387 applications for evaluation of patentable ideas in 1984 only three came from academic sources. This figure was repeated in 1985 when 395 applications were dealt with. None of the academic applications apparently led to financially assisted patent applications through the Service.

Unless there is a flow of technology to upgrade and develop present indigenous Irish Industry and to establish new companies, there is the risk that the job market will not be there for many of the new graduates.

It would appear that Government is concerned about the number of graduates taking positions overseas in recent years. The development of future technology transfer from the H.E. Sector is therefore an essential element in the national economy.

The priority given to developing technology transfer has been recognised by a series of recent Reports. Three in particular express the views respectively held in Industry, the H.E. Sector and the Government. Their principal recommendations are given in some detail below.

(i) "Strategy for Industrialisation - The role of Third Level Institutions", published by the Confederation of Irish Industry (1981).

The three major themes developed in the C.I.I. Report were: -

- "There must be a willingness on the part of government to generate a climate conducive to research and innovation through the provision of proper funding and opportunity.

- "There must be a parallel willingness on the part of academics and industry to try to breach institutional and attitudinal barriers to cooperation. Industry must be encouraged to increase significantly its investment in R&D particularly related to new technologies.

- "There is an urgent need for a continuing supply of well trained and well motivated manpower to carry out future research and development, and to meet the needs of future industry."

Included in the recommandations set out by the C.I.I. were the following: -

- "No unnecessary impediments should be imposed on academics or people in industry who wish to contribute to the process of technology transfer.

- "The establishment of facilities to enhance the transfer of technology should be actively encouraged.

- "Continuing information on all aspects relating to patents should be made available through seminars etc. The ability to recognise patentable science is to a great extent an acquired skill which requires development."

(ii) Education, Innovation and Entrepreneurship, Recommendations of the National Working Party of Deans, pubished by the National Board for Science and Technology (1983).

Among the recommendations set out by the National Working Party of Deans were: -

- "1.3. The inclusion of topics such as patents, licensing, innovation and entrepreneurship in science, engineering and business curricula is valuable, and such topics should be extended or introduced where already not available.

- "3.1. The value of consultancy from academic staff to industry be recognised and this activity encouraged.

- "3.2. Recruitment and promotion procedures within higher education to give due recognition to industrial experience and interaction.

- "5.3. A system of "Recognition for Excellence" in invention/innovation be set up for educators, industrialists and public sector employees.

- "6.2. Third level institutions be encouraged to develop Centres of Advanced Technology, each of which could offer a specialised service to industry and be co-ordinated with industrial planning."

(iii) Review of Links between Industry and Third Level Education, published by the Manpower Consultative Committee (1985).

The relevant recommendations were: -

- "The Sub-Committee believes also that each Third Level College should consider the establishment of formal structures for the purpose of furthering cooperation with Industry. Examples of such structures already exist in some colleges. The Sub-Committee urges each College to take up more of the range schemes of co-operation which are operating successfully in certain Colleges.

- "The Sub-Committee believes that Industry has much to gain from cooperation with Third Level Education, and that it should take steps to exploit the opportunities open to it in this area. Industry should be encouraged to identify where Third Level expertise could be of assistance to it, and should support seminars, and similar activities designed to elucidate its problems."

Barriers to Cooperation

As a result, in part, of the issues discussed in the Reports referred to above, the NBST commissioned in 1985 the first of two Reports which have directly considered the problems that the H.E. Sector is facing, both in general collaboration, and in developing the beneficial transfer of its technology.

The first NBST Report (1) considered the barriers to commercial research and consultancy and identified inter alia the following problems:

(i) The need for the Department of Education to publish clear positive statements of its support for commercial research and consultancy, together with general guidelines within which these subjects could be undertaken.

(ii) The constraint put upon the development of commercial research and consultancy due to the fact that, as civil servants, members of academic staff were not allowed to receive any remuneration other than the salary of their post.

(This is an obvious barrier and disincentive which, despite the strong recommendation for its removal in this Report, and the subsequent Report, still applies to-day.)

(iii) The attitudes and practises in the Higher Education Sector which give rise to basic misunderstandings between the two Sectors. These included concern that "an over-emphasis on applied research may militate against basic research" and the need to ensure "academic freedom".

(iv) The management practices and management styles in the H.E. Sector had not been established to deal with commercial problems and disciplines.

(v) The need for the publication by the institutions in the H.E. Sector of the necessary policies and procedures dealing with commercial consultancy, research, and the ownership of intellectual property.

This Report also highlighted the special problems faced by the Regional Technical Colleges (RTC's), coming under the management of Vocational Education Committees set up under an 1930 Act.

The RTC's are not, as in the university institutions, separate legal entities established under their own constitutions as corporate bodies. They therefore have to face specific legal problems with regard to the undertaking of commercial research and consultancy, and legal liability arising therefrom.

In 1983 the Association of Vocational Education Colleges (AVEC) had already published a well-received Report on the problems facing the development of consultancy and research in the R.T.Cs.

The Report recommended the setting up of a management framework to foster R&D, including the establishment of Companies, limited by guarantee, to be the structure through which research and consultancy work could be administered.

The Ministry of Education, altough recognising in its November 1985 Green Paper ("Partners in Education"), that the relevant Colleges are "essentially third level institutions", has done nothing to-date to implement the terms of either the AVEC, nor the NBST Report, or to officially assist in the development of cooperation with Industry, or technology transfer, by the RTC's.

Structures for Technology Transfer in the H.E. Sector

The NBST is presently considering the terms of the second Report published in 1986 on Structures for Technology Transfer from the H.E. Sector (2). This Report concurs with the above statements made in the first Report, and goes on to make the following recommendations relevant to the present Study: -

(i) The need for the formulation by Government of a clear, coordinated and consistent strategy on the H.E. Sectors cooperation with Industry, in particular technology transfer.

(ii) The Institutions should also adopt a strategic plan, and carry out an audit of their relevant resources to properly deal with general cooperation with Industry, and in particular technology transfer.

(iii) The I.L.O's should receive the necessary training on the identification, protection and development of intellectual property, and be able to instruct the relevant staff, and students, on the benefits arising from this property, and its transfer.

(iv) The post of I.L.O. must be accepted, and established on its own merits, giving to the holder the academic standing which it requires in dealing with staff, both in institutions, and Industry.

(v) There should be the required amount of "missionary" work by the institutions, to stimulate and maintain the interest of Industry, particularly indigenous Industry, in the expertise and facilities of institutions. Also the establishment of needed links enabling institutions to identify and understand the problems of Industry.

(vi) Institutions should facilitate the incorporation of spin-off companies or other suitable structures to ensure that, if Industry is not able to deal with the transfer of technology, the institutions would be able to see that beneficial transfer is accomplished.

As a result of this Report, consideration has been given to the utilisation of the limited liability company as a vehicle for technology transfer from the H.E. Sector. The needed policies and procedured on consultancy and intellectual property are also being examined.

The NBST also appears to be emphasising the funding of specific industrial liaison activities, to assist the development of technology transfer as, despite the direct interest, valuable advice, and financial assistance which the Board has given, particularly over the past five years, there is general recognition that the national economy has still not noticeably benefitted by any significant movement of science and technology from the H.E. Sector into Industry.

The main duties to-date, carried out by the majority of I.L.Os apparently have been those of the most immediate benefit to their institutions, namely - student placement, careers information service, fund raising, cooperative education, relations with graduates and public relations.

The academic and career backgrounds of the presnt I.L.Os would also indicate that they could not have been appointed to deal specifically with intellectual property and technology transfer, but were apparently chosen for their general experience in the two Sectors.

No training has apparently been given on a formal or regular basis to the I.L.Os, on such matters as contract negotiations, licensing agreements, and intellectual property rights.

Despite the recommendations of the NBST Report on Barriers to Cooperation, and lengthy deliberations within the institutions, only one, University College, Cork, has published a policy and procedures dealing with Intellectual Property Rights arising from work in the College. This is also the only institution which has been able to produce details of the intellectual property owned by it, and which will provide an income from its transfer.

(b) Governmental Policy and assistance

The Department of Education's document, published in 1985, "Programme for Action in Education 1984-1987", clearly states that "the links between higher education and industry will be intensified". At the time of writing this Study no strategy and relevant policies on the intensification of these links have been published.

It is of interest to note, however, that the Fianna Fail Party, who were returned to government in March this year, had published a Policy Document on Science and Technology in October 1985, setting out the need for a definite strategy.

The main element of this proposed strategy of relevance to this Study was: -

"A major focus of a technological strategy must be the process of industrial innovation. This is the development and commercialisation of new products or processes or by improvement of existing products and processes, which result from advances in scientific and technological knowledge. The experience of industrial development in different countries has shown that strength in the discovery of new knowledge does not necessarily ensure that the country which makes the discovery will reap the benefits of commercialisation of the new knowledge. The argument also applies in reverse. It is a major objective to maximise the commercial spin-off from advances in

Science and Technology, thereby directly contributing to economic development."

To carry out this element, it was proposed, in the Fianna Fail Document inter alia that -

"The third level colleges will also be assisted and positively encouraged to apply their resources to local industrial needs. Their industrial liaison efforts must be boosted to assist in this task.

"In addition, a greater market industrial spin-off will be expected from existing third level reserve allocations. An overall set of grants/incentives, budgetary allocations and penalties must be established which is consistent with promoting innovation. Each third level college will be expected to specifically include its plans for industrial links in their overall planning approaches.

"Increased attention must be devoted to assessing developments in Science and Technology internationally and realising potential innovations for Irish Industry."

Official Government policy in Ireland, at the time of the compilation of this Study, gives high priority to the development of greater cooperation. In the H.E. area this is reflected in the provisions being made for funding developments geared towards a changing modern society with increasing emphasis being placed on science and technology. Increasing emphasis is being placed on strategic and cooperative research and education for innovation and entrepreneurship.

In addition, current industrial policy includes measures to promote cooperative research between Industry and the Higher Education Sectors, to foster commercial spin-off companies from the Higher Education Sector and to support the establishment of a technological infrastructure and services partly within the Higher Education Sector. These initiatives are intended to underpin the development of indigenous Industry and to assist in the attraction of industrial investment from abroad. The new government has also appointed a Minister for Science and Technology attached to the Department of Industry and Commerce.

The NBST : its role and programme

The statutory body central to the implementation any of any new strategic plan and policies is at present the NBST.

As already noted in the opening remarks on Ireland, the NBST was established in 1973 as the successor to the National Science Council. The Board is the chief advisor to the government on policy and planning in the field of science and technology, and is the central organisation for promotion and coordination in this area. It has specific statutory functions set down in a 1977 Act.

Members of the Board are drawn from Industry, the professions, the universities and the public sector.

The progressive development of a coherent framework of science and technology policies is a priority task of NBST. Other functions include the preparation of a Science Budget; promotion and coordination of public investment with private investment in science and technology; promotion of research; the application of science and technology to economic and social development and the development of cooperation between the H.E. Sector and Industry.

In assisting this cooperation the NBST has established the following programmes :

(i) **Higher Education/Industry Cooperation Programmes.**

(a) Joint Industry/Education Research and Development - supplying support to projects of an immediate or medium term commercial nature where the bulk of the work is carried out at an institution. Funding of up to 50% of eligible costs, including salaries, materials and equipment, are available.

(b) Skills/Technology Transfer - placement of graduates in SMEs to provide work experience of graduates and help upgrade the level of technology in the company. Grant support is negotiable.

(ii) **Strategic Research Programmes.**

(a) National Strategic Programme - developing a viable national competence in technologies such as Information, Biotechnology and Food, Engineering and Advanced Materials.

(b) Cooperative Research Visits Programme - travel costs for Irish researchers to acquire skills and techniques relevant to Irish Industry.

(iii) **Resources Development Programmes.**

(a) Scientific Research Programme - to enable researchers to contribute, at the forefront, in certain areas of science, and to underpin strategic oriented R&D Programmes.

(b) Facility Usage Scheme - A Pilot to promote intercollege usage of major research facilities in the H.E. Sector.

(c) Student Project Development Programme - grants to students to encourage the development of their innovative ideas with a good prospect of commercial and technical success.

(iv) **Teaching Company Programme.**

Under this Programme financial support is given to enable high calibre graduate to undertake specific problem-solving projects in manufacturing firms.

(v) **Industrial Liaison Programme.**

To support an industrial liaison network in the H.E. institutions through "seed corn" funding for the establishment and support of industrial liaison activities, particularly technology transfer.

The NBST has provided most valuable assistance to the development of cooperation between the H.E. Sector and Industry in Ireland. It has also been the recognised, and coordinating, body for governmental assistance to cooperation, an essential element to ensure that scarce resources are optimised.

The assistance of the Industrial Development Authority (IDA) has also been utilised in the H.E. Sector in the setting up of companies to develop institutional science and technology. Venture capital assistance provided by the National Development Corporation has also been utilised to establish new hi-tech companies whose technology has been generated in an institution.

2. UNITED KINGDOM

(a) General developments in cooperation

The H.E. Sector in the United Kingdom considered in this Study covers the Universities funded by the University Grants Committee (UGC). It includes the federal universities of London ans Wales with their constituent, but autonomous Colleges.

The UGC was established in 1919 and was given the task of advising the Government of the financial needs of the universities. These terms of reference were amended in 1946 and 1983 and now include the advising of Government on the financial aid that university education requires; collecting, examining and making available information relating to university education, the planning and development of universities and ensuring that they are "fully adequate for the national needs".

The Committee is not a statutory body and there is no legislation governing its existence. The UGC is supported by a system of advisory sub-committees, including one covering the cooperation of institutions with Industry.

The Department of Education and Science (DES) has overall responsibility for Higher Education and within this Department is located one of the main funding bodies for academic research, the Science and Engineering Research Council (SERC). This Council, and the Medical Research Council, have been two of the main sources for the funding of research which has led to technology being transferred from institutions.

SERC was established in 1965 and amongst its objectives is to concentrate growth in areas of high scientific quality appropriate to the national needs. It seeks to augment its effective resources through collaboratiion with Industry. The work of the Council is carried out mainly through four of its Boards : Astronomy, Space and Radio Board; Science Board; Engineering Board and its Nuclear Physics Board.

The H.E. Sector also includes the Polytechnics in England and Wales, and the Central Institutions in Scotland, which are funded by regional and national bodies.

Informal cooperation between members of academic staff and Industry in the United Kingdom had existed for many years before the Second World War. The first formal structure after the war would appear to have been a committee established at the University of Edinburgh to deal with cooperation with Industry at the end of the 1940's.

Industrial Liaison Centres, also to be found in Scotland, were apparently established in the 1950's but no details of their work is available.

Emergence of Industrial Liaison Officers under the 1964 Scheme

The first reference to I.L.Os, about which information is available, is in connection with the establishment of Industrial Liaison Centres throughout the U.K. in 1964 by the Ministry of Technology, in co-operation with the Department of Education and Science, and the Scottish Education Department.

The objectives of this Scheme were to help firms that were without adequate scientific and technological support, mainly small and medium sized enterprises (SME's). The ILO was to assist in dealing with the firm's technical problems and encourage their technological development from any available source.

Under the Scheme, I.L.Os were stationed at Universities and Technical Colleges throughout the Country. They were members of the staff of the institution and their salaries were funded 2/3rd by the Ministry and 1/3rd by the institution. The Ministry's costs for the Scheme amounted to 270,000 in 1971.

By 1965, 29 Centres had been opened and the number had risen to 72 by 1969. In 1973 when the Scheme closed the final total appears to have been 75, with 85 I.L.Os engaged in their management.

The I.L.O. was considered by the Ministry to be a vital link in the innovation process. His local knowledge, ability to bring in expertise from a wide area, and above all, his personal contact with the firms, was thought to be the best method of producing results.

The day-to-day activities of an I.L.O, as laid down by the Ministry were:

(i) To visit firms in a designated area

(ii) To assist smaller firms to innovate and to raise their efficiency.

(iii) To provide practical assistance to smaller firms in the framing of their technical enquiries and in directing them to the best source of information whether this was his own University/College or not.

(iv) To maintain records of his work, also a directory of technical information and advice available, which was to be regularly updated.

(v) To publicize the work of his Centre.

(vi) To lecture on subjects related to his functions.

(vii) To encourage the maximum use of technical educational facilities.

Besides the resources of his own institution, the I.L.O. had the available information and advisory services of the Ministry, and Government-sponsored laboratories, at his disposal.

The I.L.O. was responsible to the Head of the institution, but the Ministry took a direct interest in the work of the Centres through their Regional Offices. Appointments were as full time academic staff at the Senior Lecturer grade.

Training for I.L.O.s

The Ministry provided formal training for I.L.Os and attendance at the courses was a necessary part of their duties. The training was aimed at improving their effectiveness. In view of the terms of reference of the present Study, it is felt useful to set out in some detail here how training requirements for ILO's were dealt with under the Scheme.

The recognised academic and professional backgrounds of I.L.Os were defined as "Chartered engineers or graduates in Science and Technology, or Industrial Administration, with broad technological interests".

On appointment an I.L.O. was given a 6-week induction course in London. This consisted of four weeks of lectures and workshops followed by two weeks of visits to relevant establishments.

The course was later reduced to 4 weeks but allowed for "training" and "information" visits to agreed national and local major sources of information. These visits were determined by the previous experience ef each particular I.L.O.

The induction course covered such basic subjects as problem-solving, sources of information, office systems, publicity, handling of enquiries, initial visiting, follow-up visits, and the objects of the Scheme.

The visits to establishments covered major sources of information such as the Patent Office, Government Research Stations, Cooperative Industrial Research Associations of which there were 48 in 1971 aided by the Ministry, and also established Industrial Liaison Centres.

National, and subsequently regional courses, formed part of the annual training. Examples of four national courses were:

(i) Financial techniques - for 5 days by Aston Small Business Centre, University of Aston

(ii) Diagnostic interviewing - for 5 days by Associated Industrial Consultants Ltd, at St Leonards

(iii) Plastics - for 3 days by I.C.I., at Welwyn Garden City

(iv) Lecturing skills - for 3 days by the Civil Service, in London.

Looking at the content of the first two above mentioned courses, the following are some of the subjects covered :

(i) **Financial techniques**

(a) Profit and loss account. Interpretation of a balance sheet
(b) Sources of finance
(c) Costing and costing control
(d) Preparation of a budget and budget control
(e) Marketing
(f) Long term planning and strategy
(g) Management development
(h) Current aspects of company law and taxation.

(ii) **Diagnostic interviewing**

(a) Tactics of marketing the benefits of the Scheme
(b) Negotiation
(c) Effective communication
(d) Interviews to reveal the problems
(e) Interviews to gain acceptance of a course of action
(f) Planning an action programme
(g) Overcoming obstacles to ensure the realisation of the benefits for a firm.

Proposals for annual training subjects for the coming year were discussed with all the I.L.Os at the beginning of each year. The normal time taken by the courses in a year was 12 days. Approved visits to government research and advisory units or individual firms, for the purpose of improving the I.L.O's background knowledge, were regarded as training, but limited to a certain number of days in each year.

These courses were found to be of direct use ot the I.L.Os who attended and who were interviewed during this Study. The main complaint apparently being that they were not given sufficient training to maintain their own personal expertise.

Initial appraisal of the I.L.O. Scheme

In October 1969 a Report was prepared by Associated Industrial Consultants Ltd (AIC) for the Ministry giving an appraisal of the Scheme.

The terms of reference of the A.I.C. Report were to look at the work of the Scheme and to make a critical assessment of its effectiveness. Particular attention was to be paid to:

(i) The benefits derived by the firms contacted and on whom reports had been made

(ii) The benefits derived by firms from other activities of the I.L.O.

(iii) The benefits to the academic institution where the I.L.O. was employed.

The Report was of the opinion that an average of 45% of the contacts made by the I.L.O. had made a useful contribution to the firms approach to innovation.

There was a spread of performance levels as between industrial liaison Centres, which persuaded the Consultants that basically the scheme was a worthwhile national project requiring corrective action, including further regular training and a triennial refresher training course.

The industrial mix of the various areas served by the Centres was a direct factor to be considered in assessing their work. It was recommended that I.L.O's should be able to tap expertise beyond that held by their own institutions.

The publicity efforts of I.L.Os who had published newsletters was commented on favourably. However, publicity was identified as no substitute for personal contact.

The acceptance of the I.L.O. in institutions and the benefit he could bring was seen as dependent upon:

(a) The attitudes of the Head of each institution

(b) The available resources

(c) Jealousy from staff with existing links with Industry.

The A.I.C. Report specifically noted the problems faced by I.L.Os who were reporting both to the Head of his institution and a Regional Office of the Ministry. It also drew attention to the need for a systematic means of indexing and assessing consultancy resources in their institution.

The main direct comment on the I.L.Os themselves concerned the lack of security, promotion and job prospects which the post offered.

A further comment on the usefulness of the Scheme was made in the Bolton Report on Small Firms published by the Government in 1971.

The Bolton Report referred to the growing importance of the industrial liaison Scheme, which was then undertaking about 13,000 visits and answering about 26,000 enquiries annually. It then went on to state (para. 10.30):

"The great assets of the I.L.Os are their ready availability, at the cost of a telephone call, their local status, which contrasts with the remoteness of most consultants with the businessman on his own ground. This is by far the best way to establish a relationship of trust; most businessmen ignore promotional literature and invitations to courses and seminars, but will listen to a visitor who will talk sensibly with relevance to their own situation. The I.L.O.s, all of whom have industrial experience as well as academic qualifications, are well fitted to do this. In some areas the I.L.Os' apparent independance of govenment has been found to be a definite advantage when dealing with local industrialists, while in many other places just the reverse has been true and the I.L.Os connection with government has proved a positive advantage. In general, we have been much impressed with this service many of whose officers appear to have won the respect and confidence of businessmen in their locality. Such small firms aware of the existence of the service have found its "sign posting" facility particularly valuable, since they commonly have no idea where to turn to for help among the multiplicity of services available - or else do not even know the services exist. Some I.L.Os participate in small local businessmen's clubs and other activities, thus helping to widen knowledge of and trust in the service." (1)

Government support discontinued but industrial liaison centres remain widespread

Despite the above acceptance of the Industrial Liaison Centre Scheme by these two independent Reports, the Scheme was discontinued by the Ministry in 1973. The reasons for this discontinuance would appear to be linked with the Ministry's majority funding, but lack of control, of the Scheme, and the final recommendation on the Scheme in the Bolton Report which proposed that the Centres be subsumed by Advisory bureaus.

The proposed Bureaus were to abandon the problem-solving function for firms, and would undertake less in-firm diagnosis of problems.

This was recognised by Bolton as being unlikely to appeal to the I.L.Os who were specialists in technology or management "and for whom the opportunity for close involvement with the business they advise is the greatest attraction in their jobs."

It was proposed that I.L.O's would wish to stay at their intitutions, and that the Bureaus be controlled and staffed by the Department of Trade and Industry.

In view of the experience of other countries in H.E. Sector cooperation with Industry over the past two decades, it appears that an important element in establishing beneficial and lasting linkages in the U.K. between the two Sectors was greatly diminished by the implementation of this recommendation. Several Centres had to close due to the lack fo financial support, and institutions were therefore also deprived of the direct benefit of up to-date knowledge of industrial and commercial problems which were relevant to their courses.

Despite these setbacks, many institutions, including several universities, appear to have directly benefitted from the industrial liaison Scheme. Moreover, universities were also aided when in 1967 the University Grants Committee (UGC) also established a special fund to give initial assistance to specific shcemes for university/industry collaboration.

Under the UGC fund, universities were requested to put forward proposals for collaborative projects involving not only technological disciplines, but also the physical, biological and social sciences. These projects were to be self-supporting in one or two years or be capable of being absorbed into the normal range of university commitments.

The UGC's "pump priming" scheme was reviewed in 1976 and up till then had supported 58 projects: 37 for industry oriented courses, 11 for industrial liaison posts and bureaus and 10 for research/consultancy activities. 46 of these projects were deemed to be wholly or partially successful. The majority of the failures involved courses which had to be abandoned for lack of students.

The success of the UGC arrangement led to a further sum of 200,000 being set aside from 1979 to 1981 in order to assist projects involving collaboration with Industy. Universities were again invited to "make proposals under a strict set of criteria; in particular it was a prerequisite of support that there should be clear evidence of specific commitment on the part of industrial or commercial organisations to support any scheme proposed with cash or facilities."

The Government reduction of the U.G.C. funding in 1981 would appear to have brought the pump-priming arrangement to an end.

Nonetheless, the principal result of the Industrial Liaison Centre Scheme and the UGC arrangement was the permanent establishment of industrial liaison units throughout the United Kingdom.

One institution which had taken part in the Industrial Liaison Centre Scheme was the University of Strathclyde, Glasgow, which established its Centre for Industrial Innovation. This Centre continued its information service, advisory and consultancy activities as well as contract problem-solving activities in its own workshop, laboratories and design office, after 1973. The activities of this Centre have now been taken over by a University Company Strathclyde Technology Transfer Ltd.

The Centre for Industrial Consultancy and Liaison at the University of Edinburgh was a Centre established in 1969 with funds from the University Grant Committee. Originally the Centre was set up to assist the negotiation of contracts but later it covered research contracts, consultancies, licensing of university intellectual property and services, post experience courses, staff secondments and conferences. This Centre has also been superseded by a University Company, Unived Ltd.

Continued demands for measures to encourage cooperation

Widespread interest has continued to be evinced, right up to the present day, in measures to facilitate cooperation. This interest has been expressed in particular by a series of reports representing the views of the H.E. Sector, Industry and Government. Because of the relevance of their recommendations to the terms of the present Study, and of their importance for developments in the UK in the area of cooperation, these reports are examined in some detail in the following pages.

The first, in 1970, was the report of a working party made to the Universities and Industry Joint Committee of the Confederation of British Industry (CBI). The report "Industry, Science and the Universities", (called the Docksey Report from the name of the Chairman of the Committee) provided the first comprehensive study of cooperation in the U.K. Although the terms of reference were to study existing relationships between the two Sectors in the field of research, the terms of the Report dealt not only with the strict research function, but also with wider technological activities relating to research and development.

The relevant findings of this Report, which were produced over a period of 3 years, were:-

(i) "The lack of time on both sides which can be devoted to all the various worthwhile activites which will improve mutual understanding and most of which would have a pay-off in the long term". According to the Report neither Sector was prepared to work "as vigorously as it should" in improving cooperation.

(ii) The increase of institutional consultancy services available.

(iii) The increased use of Industrial Liaison Centres run by institutions.

(iv) Account should be taken of staff expertise and skill in assisting industry, in respect of academic recognition and promotion.

(v) A recommendation that all bodies which assist and advise industry, should recognise that they have an important role in translating industrial needs to institutions, and in encouraging closer industry-institutional links.

(vi) Industrialists should take a greater interest in institutional activities by giving lectures, serving on committees, and making industrial laboratories available to institutions. Industrial staff should be seconded to institutons and institutional staff to industry.

(vii) There should be an increase of industrial sponsored research and the provision of more refresher or retraining courses by institutions.

Following on from the Docksey Report there have been several more recent publications which have indicated the growth and range of interest in developing cooperation between the H.E. Sector and Industry. These include, in chronological order:

* <u>The House of Commons Select Committe on Science and Technology's Report on University-Industry Relations (1977)</u>

The relevant recommendations in this Report commenced with a general statement of encouragement on the bringing of the two Sectors "generally into closer alignment". Specific recommendations were then made about allowing employees, in both Sectors, to cooperate and that such work should be taken into account for promotion. The funding by government of industrial liaison bureaus, consultancies and industrial units in universities was recommended. Also the support of development of Science Parks or their equivalent.

The giving of generous tax allowances to Industry to place research contracts in universities was also suggested.

* <u>The Committee of Vice-Chancellors and Principals of the Universities of the United Kingdom (CVCP) Report on Research in Universities (1980)</u>

This Report detailed the diversity and range of work undertaken by the Universities, to emphasize not only the basic research being carried out, the majority of which is undertaken by universities, but also the direct contribution which was made to Industry and society, both nationally and internationally.

The Report considered specific areas of research being undertaken in the disciplines of Engineering, Science, Medicine, Social Sciences and Arts.

* The CVCP's Report on Universities and Industry (1981)

Following the Report on Research, the previous year, this publication considered specific examples of cooperation with Industry then being undertaken by universities. It pointed out that the relationship had never entirely has been an easy one, but it had been one of the most important features in the history of British Universities over the previous one hundred years, resulting in the establishment of many of the great civic universities.

The Report also considered the structures which were then being utilised for cooperation such as Liaison/Advisory Centres and Units, Limited Companies and Science Parks. The final Parts examined the development of staff consultancy and other personal involvements with Industry.

* Advisory Council for Applied Research and Development (ACARD) on Improving Research links between Higher Education and Industry (1983)

This Report, by the main advisory body to Government on R&D, drew attention to the "vital long term importance" of links between the H.E. Sector and Industry. It was of the opinion that generally the progress in establishing productive links had been slow.

It also _inter alia_ noted that the government should "mount a campaign, with active ministerial involvement, to improve awareness of the benefits of academic-industrial collaboration and of the measures available to encourage it". Also to ensure that business advice was available to academics.

The principal recommendations of the ACARD were:

"(i) The Government should establish an "industrial seedcorn fund" to support the infrastructure and basic research that will complement effective, industrially-financed applied research. The fund should equal 25% of the money earned by HEIs (Higher Education Institutions) through contracts, consultancies and investigations from the private sector and the public trading sector (excluding contracts for teaching and training). This would initially require about 10M pa. HEIs should receive allocations from the fund equal to 25% of their eligible earnings. The fund should be established for 5 years in the first instance. Its size should be adjusted annually in order to remain equal to 25% of eligible HEI earnings.

(ii) A minimum of 5M pa should be earmarked by the Department of Industry (DOI) for an initial period of 5 years to be used for projects proposed by HEIs that contribute significantly to the infrastructure for academic-industral co-operation. This scheme should be managed jointly by DOI and the Science and Engineering Research Council (SERC). Pump-priming funding should be conditional upon evidence of serious intent by HEIs to adapt to industrially-oriented work, notably through appropriate conditions of academic appointments.

(iii) Bodies on which industry is represented at a high level - CBI, BIM, NEDO, local Chambers of Commerce and Industry, the Royal Society, Fellowship of Engineering and learned societies - should urge firms to show initiative commensurate with that of the HEIs in establishing and maintaining academic-industrial links, notably by bringing together firms with a common interest in a particular activity, discipline or HEI. Building upon what already exists, the Royal Society for the Encouragement of Arts, Manufactures and Commerce (the RSA), with a membership and objectives highly relevant to this issue, should foster and co-ordinate these activities, the Royal Society of Edinburgh is well-placed to promote such activities in Scotland.

(iv) DOI and SERC should collaborate more closely in supporting both joint activities carried out by industry-HEI partners and industrially-oriented work in HEIs (we see SERC's directorates as a model); DOI should provide most of the funds for new initiatives in this area, although SERC might administer the schemes; and other Research Councils should consider with appropriate Government Departments the introduction of joint schemes for supporting academic-industrial collaboration.

(vi) The Department of Education and Science (DES), the University Grants Committee (UGC) and other relevant bodies should taken action -

* to agree an appropriate average level of research activity in universities, each university proposing the level which it wishes to adopt;
* to assure adequate support for research by means of an identified proportion of the UGC grant;
* to ensure that funds intended for research are used for that purpose;
* to ensure that research funds are effectively managed by universities by means of Research Committees (as advocated in the Merrison Report) or equivalent bodies".

It appears that the main reason why the ACARD Report, generally accepted as being the most definitive report to-date, has not yet been implemented, relates to the funding implications of the first two recommendations and the lack of government funds.

The need for an infrastructure fund which would help to pay for joint academic-industrial research units, and for providing expert advice to institutions on matters such as intellectual property, and technology transfer, has been raised in the press from time to time.

The proposals contained in the ACARD Report have been regarded as the main solution to these problems, and for establishing the needed national programme to promote academic initiatives through industrial research.

Although the terms of the Report have not been adopted to-date, <u>they have been reflected in the Government's Green Paper on the Development of Higher Education in the 1990's, considered later in this Part.</u>

* <u>The Scottish Council, Development and Industry's Report - Profit through Partnership, Industry-Academic Collaboration in Scotland (August 1983)</u>

This in-depth Report of the relationship in Scotland between the H.E. Sector and Industry contains several recommendations which are directly applicable to this Study. The relevant recommendations were as follows:

(i) Each university and college should have a specific agency within its organisation responsible for industral liaison and services, with at least a full-time managing director of senior rank and an industrial liaison officer, and with an advisory board with strong industrial representation. These agencies would have wide duties to promote the university or colleges, provide services for academic staff and for industrial customers, and seek by a variety of means to increase the contacts between, and use of, their institution and the outside world.

(ii) The agencies in the universities and colleges should create a Federation with the managing directors of each forming the executive committee. They should use a communal name (eg CUBIS) and arrange for common services where that would achieve economy. They should seek jointly to improve the public relations and image of the universities and colleges. They should investigate potential opportunities and the relationships with official bodies on behalf of their institutions.

(iii) Industry should recognise and use the agencies and take a positive part in their advisory boards.

(iv) Industry, either directly or through sectoral associations or industrial "clubs", should determine its research directions and needs, and then seek agreement with universities and colleges about programmes which give guidance to funding bodies.

(v) The Scottish branches of sectoral industry associations and professional bodies should participate widely in fostering interchanges, particularly in promoting part-time exchanges of staff and in providing training opportunities amongst their members including small businesses.

(vi) Companies should earmark a percentage of their R&D budget for expenditure in universities or colleges.

(vii) Industrial leaders and company staff should devote more effort to participating in the work and committees of universities and colleges.

(viii) Company chairmen should invite academics to hold non-executive directorships. Universities and colleges should improve their management in those areas which involve industrial work.

(ix) Universities and colleges should also declare their policies and objectives for work with Industry, in fostering new companies, in encouraging consultancy and in setting targets for the percentage of effort that they wish to see devoted to outside work. They should also: -

* Improve internal communications so that all members of staff possess and understand the relevant information on the need for cooperation, in particular technology transfer.

* Improve their internal accounting systems for handling work for third parties and in any companies they create, and clarify the system to their own staff.

* Modify their systems for the career development of academic staff, to include regular assessment of performance, and definition of the criteria to be adopted in awarding promotion or in making appointments. Work for industry should be recognised and taken into account. Training opportunities, particularly using internal resources, should be increased.

* <u>Universities and industry - New opportunities for collaboration with UK Universities and Polytechnics, published by the Economist Intelligence Unit (1986)</u>

The major concerns and recommendations of this recent survey of general cooperation in the UK emphasise:

(i) That although a number of institutions have become active in encouraging and supporting increased levels of technology transfer, others, including some of the older and long established universities, have been much more passive and risk being left behind in the development of beneficial cooperation with Industry.

(ii) British Industry is not yet fully awake to the valuable resource provided by the institutions. Many academic ideas and a considerable amount of research expertise is going to the US and Japan.

(iii) . The need for funding to take academic ideas through to inventions, and then to the stage of innovations.

(iv) The need to implement the ACARD Report's recommendation to support institutional infrastructures needed for beneficial technology transfer.

(v) The need to bridge the traditional gap between the two Sectors.

(vi) The need to make more use of graduates by institutions in developing all aspects of cooperation with Industry.

(b) Governmental Policy and assistance

The Policy Framework

The Department of Education and Science, Green Paper, in 1985, on The Development of Higher Education into the 1990's, sets out the Government's main concerns about the development of Higher Education, and, in particular its place in the improvement of the performance of the national economy. Its terms go much further than any previous government document to encourage cooperation between institutions and industry.

The basis of the document can be summed up in the following terms (Paragraph 2.3): "For their part institutions and their academic staff have a responsibility to seek closer ties with employers, which are essential if higher education is to realise its full potential in meeting the needs of the economy, in terms of highly qualified manpower, and also its contribution through research, technology transfer and consultancy".

The gap still existing between institutions and Industry has been clearly recognised by references in the paper warning academics to "beware of anti-business snobbery", and to be careful not to dampen the entrepreneurial spirit.

The links between Industry and the institutions in respect of technology transfer, consultancy etc are dealt with in Sub-paragraphs 5.9 to 5.12 and these are fully set out in Appendix No.6.

They include:-

(a) Taking consultancy and other beneficial industrial work fully into account when assessing candidates for promotion.

(b) Operating industrial liaison services.

(c) Assisting in the development of a national data base of academic expertise and facilities in institutions.

The Further Education Act of 1985, confirmed Government's approach as indicated in the Green Paper.

The terms of this Act *inter alia* removed the barriers to the commercial exploitation of their research and other work carried out by local authority institutions, i.e. the Polytechnics.

The Act has extended the power of the local authorities to provide financial support to institutional companies which can now be incorporated, subject to approval of their objectives. The Act also gives formal power to institutions to sell their goods and services.

If a company is incorporated to deal with the exploitation of general cooperation and innovation the local authority must hold 20% or more of the issued share capital of the company before it can make any loans to the company under the 1985 Act.

It would appear, however, that many institutions are awaiting the outcome of proposals that they be freed from the direction of the Local Education Authority, before proceeding to incorporate their own company.

The development of effective and wide-ranging links between Industry, Commerce, and all parts of the education system is a major aim of the U.K. Government.

Government believes that it is vital for the H.E. Sector, in particular, to contribute more effectively to the improvement of performance of the economy. A closer partnership with Industry is seen as a major factor in achieving this.

Unlike some other countries whose development of institutional/industry cooperation has been considered in this Sutdy (eg Ireland, the USA, Sweden), the UK has not maintained a body directly responsbile inter alia for the production and utilisation of viable commercial resources from institutions, for benefit to the national economy. At least three Government Departments would appear to have control of various aspects of cooperation.

The absence of a single coordinating body appears to be basically responsible for the "hands off" approach still adopted by Government. This may also have resulted in a lack of a strategic planning and policies in many institutions dealing with the development of their cooperation with Industry.

The perceived shortcomings of the British framework for developing beneficial cooperation have been highlighted by leading opinion-formers in the UK. In particular, calls have been made for improved governmental coordination and concern expressed at the inadequate rate of converting research into industrial development (2).

Government Support Programmes

Some of the major initiatives which have been introduced by Government to assist in general cooperation and technology transfer, are: -

(i) The Engineering and Technology in H.E. Programme

This Programme, in response to Industry's needs, will provide 5000 additional student places by funding 18 universities and 9 other institutions with a total of 43M over three years commencing in 1986.

The industrial relevance of courses, as well as high academic quality and cost effectivennes, have been important criteria in producing this Programme.

(ii) PICKUP - Professional Industrial and Commercial Updating

The programme was launched in 1982 to encourage new learning methods and approaches to planning of training and updating activities. Also to increase awareness, particularly among employers of the crucial need to invest in adult training and retraining.

The training must be specifically vocational but also includes specific updating schemes in nine health care professions and engineering.

The development of this Programme has led to the establishment of Consortia, involving local institutions throughout England. These Consortia also act as a focus for joint development projects and are dealt with in Part III.

(iii) Technology Centres Network

This concept of a national network of Technology Centres (TC's) to be supported through Local Collaborative Projects (LCP's) was announced at the end of 1986.

LCP's have been set up to deal with information dissemination based on training and related activities; staff secondments between university-industry; encouraging new links between established technology producers and users and ensuring a high profile marketing image which will help ensure maximum usage.

Ultimately the network should provide a nationwide service of Collaborative Centres, offering a range of technology transfer services based on training and related delivery mechanisms, working on a self-financing basis.

(iv) Funding to would-be entrepreneurs and small firms developing science and technology

There are several schemes for the funding of "ideas" by Government Departments which have been taken up by the H.E. Sector such as the DTI's Small Firms Merit Award for Research and Technology (SMART) dealing with biotechnology or instrumentation.

The DTI is responsible for the British Technology Group (BTG) which also has its own scheme "Campus Investment" specialising in providing finance for academic spin-off and start-up companies.

In addition to its normal business of supporting the exploitation of inventions through licensing, the BTG has now been assisting all forms of technology transfer, with emphasis, as can be seen above, on the incorporation of companies dealing with technology from institutions.

(v) The Teaching Company Scheme

Set up in 1975 and funded jointly by the Science and Engineering Research Councl (SERC) and the DTI in cooperation with the companies concerned.

The aim of this Scheme is: -

(a) to develop active partnerships between institutions and manufacturing firms in order to raise manufacturing performance by utilisation of academic expertise.

(b) to improve manufacturing methods by implementation of new technology.

(c) to train capable graduates.

(d) to develop the training of, and re-train, company and academic staff.

(e) to enhance research and teaching through industrial association.

(vi) <u>The Alvey Scheme</u>

This Scheme is intended to provide joint cooperative programmes in the field of information technology. The research programmes are concentrated in specific areas and are appraised by committees dealing with Intelligent Knowledge Based Systems, Software Engineering, Machine Made Interface, Very Large Scale Integration and Computer Aided Design.

A total of 300m has been allocated to the Scheme, half of this sum being provided by Industry. By the bginning of 1986 48 Universities and 12 Polytechnics were involved and most of the funds had been allocated to support some 150 full time joint projects, with a further 90 projects involving academic staff only.

The main criticism of the Scheme has been that it benefits large companies such as GEC and British Telecom, who account for one third of the funding, when research monies of this nature should be going to SMEs. SME's have, however, benefitted from a measure of ALVEY funding.

(vii) Science and Engineering Research Council's initiatives

The following initiatives which, amongst others, have been taken up by a considerable number of institutions.

* The Application of Computers to Manufacturing Engineering (ACME):

  In September 1984 this Programme took over previous funding for industrial robots and the efficiency of production systems. Initial funding was 22M for five years and grants to the approximative value of 4-6M were made during the first year.

  The Programme involves partnerships between academic and industrial groups and the partner firm is expected to contribute 25% of the total cost of the project. This does not need to consist wholly of money, but can include personnel and other resources.

* Cooperative Grant Scheme:

  Set up in the late 1970's to stimulate research in the H.E. Sector involving Industry, this Scheme involves both basic or fundamental and applied research.

  The basic research projects were to be carried out at an institution underpinning a practical industrial development programme. The applied research projects were to be carried out on a joint venture basis. In assessing applications, "equal weight was to be given to the scientific and technical benefits and the benefits of collaboration, both in the transfer of know-how and on evidence that the industrial partner was well placed to exploit the invention".

This Scheme has again concentrated its funding in certain large Companies, ICI, GEC, Rolls Royce and B.P. jointly taking nearly 25% of the projects.

* CASE Studentships:

  This Scheme has now been operating for over twenty years and it involves a postgraduate research student undertaking work for his thesis in a Company which has an interest in the student's project.

  Although the initial matching of interests can be a problem the number of awards is increasing every year and over 30% of total research studentships are now in this category.

* Other Government funded incentives have been utilised in the formation of spin-off companies, Science Parks and to assist students develop their innovative ideas.

Specific mention should also be made of the direct financial and other aid given by the Scottish Development Agency (SDA) and the Welsh Development Agency, both established by Government to assist in the economic development of their respective countries. The SDA has indeed been the backbone of the transfer of academic technology in Scotland, playing a direct role in the establishment and management of 26 spin-off and joint venture companies, arising out of institutional technology, over the past nine years.

These companies are providing products and services ranging from electronics to the setting up of institutional companies to assist in technology transfer. As an example of how a Regional Agency can play decisive role in the economy through the utilisation of academic innovation, details of the relevant companies assisted by the SDA are set out in Appendix No.7.

3. FRANCE

The Study's examination of developments in the French H.E. Sector's cooperation with Industry has been conducted chiefly by reference to the experience provided by representatives of institutions of the following type:

- the universities and Instituts Nationaux Polytechniques which may possess Instituts Universitaires de Technologie (IUT), Ecoles, Unités de Formation et de Recherche (UFR), Départements, Laboratoires and Centres de Recherche and Services Communs;

- institutions and "Ecoles" outside the university structure proper.

Apart from some non-State Ecoles, the majority of institutions covered are "établissements publics à caractère scientifique, culturel et professionnel", coming under the authority of the Ministère de l'Education Nationale (MEN), now integrating also the former Ministère de la Recherche et de la

Technologie.

There are some important differences between these institutions which bear mentioning at the outset - eg. with respect to their teaching programmes, their research vocation, their financing and their legal status. Universities, which provide a broad spectrum of courses, have always been devoted both to teaching up to doctoral level and research. They have independent legal status and financial autonomy, as do the Instituts Nationaux Polytechniques. These National Polytechnic Institutes, of which there are presently three (at Grenoble, Toulouse and Nancy), are a more recent phenomenon, specializing in scientific and technological disciplines at an advanced level. At a lower level IUTs provide teaching and - but only very recently - research units in the universities to which they are linked, one of their primary function being to train technicians. There are also some private H.E. institutions (subject, however, to the same national examination process as public institutions) which are associated with industry bodies (eg. chambers of commerce) where links with business are very close.

(a) <u>General developments relating to cooperation</u>

University/business cooperation in France appears to have undergone marked changes in recent years. While the record of France compared with other Western countries was seen as relatively unfavourable as late as 1984 (1), since then the situation appears to have improved. Among the perceived reasons for this is the more positive policy encouraging cooperation recently espoused by the Government, particularly as expressed in the Savary Law of 1984.

This change is especially evident in the universities, particularly those whose hierarchy is alert to the potential of, and need for, cooperation. Universities have traditionally been criticized for working at a distance from business, but this isolationist posture has gradually been softened. The creation of young universities, such as that in Compiègne, may have contributed to this trend of enforcing links with business. Some institutions have indicated that cut-backs in government budgets have been an incentive for finding alternative financial resources, including those available through beneficial links with the private sector.

For all that, the universities appear only to be at the early stage of developing cooperation and in particular technology transfer with Industry. The I.U.T.'s experience is somewhat different. Their closeness to the applied sciences explains a traditionally high level of general collaboration (eg. in fields like service contracts, consultancy, continuing education, and student placement for traineeships), but actual involvement in technology transfer via exploitation of research results is a much more recent phenomenon.

No picture of H.E./Industry cooperation can be drawn without reference to the Centre National de la Recherche Scientifique (CNRS). The CNRS is a body responsible to the MEN. Its laboratories are to be found in many H.E. Institutions. The CNRS is a key nation-wide agent for the exploitation and dissemination of H.E. research. In evaluating the efforts of the Sector in its liaison with Industry, the distinction needs to be kept in mind between laboratories and institutions that have close links with the CNRS (which provides them with an extensive service for the exploitation of their research results) and those that do not. The latter rely on other agents for technology transfer. (For further details on the CNRS, see below).

As regards the industrial liaison structures used by H.E. institutions, no comprehensive report exists, as far as can be ascertained, which gives a full picture of existing structures for liaison with Industry. Nevertheless, it appears clear that this picture has changed in recent years, and that a whole network of these liaison structures has developed. The different possible roles of liaison (such as the identification of the training needs of industry, traineeships for students and placement of graduates, the promotion of commercially viable research and consultancy) are usually played by a variety of persons and structures inside a given institution.

In many ways, the most significant of these, and one of the most recently developed is the "cellule de valorisation", which now exists in many but not all H.E. institutions. The "cellules" perform a similar but not identical role to the "industrial liaison bureaus" or "centres" in the UK and Ireland. The approximate equivalent of the Industrial Liaison Officer would be for example, the head of the "cellule", who might be titled the "responsable de valorisation et des relations industrielles". After some pilot projects, encouraged by the (then) two ministries - MEN and the Ministère de la Recherche Scientifique - in 1983, the "Savary law" of 1984 has reinforced the spread of these "cellules" by stipulating explicitly that a mission of universities is to exploit their research results.

In order to show the tasks and functioning of these "Cellules", the MEN has prepared a small information package concerning technology and know-how transfer, illustrated with some examples ("Le transfert - nouvel enjeu pour la recherche universitaire", MEN, Direction générale des enseignements supérieurs et de la recherche, see appendix 10).

There is, however, no institutionalised association of these "cellule" officers, but only an informal "club" formed recently under the direction of the MEN.

These officers meet several times a year for an exchange of experience and ideas, for training and to decide about their future training requirements. The training needs they had identified during their meetings included the following subjects:

- administrative and legal questions concerning recruitment of temporary personnel
- intellectual property and contracts with Industry
- structures for technology transfer (eg. university subsidiaries, incubation centres etc.)
- relations between universities and their region
- questions directly linked with the establishment of "cellules".

With respect to collaboration with Industry, continuing education has proved a very profitable activity for H.E. institutions and an important means of attracting business for a first contact with the H.E. Sector. Where courses go beyond general training and are tailor-made for a client (sometimes training takes place in the client's laboratories), they can contribute to transfer of specific know-how to Industry.

As regards transfer of technology, the Savary Law appears to have created an important new structure, namely the possiblity for state-controlled H.E. institutions to form subsidiary companies. As far as could be ascertained this new opportunity has not yet been taken up in any significant way. Nevertheless, it has been generally welcomed by many of the institutions visited.

Prior to this and even now, universities seeking to obtain more flexibility and independence from administrative bureaucracy have established non-profit associations based on a law of 1901 ("Associations 1901") as a channel for university activity for business; however, reservations have been expressed about these structures. These associations were mainly created for administering revenues accruing to university personnel from contracts with Industry. Such associations are often called A.D.E.R. ("Associations des Ecoles Régionales"). The members of the associations are usually members of the teaching staff.

Some of these associations fulfil some of the roles normally associated with industrial liaison offices. But "associations 1901" have also been used as the juridical form for spin-off companies.

All these liaison structures are available to H.E. institutions interface with a network of national and regional organisations and agencies which act as brokers for technology transfer towards Industry, eg. ANVAR, ARIST etc. (see c) below).

b) <u>The national approach towards cooperation</u>

Traditionally, Government has left the development of the H.E. Sector links with Industry very much up to the individual institution, acting within the framework of the laws. These various laws and other regulations have impacted on different aspects of H.E./Industry cooperation, but can hardly be said to constitute a coherent framework for the encouragement of cooperation and technology transfer. Until the Savary Law, exploitation of research had not been enunciated as a specific task of the H.E. Sector. Even now, the law does not specify how this task is to be carried out, although the possibility of creating university subsidiary companies appears to be viewed favourably as a future instrument for collaboration.

However, even the university company option is for the moment limited by the earlier constraints imposed on state-controlled institutions regarding the development of funds which institutions now need if they are to invest in this and other new channels for cooperation. This was emphasised by many institutions surveyed for this Study.

At the same time, problems of this sort are not paralysing cooperation, far from it. In most institutions individual members of the teaching staff have developed good relations with Industry and exploited their research results even before universities were legally entrusted with this specific mission.

However, the individual efforts of university staff are indirectly discouraged by the criteria applied for career structures in the state H.E. Sector. At least partly offsetting the Government's emerging support for collaborative links is the absence of recognition for the purposes of career advancement of efforts aimed at commercial recognition of academic results. Advancement in public H.E. continues to be mainly based on national and international publications, and staff sometimes have to choose between a university career and cooperation with business.

Legal provisions affecting the framework of cooperation and technology transfer

Below are listed in summary form the principle legal instruments of recent years, whose provisions - as indicated by the institutions surveyed - impact on general cooperation and technology transfer between the H.E. Sector and Industry. These instruments, presented in chronological order, affect the framework for cooperation in a variety of ways. Some include fiscal measures, others concern institutions' structures. (The following list is not intended to be exhaustive.)

* A tax for continuing education (established by law in 1971). According to this law every company is to spend a portion of its payroll - now 1.1% - on continuing education. If it is not used for this purpose, companies have to transfer the money to the Exchequer. Although this law is not addressed to the H.E. Sector, it has had an important effect on the Sector's activities. It has induced universities to create units for continuing education in order to attract a flow of private funding. This activity has been reinforced by provisions in the Savary Law (see below) which defines one of the public service missions of the H.E. to be continuing education.

* Décret no. 80-900 (of 17 November 1980) providing a structure for the individual initiatives of teachers with respect to consultancy and other contracts with Industry. It defines some of the contractual relations between H.E. research units and third parties. It states that only the president or the director of the institution may sign contracts with third parties which commit the institution.

* Loi No. 82/610 of 15 July 1982 ("loi d'orientation et de programmation pour la recherche et le développement technologique de la France") defining rules for the orientation and the programmation of technological research and development in France, which were reinforced by the Savary Law.

The "Groupement d'Intérêt Public" (GIP) was created in 1982 as a new legal form for cooperation between research centres and outside parties by the above law. This formula was especially designed to encourage cooperation of limited duration between R&D partners in the public and private sectors. It may also be used for exploiting university resources. In any GIP, one of the partners has to be a state sector research unit. The statutes of a GIP have to be approved by the minister in charge of research, and a government "commissaire" is in charge of controlling the GIP. However, up to May 1986, only 17 GIPs had been established.

* Décret No. 82/993 of 24 November 1982 (stemming from the law No. 82/610 of 15 of July 1982, concerning the orientation and the programmation of technological research and development in France), which determines the organisation and the functioning of the CNRS. The CNRS's mission of exploiting research resources derives from art. 2 of this décret (see appendix 12a).

* The MEN's "Fonds de Valorisation" of 1983 (appendix 11) was created to put funds at the disposal of research laboratories not linked with the CNRS. This fund (1.5 million FF in 1983) is used for financing patent procedures and similar services for H.E. institutions. (In 1983, 23 French patents, 6 patent extensions to other countries, 25 licencing agreements, and some 10 technical dossiers resulted as concrete projects out of about 100 dossiers presented.)

* Savary Law (no. 84-52 of 26 January 1984) states that the H.E. has to be organised in liaison with the professional environment ("milieux professionels"). It stimulates membership of Industry in institutional boards.

Furthermore it defines the public service H.E.'s missions, which includes the exploitation ("valorisation") of the research results and continuing education. Article 6 says explicitly that the public H.E. should exploit the basic and applied research and technology, and article 7 encourages the H.E. Sector to diffuse the knowledge and the results of its research activities.

With regard to the exploitation of the Sector's know-how and ideas, article 20 authorises H.E. institutions to use different means of diffusing the results of its activities: concluding conventions and service contracts, taking out patents and licences and commercialising the product of its activities.

In addition, it gives the institutions the right to create subsidiaries ("filiales") and take participation in companies within the limit of their resources. Their contribution (in money or in kind) has to be financed from activities as defined in article 20 of the law. The conditions for the creation of subsidiaries were fixed by the décret no. 85-1298 of 4 December 1985.

* Décret no. 85-618, of 13 June 1985, and Arrêté of 13 June 1985 fix the conditions of remuneration of some H.E. Sector staff for research contracts. These rules have been criticized by some interviewees. They allow H.E. research staff to have additional earnings from work with Industry, but at the same time inhibit them. The décret allows persons to have revenues (up to a certain amount - as fixed by the arrêté of 13 June 1985) from contracts as set out in the above-mentioned décret no. 80-900, but states that the persons who accrue these additional revenues will not benefit from the "prime de recherche" or the "prime de participation à la recherche", which is paid out of the national budget.

c) National and regional institutional networks assisting H.E./Industry liaison

The functions fulfilled by persons dealing with industrial liaison in the H.E. Sector, are assisted by services provided by the CNRS, national or regional agencies like ANVAR, and also the MEN. Below is a description of these networks and their interface with liaison officers.

The role of the CNRS

Despite criticism levelled at the absence of a coherent Government policy towards H.E./Industry cooperation, the role of the CNRS should not be underestimated. Its activites with regard to exploitation of research results, coupled with the parallel measures set up some five years ago by the MEN (see also Appendix 11) have led to a significant number of patents and licences.

The CNRS, which is the biggest research organisation in France has an annual budget of 8 000m FF (6 000m for administration, remunerations and fixed costs, 2 000m for scientific activities and large equipment) and employs 10 000 researchers. Half of its 1 600 research units are associated university research units (2).

CNRS in common with similar research organisations - and indeed the MEN - provides a "label", which identifies outstanding research laboratories. These research units dispose of a national network of services for the exploitation of research results. The "label" is thus directly or indirectly used by the Sector in its marketing to Industry. Conventions between the CNRS and the laboratories fix the conditions for cooperation and for the provision of services (see Appendix 12b). Since 1981, the "Mission de la Recherche" of the MEN has decided to provide a similar service for the exploitation of research results in laboratories that are not members of the CNRS.

Besides the CNRS, other research organisations have become important as channels for exploitation of the H.E. Sector's resources. They include INSERM (Institut national de la santé et de la recherche médicale), INRA (Institut national de la recherche), ORSTOM (Institut français de recherches scientifiques pour le développment en coopération, pour la recherche tropicale et équatoriale, especially in cooperation with LDCs), IFREMER (Institut français de recherches pour l'exploitation de la mer, for oceanographic research), and BRGM (Bureau des recherches géologiques et minières, for geological research). These organisations have their own laboratories as well as associated laboratories.

Their role for H.E./Industry cooperation appears to have a mixed reception from H.E. institutions.

By providing a "label" for the best French laboratories, these bodies increase the confidence of Industry in these laboratories. Companies can be sure that CNRS laboratories are among the best in France, because the CNRS carries out a national assessment on a regular basis to check the quality of the research done in its laboratories.

However, the assessment of the performance of the research units has traditionally been based on academic criteria rather than on their record of providing commercially-oriented results. According to information received, patents have recently been introduced as yardsticks of performance.

The CNRS was created in 1939 and underwent several reorganisations. In the early 1970's, ANVAR (Agence Nationale de Valorisation de la Recherche) was established as part of the CNRS. Its major task was the commercial evaluation of research ideas and dealing with financing needs, e.g. risk capital. In 1979 ANVAR became independent of the CNRS and has since particularly developed its risk capital activities.

Coordination between these different bodies and agencies is an important factor. Broadly speaking, the administrative procedures for the exploitation of research results may be described as follows: representatives of ANVAR, CNRS, INRA, INSERM, MEN etc. meet every two weeks on a national level in order to evaluate the dossiers submitted for protection of research results, patents and licencing. If this group decides that an idea may be patentable, it generally entrusts ANVAR with the patent search. If patenting is possible, the CNRS may register the patent and pays for the costs. Financial results of exploitation of ideas are shared with the institutions concerned according to the distribution key fixed in the conventions (see appendix 12a and b).

Since 1982, the CNRS has registered an increasing number of patents. The complete picture as regards exploitation of research results for CNRS scientific departments is described below (3):

	1982	1983	1984	1985
Patents registered by CNRS	71	91	133	151
licences and sale of patents	38	48	61	81
contracts CNRS-enterprise	109	172	273	377
- amount (mill. FF)	9.6	29.3	30.8	56.0
ANVAR innovation "aid"	29	66	56	48
- amount (mill. FF)	6.5	26.5	25.6	16.6

CNRS personnel made available to enterprises and technical centres	37	36	41	50
CNRS consultants in enterprises and technical centres	41	70	113	142

A CNRS analysis of its 1984 activities has revealed that for every patent registered in the name of the CNRS there are 1.5 patents taken by CNRS inventors in the name of an industrial partner. Extrapolated to 1985, CNRS would thus have contributed to 300 - 400 patents in France. The above figures also show an increased mobility of researchers assisting Industry.

The role of other networks

ANVAR, following its separation from the CNRS in 1979, acts inter alia as a consultant and service organisation for universities, business, and major scientific centres like the CNRS. It carries out patent search and other tasks linked with the exploitation of results. For this purpose it has established regional delegations which operate in close cooperation with the central organisation in Paris. ANVAR provides legal advice to laboratories, defines strategies for patenting and gives financial support to laboratories for innovation.

The CNRS has also created CRINs, its Comités de Relations Industrielles, which provide "clubs" for universities and Industry focussing on different research areas. They bring together researchers and industrialists for discussions on future trends and directions in research in the area in question, and make suggestions to laboratories and Ministries. The aim is to guarantee that Industry's ideas will be transferred to H.E. institutions and reflected in their research activities.

ARIST (Agence Régionale d'Information Scientifique et Technique) has been created on a national basis about five years ago. Its specific task is to orient SME/SMI towards scientific and new technical solutions for their problems and to provide marketing and commercial services. ARIST agencies are closely linked with the chambers of commerce and represent an important interface between academe and SMEs. Among other services for companies, ARIST offers acccess to a data bank (Rhapsodie) via Minitel, which contains information on all the scientific institutions in France which provide services to Industry.

Other interfaces at regional level exist in the form of the CRITTs (Centres régionaux d'innovation et de transfert de technologie), initiated by the chambers of commerce, the DRRS (the regional representatives of the national government, responsible for science and research) and the newly created scientific advisors in the regional councils.

CRITTs are regional innovation and technology centres which have been created since 1982 in order to assist especially SMEs and bring them together with regional technology expertise. Based on the technological potential of the regional H.E. institutions and other technologies, they assist in diversification and technical implementation of new processes. They seek to sensitize SMEs to new processes and products.

4. BELGIUM

The H.E. Sector in Belgium considered for the purpose of this Study comprises two groups of institutions. The first group is composed of universities, whether "state" (eg. Ghent University) or "free" (eg. the Université Libre de Bruxelles), with teaching and research in at least five traditional faculties (philosophy, literature, law, science, medicine, applied science). The second group comprises non-university H.E. institutions carrying out research and teaching usually in more specific fields (eg. applied sciences). Institutions in this group tend to be more directly involved in the application of their knowledge in the different professions. Both groups come under the authority of the Ministry of Education with its two linguistic subdivisions.

However, responsibility for the research and technology lies with the Ministry for Scientific Policy and its Secretary of State. Interministerial coordination for transfer of technology from the H.E. Sector thus is an important factor. It takes place in a variety of frameworks, including in particular at the political level at the "Comité ministériel de la politique scientifique" and, at official level, in the "Commission interministérielle de la politique scientifique". The latter comprises the high-level officials responsible for research in the various departments of Government.

a) Overview of H.E./Industry cooperation

Although no official reports appear to have been published evaluating cooperation between the H.E. Sector and Industry, there is public recognition of the need for effective liaison between the two Sectors. This emerges clearly both from interviews conducted for this Study with senior government officials, and from the increasing concern of the authorities, expressed in terms both of financial support and legal encouragement (see below under "Government approach") for building a framework for improved cooperation.

Historically, the importance of research (including that of the H.E. Sector) for Industry and for economic growth was already recognised immediately after the World War II. Part of the Marshall Fund was used to create "productivity offices" which, among other tasks, provided a first basis for links between the H.E. Sector and business. Their overall aim of improving the productivity of the Belgian economy, involved these offices in commissioning studies carried out both by universities and enterprises, thus enhancing University-Industry cooperation. In 1947, the "Centres De Groote" (named after the then minister of national equipment) (1) were created, of which 13 now exist. They provided a further basis for cooperation particularly in seeking to initiate and orientate research throughout various industrial sectors, eg. mechanical engineering.

Following on from these and other developments, many H.E. institutions in Belgium have gradually created internal structures for dealing with Industry links. The first official structure of this kind (although at that time outside of the institution) was created by the K.U.L. in Leuven in 1972 . These structures are normally called "interfaces", "cellules d'interfaces" or also "Commission Relations Industrie-Université" and report usually directly to the head of the institution. They fulfil similar tasks to those performed by industrial liaison bureaus or centres. These structures are described in greater detail in Part III A.5.

However, there is no national organisation of these interfaces, nor training for their personnel. Informally a first meeting between them was organised by the European Commission's press and information office in Belgium. This has since led to improved personal contacts between the interfaces. Regionalisation in Belgium has been indicated as one of the reasons for the formal absence of such an association, and for pleading in favour of an EC-wide network.

Despite the spread of these structures, the interfaces have no specific tasks allotted to them by law or administrative regulation. That said, a new financial support system (2) enumerates several steps for the exploitation of H.E. research, with which these interfaces may have to deal:

- patents,
- market research,
- identification of enterprises that are capable of exploitation,
- drawing up business plans.

In most H.E. institutions the interfaces represent a voluntary service available to the teaching staff. However, individual members of the staff continue to play an important and independent role in contacts with Industry. It is often primarily they, rather than a central office, who organise student traineeships in Industry.

More generally, professors may get leave of absence to work for limited duration in Industry. Assignments from Industry to the H.E. Sector are also very common in some institutions and faculties of the institutions. Representation of Industry in the boards of H.E. institutions is not so frequent.

Among other structures which are now being widely used for H.E./Industry cooperation are spin-off companies, university controlled "companies", particularly as "associations sans but lucratif" (non-profit organisations) and science parks. H.E. institutions have become more and more active in marketing their transfer potential at technology fairs, especially "Flanders Technology" in Ghent.

As indicated above, there has been governmental concern since the early post-war years with creating synergies between H.E. and Industry. But there are significant differences in the effectiveness of the structures in the H.E. Sector for liaising and cooperating. This in itself appears due in part to government policy.

b) National approach and policy

Indeed, variations in the performance of technology transfer in the H.E. Sector indirectly reflects the differing impact of government policy on respectively "state" and "free" institutions. The former have been strongly affected by national budgetary constraints, which often have the effect of restricting their potential for developing structures for transfer of technology. In addition they do not possess the same independence and legal flexibility of their "free" counterparts. A proposal in 1971, which would have improved this situation (in the view of a number of sources interviewed) was not adopted. However, this problem is being considered again as part of a more general draft proposal concerning Industry/University cooperation and intellectual property rights (3) (see also part III A.5).

As a general rule, "free" universities which, subsidized by the State for their teaching tasks, are much more autonomous as far as management and non-teaching activities are concerned. State universities complain they did not have the financial resources to establish industrial liaison structures until recently nor to invest in companies. Meanwhile, the free universities could use funds generated from other activities to pay for the interfaces. A final point made by interviewees is that decision-making in the state universities can be a long procedure, which makes links with Industry more difficult.

As for individual members of the teaching staff, they have for some time been able to undertake consultancy without passing through the central financial control (law of 28 April 1953). This law, as reflected in university statutes, allows full-time teaching staff to use two half days per week for these activities. Also defined by law are which outside activites are incompatible with a full-time teaching post in a university.

As regards services provided to Industry on behalf of H.E. institutions, the rules were clearly set out in 1976 ("Arrêté royal" of 8 April 1976). It was especially mentioned that all unversities were allowed to supply services to third parties against remuneration. However, staff members need to get the authorisation of the university's financial controller. This same instrument states furthermore that universities may participate in companies provided there is no conflict with the general interests of the institution. Some limitation is put on financial risk-taking. Nevertheless, state universities are still less far in the development of structures for technology transfer (e.g. involvement in companies, science parks) than free universities.

Besides financial measures aimed at creating centres of excellence, financial support mechanisms available for the H.E. Sector for encouraging technology transfer and exploitation of research results have existed for some years. They cover measures in favour of "concerted" research ("Arrêté royal" of 7 July 1976) and programmes for technological innovation ("Arrêté royal" of 2 February 1982). With respect to exploitation of research results, the Services de Programmation de la Politique Scientifique (SPPS,) under the responsibility of the Ministry of Science Policy, has provided financial means to exploit results of university research. Once an industrial partner is identified, the Ministry can support the project by credits provided by the "Arrêté royal" of 2 February 1982 for assuring the exploitation and transfer of these results.

Liaising between universities and Industry in Belgium is furthermore assisted by a special prototype-fund, set up in 1980. All Belgian companies, including therefore spin-off companies, have access to this fund for developing prototypes. This is particularly interesting for transfer of technology from universities to Industry, because prototype development provides an important bridge between the idea/invention originated in laboratories and its final application. However, it is usually very difficult to find financial sources for this part of the transfer process. Two thirds of the fund are managed by the regional authorities since 1983. The fund is an interest-free loan to companies for five years. The enterprises have to report during these years on development of the prototype. If after five years the project has been successful, the repayment schedule starts.

The H.E. Sector's relations with Industry have recently been given further encouragement in the form of a so-called "brokers fund". In April 1987, the Ministry for Science Policy announced the creation of a new fund (BF 50m for 1987), available to universities and national research centres during 6 years in order to exploit their research results ("Arrêté royal tendant à valoriser la recherche scientifique fondamentale", Moniteur Belge, 2 April 1987). It encourages research institutions to use "brokers" - eg. experts in project financing, patent law, product marketing - to assist in commercial exploitation of their technology. Institutions which make use of these brokers may ask for an interest-free credit for 6 years up to 80% of the total costs. 20% have to be covered by the institutions out of their own funds. The credit only has to be repaid if the project is financially successful. The aim of this fund is to make sure that after 1992 the institutions will be able themselves to finance the transfer of their technology.

An overview, summarising the Government's approach to cooperation was published recently. In May 1986, the Minister for Science Policy outlined the official position on scientific research and development policy ("Note sur la Politique de Recherche Scientifique et de Développement", 4 May 1986). It recognises the importance of the links between the H.E. and Industry. It identifies three existing methods for liaison:

- the science parks of which there exist 7 in Belgium;
- the "Centres De Groote" (named after the then minister of national equipment) for promotion of research;
- "brokers" in technology transfer, such as patent offices, market research centres etc.

In this note, the Government emphasises that universities must maintain intensive links with Industry. They are encouraged to conclude contracts with Industry which contribute to the institutions' further development. The note also encourages Industry to help universities in the area of financing of fundamental research. Enterprises could benefit, says the note, using the H.E. Sector's scientific and technological potential.

For all this general encouragement, there still appears to be the need for specific Government action in certain areas of transfer of technology. In particular, a common complaint heard from the H.E. Sector is the absence of clarity on rules concerning intellectual property rights. A proposal, which has been discussed among all universities in Belgium (4), would clearly defines the rules in this area. In the meantime most H.E. institutions have set out rules in their own statutes (see Part III A.5).

c) <u>Regional incentives for cooperation</u>

Apart from national initiatives, there have also been regional measures to support cooperation. The various regional financial support schemes provided to Industry's research activities have a considerable impact on HE institutions' relations with, and transfer of technologies to, business and in particular to SMEs. In Wallonia, for example, where an important share of regional financing schemes has been allocated to steel sector restructuring, universities' involvement via transfer of know-how in its different forms has been encouraged too. A combined effort by the Walloon H.E. institutions has been presented recently in the form of a brochure outlining their transfer potential to Industry ("Wallonie: Technologies et Formation").

In Flanders, "T-days" (Technology days), which were replaced by "P-days" (Project days), have been organised by the regional government in order to strengthen ties between universities and Industry. During these days, selected projects of universities are presented to interested enterprises. Whereas T-days were of general nature, the P-days are specifically designed for the needs of a region. For the purpose of P-days, universities can present projects they consider of special interest to the region concerned. The projects are then selected and presented to the enterprises. This type of exploitation of research results has proved to be very effective.

A further initiative of the Flemish Region has been a data bank on transferable technology which can be consulted by companies. This data bank contains information about research results from universities, but also technologies developed elsewhere. The existence of this network provides an opportunity for universities to diffuse their information by simply sending the relevant information to the data bank manager.

Belgian universities are also encouraged to send information on the results of research work to a national databank.

d) <u>The University-Industry-Foundation</u>

The University/Industry Foundation, which was created in 1955 and is now financed by contributions from companies, plays a further role in the intensification of University/Industry links. One of its tasks is to encourage the exchange of personnel and students between the two Sectors. In addition the Foundation has recently commissioned a study on the situation of, and impediments to, University-Industry cooperation in Belgium. As background to this, an agreement was concluded in 1981 between the organisations representing Belgian enterprises, H.E. institutions and the Foundation with the aim of intensifying links between enterprises and the institutions. The agreement consists of eight action areas. The Foundation is in charge of putting this agreement into practice. The most important action areas with respect to technology transfer are:

- the reinforcement of fundamental and applied research in areas such as new technologies, new structures etc.;
- development of research into new management techniques;
- organisation of systematic continuing education;

- exchange of personnel and information between universities and enterprises.

* * *

5. A SUMMARY OF THE DEVELOPMENTS IN THE OTHER COMMUNITY COUNTRIES BASED ON REPLIES TO A QUESTIONNAIRE

The survey of the following countries is mainly based on the answers to the questionnaire that was sent to a representative sample of H.E. institutions in the different countries and on information provided by some of the responsible Ministries. For some countries, responses to the questionnaire were limited, and the data produced not very detailed. These limitations should be borne in mind when reading the following summary.

(i) DENMARK

The H.E. Sector in Denmark concerns:

- higher academic education (hojere akademiske uddannelser) at the universities and other advanced-level colleges and

- a range of shorter courses of academic study (kortere uddannelser). Most of these institutes fall under the competence of the Ministry of Education.

This review is limited to universities and university centres (universiteter and universitetscentrene).

According to information provided by the Federation of Danish Industries together with the Danish Employers' Confederation, "one factor to be considered in Denmark is the mixture of old and new universities..... By tradition, the interaction between Industry and the old universities has not been very intensive. In a few fields, however, the existence of unique equipment has given rise to a certain cooperation." As one example they mention the service activity of the Institute of Advanced Physics (Aarhus University) in ion-implantation.

An evaluation of technology transfer activities in Denmark must take account of Denmark's specific economic structure. A very large number of Danish companies (50.000) are very small (between 5 - 10 employees), and mainly export-oriented. The two professional federations argue that "faced with the hard competition on the export markets relatively small companies have to turn to advanced products' development and research to survive." This would suggest a relatively high interest on the part of business in the applied sciences.

The Danish Employers and Industry Federations also refer to some new special structures, eg. the technical university near Copenhagen and the engineering departments in Aalborg. Science parks appear to have been established very recently in Aarhus and near Copenhagen. There do not seem to be any restrictions on universities setting up their own science park. However, the Federations express concern that science parks might drain the limited scientific resources available in Denmark's H.E. institutions. In addition they said many companes felt there was no need for an interface within the university campus and that direct links could be developed as necessary.

Denmark also possesses a centre that assists technology transfer nationally, the Danish Invention Centre. This body receives some financial support from the Ministry of Industry via the Council of Technology. The Danish Invention Centre forms part of the Technological Institute in Copenhagen.

In 1977, the Centre started a "technology scout programme" for transfer of technology. Since 1978 this programme includes activities such as visits to institutions and documentation on ideas with a high content of technology and promising market potential.

(ii) GERMANY

The Community's Directory of Higher Education Institutions classifies German H.E. institutions coming under the authority of the Ministry of Education and Science, in the following manner:

- Wissenschaftliche Hochschulen: Universitäten und Technische Hochschulen/Universitäten (all disciplines), Pädagogische Hochschulen/Erziehungswissenschaftliche Hochschulen (training for school teachers), the Gesamthochschulen (combine the functions of different types of higher education institutions; vary from State to State), the Fernuniversität Hagen (Gesamthochschule).

- Fachhochschulen:a new type of higher education institutions with practice-oriented training;

- Ressorthochschulen: established by the Federal and State Governments for the training of public servants belonging to specific services;

- Theologische Hochschulen: colleges of theology;

- Kunsthochschulen and Musikhochschulen: colleges of art and music.

Out of 217 H.E. institutions there are 67 "Universitäten", 52 "Pädagogische", "Theologische" and "Kunsthochschulen" and 98 "Fachhochschulen". This survey conducted for this Study concentrated on those institutions in the Sector which possess technical sciences faculties.

Development of cooperation between H.E. institutions and Industry

Cooperation with Industry has been practiced for many years by individual teachers, but government policies have started much later with incentives for this kind of liaison. Some six years ago the German Research and Education Commission suggested the establishment of model offices or model centres for technology transfer.

The importance of links between universities and Industry is still modest in financial terms. At a conference in Berlin in June 1984 (Wissenschaftliche Fachtagung, "Hochschule und Wirtschaft - Möglichkeiten und Hemmnisse der Zusammenarbeit"), the German Minister of Education and Science said that out of the DM 6.500m total funds available for R&D in the H.E. Sector, only DM 120m came from industry, mostly from large companies.

The German Science Board ("Wissenschaftsrat") specified in its opinion on cooperation between the H.E. Sector and Industry (16 May 1986, see Appendix No. 13) that it considered the best form of transfer of know-how between the two Sectors is the exchange of persons.

Close links of H.E. institutions with science parks appear to be still relatively limited in Germany. Nevertheless, science parks or technology parks are sometimes managed by the universities and provide a host location for spin-off companies. This is the case, for example, in Berlin, where the

Berlin Centre for Innovation and New Enterprises (BIG), which has some of the traits of an incubation centre, has close links with the "Technology and Innovation Park Berlin" (TIP). Similar projects have been created in a number of other cities, eg. Aachen, Hamburg, Heidelberg, Karlsruhe and Stuttgart (see also Part III A.5. for technology transfer structures).

Since the introduction of the model centres in universities, a network of transfer offices and centres has developed in recent years. In 1986, already 20 universities, 6 "Fachhochschulen" had some kind of structured contact offices for relations with industry, and a further 19 "Hochschulen" have appointed officers for technology transfer without establishing any special infrastructure for their activities. The Ruhr-University of Bochum has published a book listing all these technology transfer centers and bureaus ("Technologietransfereinrichtungen") in Germany. (See also Part III A.5.)

Companies seeking to contact German H.E. institutions may either do so directly or via an intermediary network of organisations and brokers: innovation offices of the chambers of commerce, the professional respresentations, the information services of the German patent office and local/regional initiatives e.g. the "Kommunale Technologie-Beratung Ruhrgebiet". All in all the transfer system has developed into a very widespread network in Germany covering most of the different aspects of technology transfer, although not all the H.E. institutions have persons fulfilling tasks equivalent to an Industrial Liaison officer (as defined in Part I.B.).

Central and Regional Government policy and approach

The general frame for the tasks of the H.E. Sector is outlined by the Framework Act for Higher Education of 1976, as last amended on 14 November 1985, which was implemented by legislation at the "Länder" level.

In recent years, Government policy has done much to encourage cooperation between the two Sectors (see Unterrichtung durch die Bundesregierung: Bericht der Bundesregierung "Hochschulpolitische Zielsetzungen der Bundesregierung und Foerderung der Drittmittelforschung", of 4/9/85).

In the above-mentioned opinion of the German Science Board on collaboration between the H.E. Sector and Industry, the Board recommended that:

- H.E. institutions should accept that industry-oriented R&D should be governed by business constraints, i.e. sticking to fixed dates and deadlines, presentation of cost calculations and fulfilment of contracts;

- H.E. institutions should speed up their research results and present them better; SME's should be given more consideration;

- consultancy and technology transfer centres and bureaus should be regularly controlled and only be continued if they show the expected results.

The report advised also that Industry's awareness of technology potential in universities be improved. Some institutions have already accepted the need for better control of transfer centres by imposing the condition that they have to be self-supporting, after a certain time.

Another indication of the Government's policy to encourage cooperation was the "technology-transfer-prize" awarded by

Ministry of Education and Science for the first time in 1986.

Ownership of intellectual property rights are defined in Germany by the "Arbeitnehmererfingungsgesetz" (law on inventions for employees). It states that the property rights enjoyed by teaching and scientific personnel (Professoren, Dozenten und wissenschaftliche Assistenten) at universities is a personal right (Professorenprivileg), and does not as a general rule belong to the universities. The situation is different for companies, where property belongs to the company if it was developed in its laboratories and with its resources. However the "freedom of research" and the above-mentioned privilege of professors is only valid for universities (wissenschaftlichen Hochschulen: Universitäten, Pädagogische Hochschulen), but not for other establishments, eg. Fachhochschulen, nor for other personnel at universities. Also independent research institutes, such as the Max Planck Gesellschaft, do not have the privilege (Max Planck Gesellschaft takes out the patent and the inventor gets 30 % from the licence revenues).

According to the information provided by Mr. Retzlaff from the Ministerium für Wissenschaft und Kunst, Baden-Württemberg, there will be an initiative this year by the Land Baden-Würtemberg which will provide the two technical universities in Karlsruhe and Stuttgart with a service to assist the professors in the exploitation of their inventions. Similar services have been mentioned for the technical universities in Aachen and Berlin.

Training for Transferbeauftragte (I.L.Os)

The Gesamthochschule Kassel, which possesses one of the oldest transfer points in Germany, was requested by the Ministry of Education and Science in 1986 to develop a training programme for the transfer officers. Several training courses have already taken place and others are planned (see Appendix No. 15). These courses are spread over a period of about two years.

The programme comprises courses on:

- legal aspects of finance and personnel questions
- conference and PR techniques
- management of industrial innovation processes and project management
- creation of enterprises in technologically-oriented areas
- moderation of working groups
- patent laws and exploitation of inventions
- patents and licences
- general management
- use of data banks
- information and communication technologies supporting transfer work
- strategies for the further development of know-how and technology transfer.

The programme includes a conference about patent law and other linked legal questions. There is no training on science parks.

(iii) GREECE

The H.E. Sector in Greece consists of two main categories: university-level higher education (called Highest Education) which is provided only by institutions which are public and self-governing (supervised and financially supported by the State - Ministry of National Education), and non-university-level higher education (called Higher Education) which falls under different Ministries (Directory of Higher Education

Institutions). The former include universities, polytechnics and independent colleges. The latter includes particularly the new Technological and Educational Institutes that were created in 1983.

Cooperation and government policy

University collaboration with industry in Greece is subject to heavy constraints. Problems in transfer of technology and general collaboration with Industry are partly linked to the following facts:

* research budgets are very limited in Greek universities, according to an OECD report (1). The "rector of a top-ranking Greek university is supposed to run his research laboratory on only Dr 50.000 a year"; Industry may thus turn more often to other companies, professional specialists or foreign countries for obtaining new technology;

* the same report states that salaries for teachers are relatively low, which induced many of them to have outside activites and sometimes neglect their research activities; for that reason the reform law for the Sector in June 1982 included provisions that teaching and research staff may not take any other employment in addition to their university duties. As understandable as this regulation is with regard to research, it might discourage links with the business world.

According to the responses to the questionnaire, there is no staff dealing only with collaboration with Industry in universities, except the "research committees". These research committees for universities (2), are responsible for developing the relevant policies and decide about themes for studies against remuneration.

The Higher Technical and Educational Institutions were created by law in 1983, and a law of April 1986 defined the financial regulations concerning the share of funds from contracts (20 % institute, 80 % researcher). These institutes appear to have developped good links with industry for applied research activites. According to the information provided by one of the institutes, their major tasks are to "advise scientifically and technologically Industry, Enterprises and the Social Environment in general and develop and innovate through the links with production units new materials, equipment, procedures, tests, etc." and to "participate in technological research projects".

The same OECD report refers to other laws, intended to encourage research being carried out for Industry. In addition to the provisions of law 1968/82, presidential decree 432 of May 1981 authorised universities to set up "Special Accounts for the management and efficient use of financial resources for research projects." As the OECD points out, there was initially strong opposition to this law, but by 1984 nine of the twelve university-level establishments had introduced the special accounts. This system uses the more flexible accounting rules of the private accounting system and enables the management of funds from the Ministry of Education as well as Industry. (The importance to universities of flexibility in fund management was also mentioned by institutions in Belgium or France).

Most of the H.E. institutions replying have indicated that they have a policy on cooperation with Industry and on intellectual property. However, the only evidence included is the reference to the above-mentioned laws and the established research bodies, without indications on the specific policies and procedures.

(iv) ITALY

Italy's H.E. is provided by universities and university institutions, higher institutes of physical education as well as art academies and music conservatories. This Study concentrates on technically-oriented institutions. Universities and university institutions may either be State universities (universita statali), which depend on public funding and administration; and the State-recognized universities (universita legalmente riconosciute), which have been founded by various bodies or organizations. The H.E. Sector is subject to supervision by the State, specifically the Ministry of Public Instruction (source: Directory of Higher Education Institutions).

The Italian situation regarding research at universities was presented in very strong terms at a conference in Berlin November 1983 (International Workshop - "The future of industrial liaison") by a representative of Innovazione S.R.L., Milano: " The situation in Italy ... has degenerated to the point that certain sectors of the academic community seem incapable of generating original ideas and are content to walk down paths made by foreign researchers, while much of the research work actually carried out in universities is totally inrelevant to the business community."

Concerning the utilisation of research results L. Ascione from the Scuola Superiore Guglielmo Reiss Romoli, Rome, said at a Conference held in Berlin in February 1985: "Even if the situation is slowly evolving, the university-to-industry relationship is in our country a rather weak one. ...... In practice it is necessary to follow up good ideas rather far into commercialization to obtain a solid enough basis for evaluation. Possibly, the only solution is a more and more intense dedication by both industry and universities, and it is clear enough by now that the almost ideal environment for strengthening the required contacts is the Science Park." (3)

Contacts with Industry are usually initiated by the teaching staff. This was suggested by one Italian professor as one reason why relatively few H.E. institutions responded to the questionnaire that was sent. He suggested that only a small part of consultancy and liaison with Industry is administered centrally by the institution. Most activites are done on an individual basis.

Reference was also made to the Government's National Research Council which sponsors programmes to stimulate university-industry interaction.

The framework for university contracts is set out by law. (4) The decree of 1980 sets the rules concerning contracts with third parties and fixes the share-out of revenues from these contracts.

Up to 50% of the total revenue from a contract may be distributed to the teaching staff but this must not exceed 30% of their annual income.

(v) LUXEMBOURG

Luxembourg is in a very special situation with only three H.E. institutions (under the Ministère de l'Education Nationale et de la Jeunesse):

* Centre Universitaire de Luxembourg
  short programme for management (bac + 2)

* Institut Supérieur de Technologie
  education programme for technical engineers (bac+ 3)

* Institut Supérieur d'Etudes et de Recherches Pédagogiques
  formation of primary school teachers

In the first two cases general collaboration with Industry has existed for many years via the teaching staff that is seconded by Industry and via two commissions (one for services and one for new information technologies).

The small number of universities in Luxembourg partly explains why some universities in Belgium have mentioned that they collaborate with enterprises in Luxembourg.

The policy of the Government is to foster transfer of technology with the intention to promote scientific progress and technological innovation. For this purpose a special law was passed on 21 January 1987. (5)

Art. 2 of that law entrusts all H.E. services and institutions that are authorised to do research with the mission of exploiting their research results.. The law envisages the creation of "centres de recherche publique" and states that property rights resulting out of research that has been financed by the state belong to the state (art. 6).

An increase in the R&D budget, especially for research in collaboration with industry, underlines the importance that the government gives to this activity. Thus, the total credits for "recherche scientifique et recherche appliquée" increased from FL 1.575.000 in 1986 to 96.993.000 in 1987. (6)

(vi) THE NETHERLANDS

Higher education in the Netherlands consisted principally of two distinct sectors: the universities (universiteiten) and other university-level institutions (hogescholen - similar to the German Hochschulen) and the institutions of higher vocational education (hoger beroepsonderwijs). The institutions of "hoger beroepsonderwijs" provide training for independent professions and personnel in Industry in sectors such as agriculture, architecture, medical sciences, teacher education etc. (source: Directory of Higher Education Institutions) Although officially the "hogescholen" are today called "universities" we will still refer to them under the name indicated in their responses.

Among the 13 university institutions and universities mentioned in the University Education Act there are 5 State universities (Rijksuniversiteiten), two private religious universities, the Municipal University of Amsterdam and five "hogescholen". In addition there exist 8 recognized "hogescholen."

The present national policy concerning liaising with Industry is embodied in a ministerial circular of August 1986, which encourages cooperation. This circular indicates the possibilities of obtaining financial support from the Ministry in order to finance transfer of know-how activities. HFL 25m will be provided during the next 5 years.

Pilot projects mentioned include:

- Science Park Groningen
- Academische Bedrijven Centrum, Leiden
- Instituut voor Productie Automatisering, Tilburg (concerning product automatisation in SMEs)

- LAICA Transfer, Amsterdam (concerning laser technology).

The Council of Higher Professional Education (HBO-Raad) operates several projects aimed at bringing professors into closer contact with Industry. This office and another one specialised for engineers serve as national offices for relations between Industry and universities in the form of exchange of personnel.

The most common structure used in the Netherlands for technology transfer is the so-called "transfer point". The first transfer points (always non-profit organisations) have been initiated in the mid-1970's (eg. Twente and Eindhoven). The Ministry (then Ministry of Science Policy - now Departent of Science Policy within the Ministry of Education and Science) had financed for some years the first transfer points in three technical highschools (Technische Hogeschool), then in universities, and finally some other universities have taken their own initative. Initially the transfer points were only involved in counselling, but now they tackle more and more research questions that are innovation-related. The importance of these transfer points was confirmed in a report from the Economics Ministry ("Naar een marktgericht technologiebeleid", February 1984). (The transfer points are described in more detail in Part III A.5.).

By now there exists a national network of transfer points (OTRA), which meets once a year and even some regional meetings take place.

The legal basis for the exploitation of inventions was set out in 1982 (7). The "own incomes" of universities are governed by the "Ministerieel Besluit" of 9 September 1981 and art. C3 of the law "Invoeringswet WWO".

Own incomes of universities derive from a variety of sources, including:

- contract research
- training for third parties
- services for third parties
- subsidies
- intellectual property rights.

(vii) PORTUGAL

The OECD report "Reviews of national science and technology policy - Portugal" (8), states that at present Higher Education consists of "university and university institutes (long cycle) on the one hand and polytechnic institutes and colleges (short cycle) on the other."

University research and its transfer in Portugal has considerably suffered from the unstable political developments in the country during several decades. Higher polytechnic education was only introduced in 1979. The same OECD report indicates (p. 47) that according to official figures "business contributes only 0.1% to the financing of university research", which, it concludes, "is a clear sign of the production sector's lack of confidence in the value of research undertaken in higher education."

The following comment could be an explanation why most of the answers to our questionnaire were negative concerning centralised university policies: "Despite the existence of the scientific boards, chaired by a vice-rector, research and development activities depend solely on the initiative and evaluation of each research director or even each full professor." The relatively low salaries in the universities have encouraged teachers to do private consultancy work and take active involvement in enterprises, uncoordinated by the university. This has damaged research activities at the universities and finally led to a new regulation that increases teachers' salaries if they do not have any outside activities. The salary of any research scientist who "declares that he has given up all other paid public or private employment, including the practice of a profession", shall be increased by 35%. Teaching activities up to 6 hours per week are excluded from this rule. This decision - although understandable from the research point of view, might be counterproductive for collaboration with Industry.

Furthermore the report (p. 34 ff.) points out one of the major shortcomings concerning research in Portugal - the absence of a common "science budget". The National Institute for Scientific Research (INIC - Instítuto Nacional de Investigaçao Científica) was created in 1976 and enjoys administrative and financial autonomy (its total budget was ESC 563.3m in 1982). It comes under the Ministry of Education. The INIC has 126 research centres, which - with a few exceptions - are all located in the universities.

With reference to careers it has to be added that only since 1980 (decree-law No. 415/80) is there a profession and career structure recognised and defined by law.

According to the information provided by the national Comett representative from the Universidade do Minho, there is no defined government policy concerning the collaboration between university and Industry. However, in December 1986 a working group was created with the long term aim of creating a Council for university-enterprise-cooperation. The members of this Council comprise the universities and the major enterprises. The objectives of the Council, among others, will be to define the general guidelines for a global policy for cooperation between enterprises and universities.

Up to now, only the university of Coimbra has initiated a study with the objective of establishing an institutionalised policy for technology transfer. This was induced by increased demand from Industry for cooperation.

(viii) SPAIN

There are 34 universities in Spain, three of which are private and 31 public. Within these public universities there are only three Technologica Universities (one in Madrid, one in Barcelona and one in Valencia) and 28 universities in which different types of social, scientific and technological careers are offered. Each teaching research centre is organized on the basis of Departments. The heads of Departments are responsible for the teaching of specific subjects and for the research projects in their department.

A representative of the Universidad Complutense de Madrid has explained that "up to recent years, the scientific and technological research developed by universities was poorly linked to industrial and community needs. Even though there has not been a significant change in this trend, there is little awareness about the problem. Some efforts have been made in order to organize research data and establish links between university researchers and the industrial world." (9)

The collaboration of universities with industry is based on the law (10) which authorises the work for third parties. The details of the organisation of these outside contracts are fixed in the "Real decreto, 1930/1984" of 10 Oct. 1984. It states in art. 5 the maximum amounts that teachers can earn in addition to their normal salary.

In most universities, the vice-rector for research has the responsibility for policies concerning collaboration with Industry, but contacts with Industry are mostly initiated by individual teachers.

The "Ley de reforma universitaria" authorises departments to conclude contracts with industry in the name of the institution, which was not possible before. This explains why most collaboration in Spain is still organised via "University-Industry-Foundations", which was one way of avoiding complicated bureaucracy for liaising with Industry. The University-Industry-Foundations Board is usually composed of:

- representatives of the university
- representatives of the chambers of commerce
- representatives of the employers' organisation
- a managing director.

* * *

B. CONSIDERATION OF RELEVANT DEVELOPMENTS IN SWEDEN AND THE U.S.

Two countries outside the Community whose national economies appear to have directly benefitted from cooperation between their H.E. Sectors and Industry are Sweden and the U.S. As in the other Sections in this Part, consideration has been therefore given to both a numerically small and a large country.

An outline of the development of cooperation between the two Sectors, directly applicable to this Study, have been set out below. Consideration of the relevant structures utilised for cooperation in these countries are set out in Part III.

Greater space has been given to the U.S., as it is widely recognised as having had a longer and more beneficial relationship between its two Sectors, than any other developed country in the world. To ascertain just how the science and technology in institutions has benefitted the U.S. economy, the development of two geographical areas, which have been identified with academic technology transfer, will be looked at.

(i) SWEDEN

Over the past five years Sweden has approached the utilisation of its activities in science and technology in a planned and co-ordinated manner.

As a country with a population of approximately 8.3 million the development of international markets in high technology has been crucial to its economy. It has also had to restructure large parts of its traditional basic industries.

The major planning objectives for the public R&D system were set out in legislation dealing with the Swedish National Science Policy, adopted in 1982. This covered, in the first instance, a period of five years, with a further review every three years.

There appears to have been a change in attitude to the need for more cooperation between the H.E. Sector and Industry starting in the late 60's when it became apparent that to maintain its place in international markets, Swedish industry would require to provide more investment for R&D projects.

The relevant figures indicate that about 90% of the investment made at this time was expended on development, making the H.E. Sector's research input of direct importance to Industry and the national economy.

The role of the Swedish Board for Technical Development

The government body mainly responsible for the implementation of cooperation is the Swedish Board for Technical Development (STU) which was established through, and in the same year as, the Ministry of Industry, in 1968. One of the main objectives of this Ministry was set out in the following terms:

"In order to create an effective innovation process, one should treat it as far as possible as an integrated process, where research and development work are completely coordinated with other functions and as far as possible oriented towards market needs. The innovation work must be planned and carried through in intimate cooperation between research, production and market divisions of a company."

STU provides backing for approximately 3000 projects annually and its budget for the fiscal year 1985/86 was in the region of SEK 750m. Under these projects, and with this funding, STU takes initiatives, plans, coordinates, gives consultative and financial support, to the H.E. Sector and Industry, as well as individual entrepreneurs and inventors.

The financial support assists the development of the following activities:

* "Fundamental and long term promotion of expertise and knowledge (eg. by means of selected programmes for the development of technical knowledge);

* "Coordinated technical development programmes of broad interest to Swedish industry (eg. by means of "action areas");

* "Selected programmes for co-operative research;

* "Strictly-defined research and development projects;

* "Service and advisory activities."

The efforts in Sweden to develop comprehensive on-going, growth-creating programmes have been intensified over the past years, including programmes in the H.E. Sector to assist in that Sector's cooperation with Industry.

STU's role in the H.E. Sector involves both the orientation and resources of research, in the relevant institutions, also the development of technical scientific knowledge within Industry. To ensure the transfer of this knowledge into Industry there are at present approximately 500 academic researchers and 1000 post graduates working on projects funded by STU.

Researchers trained through these projects are given direct participation with Industry in strategically important areas of development, allowing them to find suitable employment on the completion of their project.

It is clearly recognised in Sweden that the H.E. Sector will have, in future, an increasing and even more important role to play in the national economy, as one of the main research resources for Industry.

As a result of cooperation over the past years between the two Sectors new forms of linkages have emerged. Science Parks have been established adjacent to, and directly linked with, technical institutions. As will be seen later in this Study, there has been, at some institutions, a marked increase in the number of companies whose products were originally generated in an institution.

This phenomena is recognised as being one of the most important activities of STU. The objective is to ensure that the results of academic research should be utilised increasingly in development work, and as a means of establishing new technology-based companies. Direct funding is therefore provided to companies undertaking knowledge-developing projects jointly with institutions.

STU directly employs approximately 250 persons with expertise covering all the areas in which it operates. Approximately half of the staff are "professional, development-oriented graduate engineers, most of them with advanced academic training and research or industrial experience."

STU also has a broad network of contacts, both national and international. This network includes around 50 national working groups, reference groups, and steering groups, with representation from Government, Industry, Trade Unions and Academe.

Technology transfer to SME's

Mention should also be made of the impetus given to technology transfer from institutions through regional development funds. In 1978 some of these funds were directly used to strengthen SME's in various regions. Several SME's had been identified as potential hi-tech developers, particularly in the pharmaceutical and medical-technical areas, and with ties to their local institutions.

The utilisation of these funds, however, did not appear to reach the expectations of the funding bodies in respect of the development of the SME's hi-tech potential. Due to this problem some of these funds have now been switched to institutions as the producers of the knowledge which is required by the SME's.

Funding of up to 50% for small development projects with SME's, has been given to assist the institutions in the transfer of their technology and services. This funding has proved useful in establishing or strengthening, beneficial links, and, establishing a cooperative environment, between the two Sectors, in several regions.

(ii) THE U.S.A.

"University-industry relations have been incomparably more extensive, frequent and systematic in the United States than in almost all other Member countries. Although R&D was not at the core of the network of relations, past experience has given the university the image of an institution which has, directly or indirectly, contributed a great deal to economic and social development, as well as to the accomplishment of various national objectives. There is no basic prejudice to overcome, among industrial managers or university leaders, to discuss the merits of future collaboration."

The above extract from the opening paragraphs of a survey taken by the Directorate for Science Technology and Industry, OECD in 1983 on "New forms of co-operation and communication between industry and the Universities", succintly indicates the differing basic positions of the H.E. Sector's cooperation with Industry, in the U.S and in the European Community.

In the U.S. the public has come to expect that scientific and technical discoveries can, and should, produce concrete benefits to the national economy. There has also been a growing realisation in the H.E. Sector of the benefits that the establishment of Intellectual Property Rights (IPRs) generated within institutions can bring.

The clearly perceived objectives of many famous US institutions - eg. M.I.T. whose 1861 Charter explicitly emphasised the application of science to manufacturing and commerce - have made them more innovative and dynamic than many of their European counterparts. It has also led to the development of links with Industry as an accepted and integrated part of academic life in these institutions.

American cultural values have clearly accepted the prestigious use of industrially generated funds to assist academe, both nationally and locally, on a level not adopted in Europe.

The above developments have led to a far greater rapport, between institutions and Industry in the US than has been seen in Europe to-date, and a far greater acceptance of the mutual benefits which can be derived from cooperation, in particular technology transfer from institutions to Industry.

The National Science Foundation

One of the main elements in bringing academic technology on to the market place has been the work of the National Science Foundation

This federal agency was established after the Second World War with the specific mandate to fund research in institutions. Although its ties to Industry are somewhat less traditional these have been greatly improved in recent years through such means as basic research directorates i.e. the Engineering and Applied Science Directorate.

The co-ordinating and facilitative programmes of the NSF are proving successful and have gained acceptance as examples of the federal role in bringing about increased cooperation between institutions and Industry.

The Federal Government has decided that one of the NSF's roles is to remove barriers with a view to stimulating innovation and increased production. This has led to the removal of obstacles to institutions holding the IPRs generated from government funded research projects.

One of the main objectives of the NSF therefore is in "transferring new knowledge and new technological possibilities into development in the private sector".

This objective is basically being carried out through several major NSF programmes, which include: -

Industrial-University Cooperative Research Projects
Innovation Centre Experiments
University-Industry Research Centres
Small Business Innvation Programme

The direct benefits of the Small Business Innovation Programme will be looked at in practice in considering the developments on Route 128 and in Silicon Valley, the two leading examples of the geographical focussing of Industry/H.E. Sector cooperation. The other programmes will be considered in the structures for general cooperation and technology transfer set out in Part III.

Two leading examples of Cooperation and Technology Transfer in Practice

There are two geographic areas in the U.S., which are internationally synonymous with institutional technology transfer - Route 128, the eight-lane highway that encircles Boston, Massachusetts, in a radius ten miles from that city, and, the Santa Clara or "Silicon" Valley in Northern California, a thirty mile strip of land running south east of San Francisco.

Consideration of the general background and development of these areas establishes the factors which have been instrumental in their growth as centres for spin-off companies i.e. companies incorporated to sell products, processes and services which have emanated from institutions, or a parent company.

One of the main factors has been the part played by local institutions such as the Massachusetts Institute of Technology (M.I.T.) and Stanford University.

Route 128/Massachussetts

Prior to M.I.T. being established in 1861, the New England area had already been recognised as an industrial and entrepreneurial centre. M.I.T., having as one of its objects, the preparation of students, "to apply the lessons of science to the world of business", had by the beginning of this century established itself as a prestigious educational establishment teaching practical programmes dealing with the problems of Industry.

The personal consultancies of staff to Industry were not just allowed, but actively encouraged. This and other factors led to the present policy of allowing staff to spend 20% of their time, during the 9 month academic year, on outside professional interests, including their own businesses.

Although the name of M.I.T. may be synonymous with Route 128, there are sixty five colleges in the Boston area including Harvard, Tufts, Boston and Northeastern Universities. However none of these colleges can match M.I.T.'s "long history of extensive, mutually beneficial interactions with industry".

Prior to the Second World War several spin-off companies from M.I.T., and other colleges had already been established in the Boston area. The environment had been introduced, but the catalyst which brought about the present development, was the funding given to institutions in the area, during the War, by government agencies such as the Office for Scientific Research and Development (OSRD). $ 177,000,000 being given by this agency to M.I.T. alone.

During the First World War, German superiority in certain scientific and technical areas had forced the British Government to establish government research centres, which also carried out a major part of wartime research, during the Second World War.

The U.S. did not have sufficient Government centres of this nature in both the First and Second World Wars, and therefore funded a major part of the required research at institutions. This led to fundamental advances, during the Second World War, in New England, of certain technologies including aircraft instrumentation and automatic controls, microwaves, and last but certainly not least, computation.

Government funding continued after the War, particularly Defence Department research programmes, in such areas as military electronics. However, a large number of trained people, who had been brought in for wartime work, were made redundant and many started up their own businesses. This established a critical mass of trained personnel, who through their research interests, tended to create spin-off companies.

The end of the War also saw the incorporation of what has been called the first venture capital company in the world - American Research and Development Corporation (ARDC) in 1946. This was a joint venture by four local colleges, including M.I.T. and Harvard, together with local financial backing which raised an initial sum of $3,500,000. The basic object of the Company was to give financial assistance to the growing number of research based and consultancy companies. The financial strategy of this company was a continuation of investment in research based companies which had started in the Boston area during the War.

About two-thirds of the U.S. venture capital market is now established in the Boston and New York areas, and one third in the vicinity of Silicon Valley.

The 1950's saw the start up of such internationally known spin-off companies as Wang in 1951 and Digital in 1957, the year that the U.S. Government also introduced the Small Business Investment Act making investment by trading banks and other financial institutions in small ventures very much more attractive.

The provision of investment capital in U.S. for research based companies has been one of the factors in technology transfer from the H.E. Sector, as it has allowed institutional research to be turned into marketable products more easily.

A study undertaken by M.I.T. for the Swedish Government on Technology and Industrial Innovation in 1982, made particular reference to the fact that relevant American companies tend to be better funded initially and were, at that time, more able to obtain venture capital.

Further Government assistance in 1977 under the Small Business Innovation Research Programme (SBIR) has also been a factor in development both in New England and Northern California. This programme awards up to $50,000, to a company with less than 500 employees, or an individual to carry out a six month feasibility study on a research based project. If successful, this can be followed by a further award of up to $500,000 for a two year research programme, subject to a contingent commitment for further development funding being found from commercial sources. If venture capital can not be found at this crucial stage, the NSF is still prepared to look favorably at viable projects.

Over the first five years of the Programme 450 proposals, out of 3,500, received assistance in the first phase. 150 of those proceeded to the second stage and an average of $50-60m of venture capital was obtained for the final phase.

This programme has grown from $40,000,000 in 1983 to over $350,000,000. It is expected to provide $1.6 billion over six years. More than half the awards have been made to innovators in Massachusetts and California. Several other States are now considering the introduction of their own programmes. The U.S. is determined to maintain an innovative lead in the international markets and sees this type of funding as one of the essential ingredients to maintaining its position.

The impact of the developments on Route 128 has led to Massachusetts housing over 700 computer related companies and having the lowest unemployment rate in the U.S.A. Business statistics also show that, between 1969 and 1976, 80% of new employment was created, not by multinationals but companies with 100 or less employees. This trend has continued.

Employment in high technology companies on Route 128 provided 25% of all new jobs created in Massachusetts over the past ten years. During this period there has also been an increase in employment in this Sector of the State's economy of 59.5%, and in the U.S., of 35.6%.

The combined sales of three Route 128 spin-off firms Digital, Wang and Data General, exceeded $10 billion in 1985.

These figures should, however, not hide the serious problems that firms on Route 128 have faced, and are now facing, both at the beginning of the last decade, and again in 1985/86.

The early 1970's saw a dramatic unemployment situation in the area, when about 12,000 engineers and skilled technicians, lost their jobs due to large cut-backs in government contracts.

The survival of Route 128 as a major economic factor was due to the available critical mass of experienced people. "The second coming of high technology on Route 128 is another example of the principle of agglomeration: A region with a head start in a particular industry will grow faster than other regions. Due to the Boston area's stock of skilled engineers left over from the military electronics era of the 1960's, a pool of born-again capitalists was ready to launch the microcomputer push in the late 1970's. M.I.T. played a pivotal role, again demonstrating that a research university is the key institution in an information society".(1)

By the end of the 1970's, four Laboratories at M.I.T (Electronics Systems, Instrumentation, Lincoln, and the Research Laboratory for Electronics) were credited with "fathering" 105 spin-off companies situated on Route 128. Four other M.I.T. Departments, were also credited with the birth of a further 51 new firms.

By 1985 it was estimated that about 1,000 spin-off companies in the area had been established by the staff and students of M.I.T.

1985 again brought further problems to many companies in the area due to the down-turn in capital spending by U.S. companies. It is estimated that about 11,200 jobs in the high technology sector were lost in the State during that year.

The companies with established and increased overseas markets have been best placed to "ride out the storm". Plant automation and improvements in marketing policies, particularly for overseas sales, have now being carried out by many of these firms.

The Route 128 development has seen the utilisation of established industrial buildings by new companies, as well as the evolution of suburban industrial parks, as epitomised by Silicon Valley. About two thirds of the industrial space in the Route 128 area is said to be utilised by research and development facilities.

Mention has been made of Harvard University's role in the development of Route 128. However, this internationally known academic institution does not appear to have benefitted as directly from its interface with industry, to the same extent as M.I.T.

Although several well known spin-off companies have been incorporated by Harvard staff or students i.e. Polaroid in 1937, Wang Laboratories in 1951, and Biogen in 1979, there has apparently not been same the degree of technology transfer as has been experienced at M.I.T.

Comments have been made that any disparity in benefits from the industrial interface, may be due to the differing research strengths of the two colleges. Harvard with basic sciences, medicine, social sciences and the humanities, M.I.T. with engineering and computing sciences. The staff at Harvard have also been more in favour of maintaining the "traditional role", of a University.

This approach may be contrasted with the entrepreneurial style of some senior staff at M.I.T., such as C.T. Compton, the President at the beginning of the Second World War, who actively encouraged staff consultancy. Also worthy of mention is Vannevar Bush, Dean of Engineering, later Vice-President.

Bush played a direct part in the establishment of Silicon Valley by influencing the "father" of the Valley, Frederick Terman, who was to become Vice-President at Stanford.

Silicon Valley/California

By the beginning of this century research activity, particularly in the field of what was then called radio engineering, had been established in Northern California, particularly in the Bay area of San Francisco. One of the reasons for this research activity had been the foundation of the Leland Stanford Junior University at Palo Alto in 1891.

Stanford's founding grant provided for the establishment of "mechanical institutes". This has resulted in the establishment and development of a private research institution of international prominence, "dedicated to generating the intellectual capital on which the country depends for advancement."

In 1909 faculty members of this college and local businessmen invested in a company to be called Federal Telephone and Telegraph, the brainchild of a Stanford graduate student. Research work at this company perfected the vacuum tube, from which other inventions would develop.

The continued encouragement given by Stanford to its staff and graduates saw the start of several companies such as Hewlett Packard in the late 1930's. It was, however, wartime funding, not at Stanford, but in the manufacturing companies in the area that provided further stimulus for research and industrial development.

60% of the U.S. wartime shipping was manufactured, using new skills, in the Bay Area of San Francisco, together with other war-time industrial requirements. As in Boston this brought together a critical mass of trained personnel.

Although Stanford may not have directly benefitted as much as M.I.T. from wartime research, the subsequent development of sponsored research projects and the establishment of the Stanford Industrial Park at the beginning of the 1950's, laid the foundations for Silicon Valley.

Silicon Valley has earned its nickname from the proliferation of semiconductor firms in the Santa Clara area, the first being the Shockley Semiconductor Laboratory in 1955. Staff from this company later set up Fairchild Semiconductor which alone has spun off approximately 35 out of 75 semiconductor manufacturers in the Valley including National Semiconductor, Intel, and Advanced Micro Devices (AMD).

For all that, Silicon Valley has not been exempted from the rapidly changing patterns and problems of development in hi-tech companies - witness Fujitsu's attempted take-over of an ailing Fairchild in 1986. A 1982 Study of 250 companies in Silicon Valley over the period 1969 to 1980 noted that 36.8% of the companies were apparently no longer in existence, 30.8% had survived and were still independent, but that a high 32.3% had been acquired (2).

The establishment of the semiconductor industry led to the birth of computer companies such as Apple, Tandem and Commodore. Once again a critical mass had been created where the outstanding entrepreneurial success of some companies, inspired the continual birth of others.

The venture capital activities in Silicon Valley appear to have started with an investment in Fairchild, but the main financial backing was started during the 1960's by the establishment of venture firms by East Coast financiers, who could foresee the potential growth of high technology companies in the area.

Federal funding also continued to play a role in the early development. In the 1950's and 1960's, Defence Department purchases of semi-conductors, amounted to 40% of total production in the Valley. By 1984, however, these purchases only constituted 8% of total production.

<u>Stanford has established centres of academic excellence by selecting a limited number of areas for basic intellectual research. It also has done everything it can to encourage its staff to undertake commercial consultancy</u>.

It has allowed staff to combine careers as academics with entrepreneurial activities. It is claimed that Stanford's faculty of approximately 1,300 "produces an average of nearly three inventions or technical processes a week for possible licensing, and the gross income to the school from the licensing was over $3 million last year". (1984) (3)

The growing interface with industry is also thought to have been one of the main factors in increasing government funding and corporate gifts. Between 1960 and 1983 federal sponsored research funding grew from $13,000,000 to $137,000,000. Between 1974 and 1984 corporate gifts increased from $5,000,000 to $25,000,000.

In 1951 Stanford established its multidisciplinary Industrial Affiliates Programme, which is comparable with M.I.T's Industral Liaison Programme. This Programme, the establishment of the centres of research excellence, and the development of the Industrial Park, have been three of the main factors which have taken Stanford in to the ranks of the world's academic elite.

The spin-off factor in Silicon Valley has now seen the area becoming an international centre for laser production.

The Stanford policy of establishing centres of academic excellence has also led to the establishment of several biotechnological companies arising from the work carried on in the Department of Chemistry.

As with Harvard and M.I.T., the other internationally known local university, University of California at Berkeley, with an excellent record and research facilities, does not appear to have benefitted to the same extent as Stanford, from its industrial interface.

It can be no coincidence that the two main areas of technology transfer in the western world have developed adjacent to two technically oriented H.E. Sector research institutions, both of which have had personnel and policies to optimise staff consultancy, intellectual property, and the transfer of their technology.

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PART THREE

A SURVEY OF THE PRESENT STRUCTURES AND STAFF UNDERTAKING COOPERATION WITH INDUSTRY IN THE EUROPEAN COMMUNITY

(followed by reference to extra-Community experience)

This Part looks firstly at the environment in which the staff of the H.E. Sector, engaged in cooperation with Industry, are currently working (section A.) The term "environment" is taken here as covering the present objectives, policies, procedures and structures utilised in the H.E. Sector for cooperation in general and transfer of technology in particular. This Section surveys this environment successively in the four selected Community countries (Ireland, the U.K., France and Belgium) and summarises the situation in the remaining Community countries. Some comments have been made on certain aspects of cooperation, in order to establish the factors needed to bring about effective cooperation as dealt with in Section D.

Section B is devoted to a summary of the qualifications, expertise, experience, the status and the criteria for appointment of staff working in the structures outlined in Section A. It is organised on a country-by-country basis in the order followed in Section A.

Section C contains a survey of structures in two extra-Community countries - Sweden and the U.S.A. - with extensive experience of systematic cooperation and transfer of technology.

This Part concludes with an attempt to identify the factors needed to establish effective cooperation based on a comparative review of the material set out in the preceding pages of the Study (Section D).

A. CONSIDERATION OF THE PRESENT OBJECTIVES, POLICIES, PROCEDURE AND STRUCTURES UTILISED IN THE H.E. SECTOR FOR COOPERATION, IN PARTICULAR TECHNOLOGY TRANSFER

1. IRELAND

(a) Institutional objectives

The majority of the Irish institutions surveyed have not published clear and defined objectives informing the staff, and the public, as to their aims, and the strategy to be followed in developing beneficial cooperation with the relevant Sectors of Commerce and Industry.

The need for such published objectives is all the more necessary as, to date, the Government has only indicated in broad terms that "the links between higher education and industry will be intensified" and has itself not specifically defined its objectives and strategy for cooperation beneficial to the national economy.

The lack of these objectives is indicative of the fact that none of the institutions has apparently undertaken a proper audit and assessment of all the resources which they have available for cooperation. Thereafter, it is necessary to decide what objectives need to be established to develop beneficially these resources and to plan the implementation of these objectives.

The need for such an approach, to be carried out on a national basis, has been emphasized in the Report for the NBST (referred to in Part II) on National and College Structures for Technology Transfer. In the Report it was suggested that an audit of Departmental technologies could be carried out in the following manner, by classifying technologies as:

* Completely academic with no commercial applicability
* Mainly academic
* Interesting, but marketing difficult
* Highly commercial.

The Audit would then identify the institution's expertise which could be directly utilised under the following basic headings:

* Consulting advice, including marketing expertise
* Problem solving
* Specialised measurement
* New process development
* Product development
* The identification of all other commercially applicable services
* Licencing to existing companies
* The establishment of a soft or a spin-off company.

The Audit would also identify any special instrumentation, faclities or equipment available in Departments, particularly any unusual equipment capabilities which may not be readily available in Industry.

The above Report was concerned only with the transfer of technology, but an Audit covering all aspects of cooperation, could be carried out on the same basis involving all relevant aspects of the institution's work.

It has been noted that many non-technical Departments usually contain resources which could provide a service to such sectors as Tourism.

Before an institution can properly define its objectives for cooperation, publish its relevant policies and procedures, identify, and establish the required structures, and then employ the relevant staff, it must have iniatially identified and assessed its resources upon which the other necessary elements can be built.

This basic approach has apparently not been adopted, and staff have been employed, in several institutions, without these prerequisites being carried out. This has resulted in their duties only being generally defined, and the required expertise not being identified.

The main stated objective for cooperation in some institutions appears solely to be the generation of funds from Industry to substitute for declining public income. No attempt is therefore being made to alter the differing mental attitudes of academe and Industry to ensure that cooperation provides the optimum benefit to teaching and research, to industrial production and growth, and to the national economy.

There are still several institutions which have not agreed that work geared to industrial requirements, and the generating of commercially viable intellectual property, are elements which should be taken into consideration for academic standing and promotion.

If the environment necessary for cooperation and beneficial technology transfer in Irish institutions is to be introduced and flourish, there is recognition that this environment requires, as its base, clear and published objectives, coupled with a sincere acceptance of the need for, and benefits which can be derived from, cooperation with Industry.

(b) Policies and Procedures for staff consultancy

The majority of institutions have published guidelines for the undertaking of outside work, including staff consultancy. There are however differing approaches to the implementation of these guidelines.

Many institutions do not maintain sufficient records of the work carried out and remuneration received, nor the proper cost to the institution of the use of its facilities and materials.

The present unsatisfactory position can be directly attributed to the Devlin principle - applied to the remuneration of civil servants, including academics - of "one man - one pay". This does not officially allow for the retention of any consultancy fees by members of staff in an institution.

The great importance attached to the publishing of acceptable guidelines for consultancy, both in the development of general collaboration and technology transfer, have been clearly recognised in several countries.

Reference will be made, later in this Part, when dealing with structures for cooperation in the U.S., to the evidence that the encouragement of consultancy by staff has led to more beneficial general cooperation, technology transfer and practical input to teaching and research.

If the needed environment is to be established in Ireland the clear support of government to academic consultancy and the equitable retention of fees should be established as soon as possible. There should also be academic recognition that a consultancy which develops the consultants' teaching and research interests must be seen as "a feather in the academic cap".

In support, institutions should establish policies and procedures to ensure that they can assist their staff in developing their consultancy skills.

Although a record of the relevant expertise should be maintained to ensure accountability for public funds, and to assist in the marketing of the expertise, the most equitable arrangements possible should also be entered into with staff as to the time required, and the retention of fees. This again appears essential to ensure the development and maintenance of the needed environment.

(c) <u>Policies and Procedures on Intellectual Property</u>

As previously noted (in Part II), only University College, Cork has, during the compilation of this Study, published its policies and procedures to protect and develop the intellectual property generated by its staff.

Considerable time has, however, been expended in the other relevant institutions in the drafting of the required policies and procedures. It is hoped that these will be published in the near future.

Their publication alone will not, however, provide all the essential elements required for the establishment and maintenance of an effective technology transfer environment.

These elements are :

* The acquiring of the knowledge of what intellectual property is, its rights of ownership and the benefits

that can be derived from that ownership.

* A clear understanding, and acceptance of, the need for the early identification, protection and development of academic intellectual property, its benefits to the inventors, the institution and the national economy.

* The establishment of the correct structure to carry out the identification and protection.

* The need to develop and maintain all the available lines of communication with industry and other sectors of the economy, to ensure the continued stimulation for, and birth of, academic "ideas".

* The recognition that a commercially viable patent can disseminate knowledge for the public good just as effectively as an academic paper of merit.

(d) **Structures utilised for general cooperation.**

(i) Liaison "Committees"

All the institutions in the H.E. Sector which are cooperating with Industry have apparently established a committee, or other body, which is primarily responsible for this cooperation.

Most of these bodies have representatives from Industry as members; however, some do not. It is suggested that all of these committees or bodies require the input of relevant business and professional knowledge. The outside representation should be in the region of 50%, containing a good cross section of both national and local relevant industrial, business and professional interests.

Some of these bodies meet on a frequent and regular basis, others infrequently. Some of the bodies report directly to the President and the Governing Body, some to Senior Officers of the institution.

To ensure their effectiveness these bodies need to have direct lines of communication with, and report to the President and the Governing Body of the institution at regular intervals, both orally and in writing. Annual Reports on developments in, and problems facing, cooperation should be produced.

The number of members varies considerably, as do the criteria for appointment. The numbers should be kept as practical as possible and the criteria for appointment should provide the most useful and active members.

The effectiveness of these bodies depends very much on the genuine interest and assistance which the most Senior Officers of the institution give to the development of general collaboration with Industry.

There is apparently still some "lip service" being paid by some senior staff to the need for cooperation with industry, arising out of the apparent need to expand all available sources of income rather than to a sincere conviction that collaboration can be directly beneficial to teaching and research.

(ii) <u>Industrial Liaison Units (ILU's)</u>

The main structure which has been utilised in Ireland for the development of cooperation with industry has been the office of the I.L.O.or its equivalent in all the relevant institutions. This is, as has already been noted in Part II, either a full time or a part time post, with normally limited secretarial assistance.

These I.L.U's are established at the following institutions: -

(a) University of Dublin/Trinity College (full time)
(b) University College, Dublin (full time)
(c) University College, Cork (full time)
(d) University College, Galway (full time)
(e) National Institution for Higher Education, Dublin (full time)
(f) National Institution for Higher Education, Limerick (full time)
(g) The Regional Technical College, Cork (part time)
(h) The Regional Technical College, Galway (part time).

The duties of I.L.O's appear to differ somewhat from institution to institution despite the efforts of the NBST to set down a basic job description, as seen in Appendix No. 5. I.L.O's have become involved in activities not directly concerned with technology transfer. These activities include careers and appointments, graduate associations, student placement and fund raising.

There would also appear to be a tendancy within institutions to pass over any commercial or quasi-commercial matter to an I.L.O., if these matters have not been previously dealt with in an institution, and the duties of the post have not been properly defined. This has resulted in I.L.O's accumulating responsibilities which have definitely detracted from what should be the main duties of an industrial liaison post.

The NBST, whilst satisfied that the liaison system, acting as a focal point, helps to increase the awareness of industrial needs in institutions, has for some time been considering the future duties of an I.L.O. These have been seen as falling into the following categories:-

(a) traditional liaison services
(b) research administration
(c) advice and assistance on patenting/licensing and other matters arising from the identification, protection and development of intellectual property generated in institutions
(d) the establishment of institutional companies or assisting in the development of spin-off companies.

With regard to the two latter categories of duty, these are only seen as involving facilitating or supporting duties. It would not be expected that the I.L.O. be a trained solicitor or patent agent, but he or she would be required to have the expertise needed to advise on planning and carrying out the internal policies and procedures which would be required to ensure beneficial technology transfer. This would entail a good knowledge of intellectual property, and the workings of relevant structures which had been utilised in other institutions, both national and international.

The I.L.O. will also be required to play a major role in the planning and organisation of other structures such as product development centres, innovation and incubation centres.

The NBST has also envisaged that new expertise and experience will be required for the above tasks and that "the I.L.O. will need considerable retraining to enable him to facilitate and support the college academic staff in achieving their maximum utilisation."

The NIHEs have approached their cooperation with Industry from a differing basic concept than that adopted in the Universities. NIHE, Dublin, which has received financial assistance from NBST, has looked upon the main functions of its I.L.U. as being student placement. It has, however, been successful in the promotion of contract research, distance education, the INTRA Programme and the publication of a commendable newsletter on cooperation with Industry.

NIHE, Limerick, from its inception has had its Industrial Liaison undertaken by a well staffed Cooperative Education Division, with excellent facilities. This Division was the first of its kind introduced in to Ireland based on a concept which had been developed in the US since 1906. Again however the main objective of the Division has been student placement. The Division's objectives should provide a good base upon which to launch student "start up" businesses, and there are definite signs that this is now taking place in Ireland.

(e) <u>Structures utilised for technology transfer</u>

At the date of the writing of this Study there are some structures which have been established for sufficient time to allow a realistic assessment of their effectiveness.

Consideration will, however, be given to examples of the various types of structures which are presently in use, and relevant assessments offered.

(i) <u>Research Centres</u>

This structure and its variants appears to be one of the most effective methods of identifying institutional technology and arranging for its subsequent transfer.

Some centres have been specifically set up to deal with the needs of Industry, as can be seen in the establishment of the National Microelectronics Research Centre at University College, Cork.

The electronics sector in Ireland is one of the most important for the wellbeing of the Irish economy. The Centre is an excellent example of a research centre which is identifying and developing college expertise and technology whilst at the same time giving the electronics industry direct access to a bank of product opportunities, workshop facilities for prototype production, and technical advice on product development.

There appears to be a need for ongoing identification of the present and future areas of "excellence" throughout the H.E. Sector so that the establishment of centres of a similar nature can be considered. This could be carried out as a continuation of the well presented and received NBST Programme on Strategic Research.

The Research Centre appears to be the most suitable vehicle to undertake an academic non-profit service. If this service becomes very popular, with an increasing turnover, consideration could be given to the utilisation of a more commercial entity, such as a company, for the purpose of developing the commercial interests of the Centre, and carrying out its marketing.

The decision to establish a non-profit Research Centre does not however obviate the need to have its development properly planned. This should entail the production of a "business" plan, including a budget and autonomous administration. Definite policies should be agreed at the outset about the obtaining of any financial self-sufficiency, and the need to ensure that any monies surplus to running requirements should basically be used only for the Centre's purposes, and for future development.

If the ownership of any intellectual property generated by staff of the Centre belongs to the institution, great care must be taken to ensure that the policies regarding reward to inventors is such that it would prove a definite incentive for the generation of further "ideas".

One role which Research Centres could play in assisting the development of the national economy would be to establish themselves as advisors to Industry on their R&D requirements.

Academic experience could be very pertinent to the needs of Industry in such areas as, advice on raw materials evaluation, equipment evaluation, laboratory start ups and procedures, various production problems, staff requirements and training.

This role could lead to establishing lasting links with industrial partners.

(ii) <u>University - Industry Centres</u>

A Centre whose basic objects were :

(a) to provide a focal point for the interface required to establish links with indigenous Irish Industry and deal with its special needs,

(b) assisting in the development of applied research to solve the technological problems of industry in Ireland,

(c) to initiate R&D studies in certain areas, and arrange for any subsequent commercial exploitation

was opened on the campus of University College, Dublin at the end of 1985. Due to staff changes and the time taken for the consideration of future plans, the work carried out at the Centre in 1986 has been limited and it was not possible to carry out an assessment of its effectiveness.

The development of this structure should, however, be directly encouraged and its progress monitored to ascertain its usefulness in the transfer of the College's technology. Also the collaboration which will be necessary with the Industrial Liaison function in the institution should be carefully considered to ensure that there is a coordinated and optimum use of scarce resources.

(iii) <u>The utilisation of the limited liability company</u>

The increasing utilisation of the company structure in the H.E. Sector for the transfer of technology can be noted in three distinct applications. These are discussed consecutively, starting with:

* <u>The company on campus, in which the institution holds shares</u>

The funding policies of certain Government Agencies have led to the establishment of companies on campus to enable available technology to be placed on the market.

The company structure is apparently seen by the funding bodies as being the vehicle most suited for the minimisation of the risks inherent in investments to provide technology transfer.

Two examples of this structure can be seen in Cork. The first to be incorporated being Plant Biotechnology (UCC) Ltd which was set up in 1983 to commercialise the research expertise of the University's Department of Botany. It is providing services in micro-propagation procedures, production of new varieties by non-conventional techniques and is also developing consumer products related to their services.

The second example is the incorporation of a company at the Cork Regional Technical College called Tekscan Ltd which is engaged in the manufacture and sale of microscopes for surface analysis and of materials, based on photo electronic acoustic thermal wave.

Government funding of institutional companies is facilitating their incorporation, and is following a similar pattern to that in the U.K. and the U.S. The future importance of this structure has been recognised by the NBST which has recently arranged a seminar on the company as a vehicle for technology transfer in the H.E. Sector.

Although this form of development is very much welcomed by those involved, it has to be noted that the incorporation of a company, within the academic environment, has definite and specific problems to overcome.

There must therefore be a thorough evaluation and definition of the objects of the company. The administration of the company must also be very carefully considered, in particular the role of academic staff. A comprehensive business plan must be prepared and approved by all parties before the company commences business.

The relationship with the institution must also be very clearly defined and well established lines of communication introduced.

* <u>Companies on campus with the institution's permission</u>

A description, in a book published in 1983, of the development of this structure as utilised in the U.S. indicates its importance to beneficial academic technology transfer.

> "Starting as technical consultancies, they pass through several stages of development during which their original academic expertise is honed down, first to analytical routine and possibly then into a testing and design service before they eventually reach the point where they become manufacturers of a standardised product. Until this final stage, work is undertaken on a bespoke contract basis for special clients, usually lasting for some time, rather than being produced "on spec". This pattern of development can be described as the hardening process, starting with a "soft" company, selling highly analysed technical solutions for specific problems, and ending with fully "hard" companies selling standardised and relatively simple products to the market". (1)

"Soft" companies are normally located on campus or adjacent to it. The need to nurture this type of structure has long been recognised in the U.S., and is the base from which the development of companies in the Boston area and also in the Santa Clara or "Silicon" Valley of Northern California, already noted in Part II.

A typical example in Ireland is <u>Environmental Resources Analysis Ltd</u>, established in 1984 to carry on research work originating in the Department of Geology at Trinity College.

The originator of this development is the Chief Executive of the Company, and still retains his post as an Associate Professor in the Department.

The Department assists the company through a Research Group which advises on the development of the company's businesss namely, remote sensing by satellite and image processing.

Both Trinity College and the company have well defined their relationship, which appears to be on an excellent basis. One of the beneficial reasons for strong links being maintained is the company's possible future role in a National Centre for Remote Sensing. No figures were available to show the profitability of the Company.

The success of a structure of this nature on or very near to the campus, is one of the most viable ways of producing the entrepreneurial spirit within Faculty. It also provides a visual testimony of the practical utilisation of the institutions expertise which can be understood and appreciated by both Industry and the public.

With the close proximity of an academic and a commercial structure, however, clear and understood guidelines covering all areas of interaction must be prepared and approved both in a business plan prepared by the company and coordinating guidelines established by the institution.

Should the company wish to remain on the campus then commercial rates for all facilities supplied should be agreed. Thresholds should also be fixed to ensure the Company's proper commercial development.

The institution should be represented on the Board or a representative, such as the Industrial Liaison Officer, attend Board meetings by invitation, and regular sets of accounts of the Company, made available to the institution.

* <u>Companies situated off the campus, but with direct links to the institution</u>

These companies are normally referred to as "spin-off" or "spin-out" companies, these words being used to describe the relationship that the promotors had with an institution immediately before the company's incorporation. A relationship which allowed a product, process or services evolved in a institution to be "spun off" in to the market through the Company's development.

As the bulk of the R&D is normally carried out in the institution, the company is able to carry out early production and marketing.

The development of these companies in Ireland during the period 1974-84 was the subject of an academic thesis which contains the following details:

* "Five companies have been set up by college staff arising from R&D projects. Three companies are manufacturing products; two offer services based on advanced technology. At present, two of the companies are availing of on-campus facilities. In all cases the research leader(s) or co-investigators are involved. To-date two of the five companies have been very sucessful and now employ 30-50 skilled staff;

* "Two companies which were set up by post-graduate students in research groups did not derive from R&D projects;

* "In one case, a company employee who was transferred to the college for the duration of the R&D work subsequently set up an engineering consultancy practice".(2)

Although other examples of spin-off companies have been incorporated in Ireland in the past two years the above details sets out the basic background to the establishing of these companies.

The links with the institution normally occur in three ways:

* The licensing of the institution's intellectual property to the company.
* The utilisation of the institution's staff and facilities by the company.
* The investment by the institution in the company's share capital.

(f) Other structures, both on and off the campus

(i) Project/Product Development Centre

There is apparently only one example of this type of structure which was established by the City of Dublin Vocational Education Committee (VEC) in 1983.

The Centre provides a working environment for the utilisation of the facilities of the Dublin Institute of Technology together with the assistance of relevant staff, to help graduates to develop projects/products which had started when they were students.

Through this assistance it is hoped that the graduates will be able to develop their ideas into commercial reality and also create employment.

The Centre provides a pre-feasibility study facility and all projects must pass the Industrial Development Authorities grant aid criteria, i.e. manufacture of a product with export or import substitution potential.

By the beginning of 1986, 30 innovators had passed through the Centre which is under the direct supervision of the City of Dublin VEC's Industrial Liaison Officer.

(ii) Innovation Centres

The only established example of a Centre of this nature, set up to provide the innovative background for the identification and development of institutional and other technology is situated on the Plessey Technological Park, adjacent to the NIHE, Limerick. It is owned and managed by the Shannon Free Airport Development Company Ltd.

The links between the Company and the institution are extremely close, but there does not appear to have been the expected utilisation of the well set up facilities of the Centre, by the members of the institution. Comment has been made that this may be due to the fact that the Centre is not an integral part of the institution and is physically divorced from it. There does not appear to have been to-date, a concerted attempt to develop academic technology transfer through the Centre, although it employs staff with relevant experience.

The establishment of other Innovation Centres within the H.E. Sector is under active consideration at present.

(iii) Incubation Centres

These Centres provide the physical needs for the gestation period required to bring innovative technology fully on to the market place.

The Incubation Centre, established by the I.D.A. on the University College, Galway campus has six units offering all the required facilities, and also direct access to College expertise and facilities. The establishment of other similar structures is being considered at Trinity College and University College, Dublin.

There is normally a relatively high failure rate of the businesses in a Centre of this nature, and the institutions should therefore ensure that strict accounting is maintained for their services. The institution's name should not be tied too closely to that of the Centre if only the institution's expertise and facilities are being supplied on a commercial basis.

(iv) Industrial, Technology, Research or Service Parks

At present none of the institutions in the H.E. Sector have themselves established a Park although there are again very close links between the NIHE Limerick and the Plessey Technological Park situated on the campus.

It would appear, however, that no spin-off companies from the institution are presently established on the Park, although one such company had been situated there, and other similar companies are apparently now considering leasing premises.

(v) <u>Higher Education Directors of External Liaison (HEDEL)</u>

Both in Ireland, and in the UK, bodies representing the I.L.O's have been established for some years, such as HEDEL. Many of the members of HEDEL are members of the UK association - University Directors of Industrial Liaison (UDILs).

This association has been formed to promote, develop and coordinate the H.E. Sector interface in Ireland. To carry out its aims it holds regular meetings for the discussion of relevant matters such as the terms of contracts with Industry, policies and procedures for intellectual property, data bases etc. At these meetings representatives of the NBST and IIRS are also present thus forming a direct link with some of the main government agencies assisting cooperation.

The association's three main purposes have been defined as:-

* Education - including the identificaton of the training needs of industry, student placement and employment

* Research and Consultancy - including the promotion of cooperative research and research administration

* Information - including the promotion of the internal and external appreciation of the need for cooperation.

HEDEL also includes the representatives of the two Universities in Northern Ireland and representatives of the non-University I.L.O's in the Republic. A most useful network has therefore been established not only between the two adjacent countries, but also beween academe and Government, providing a useful forum for the passing of practical information and advice.

To-date however, no training of I.L.O's has been undertaken by HEDEL and the opportunity of providing advisory "manuals", setting out the actual problems faced in the establishment and development of policies, procedures and structures experienced by members, supplemented with the relevant documentation, has not been undertaken.

As will be seen, in this Part, from the details supplied by way of a Questionnaire, there are several experienced I.L.O's in Ireland. However, the valuable, factual experiences they have undergone have not to-date been properly recorded for the benefit of others.

The NBST has already established itself as one of the most active and foresighted Government bodies in the Community dealing with institutional/industry cooperation, and the production of publications of this nature by them, appears to be a desired follow on from the terms of the two Reports they commissioned in 1985 and 1986.

A copy of the HEDEL objects and policy is annexed as Appendix No.8.

* * *

2. UNITED KINGDOM (U.K.)

(a) Institutional Objectives

Many of the institutions in the U.K.'s H.E. Sector have to-date not published clear and defined objectives, setting out their specific aims, and the strategy to be followed, in developing beneficial cooperation with Industry.

As in Ireland, the approach of Government has been a broad acceptance and encouragement of the need for links between Industry and higher education: "business should aim to take advantage of what higher education has to offer through research, technology transfer, business start-up facilities and consultancy. Higher education too stands to gain from this involvement : staff can gain breadth and expertise, can keep up-to-date with latest developments in industry and can enhance their earnings". (1)

However, no objectives and strategy have been published by Government which could provide guidelines for institutions. Each institution is therefore free to formulate its own approach to cooperation. Unfortunately few institutions appear to have taken this opportunity to chart their own cooperation with Industry, and to approach their future developments in a pragmatic and planned way.

Some institutions have employed management and other consultants to advise them on how to approach their links with Industry. Comments, however, have been received that the consultants preparing the reports had no personal experience of institution/industry cooperation, and that some of the unique problems involved in this cooperation, had therefore not been appreciated and properly addressed.

There would appear to be a shortage of outside expertise available to institutions, and other relevant bodies from persons who have any actual, experience in dealing, not only with general cooperation, but also with technology transfer in the H.E. Sector.

As the realisation of the important role that institution/industry cooperation, particularly technology transfer, can play in the nation's economic survival increases, more expert advice will be called for in planning future developments. Academe is often criticised for providing only a theoretical approach, not a practical approach, to problems and therefore not being able to provide the needed solutions. It is to be hoped that this criticism is remembered in implementing the required planned development of cooperation and technology transfer.

As in Ireland, the lack of published objectives in some institutions appears to stem from the fact that they have not undertaken an audit and proper assessment of the actual resources they possess which could be offered to Industry, and the means available to develop these resources beneficially.

Without a proper assessment, not only can the required structures needed for development of resources, be properly identified, but also the several problems which normally arise from cooperation can not be properly tackled at the correct time. The place of basic research, the need to publish, and the need for establishing direct and recognised links with the relevant Departments, are some matters that a planned approach would identify and deal with at the outset. Not when problems have arisen during cooperation, causing even greater difficulties to the parties, often embarrassment, and loss of prestige to the institution. Academic courses would not be introduced without the required consultation and planning. The same approach is essential for cooperation with Industry.

Government is encouraging institutions to deal with portions of society who have their own peculiar interests, their own differing goals, and who approach the development of these interests and goals in a planned and practical manner. It is prudent therefore that the institutions are able to respond in a similar way, in particular to ensure that they are not placed at a disadvantage in their negotiations and relationships.

It would therefore be useful for institutions, which have not already done so, to carry out an audit and assessment of all the resources they possess, both in technical and non-technical disciplines; once completed the objectives which will be needed to carry out the development of their resources can be properly identified, the internal policies and procedures agreed, the required structures established and the needed staff employed, or the present staff trained to supply the expertise required, if it is lacking.

<u>Some of the impediments to the introduction of the needed objectives have been identified during the compilation of this Report. They are</u>:

(i) There are still several institutions unable to agree that acceptable work for Industry, and commercially viable intellectual property which is produced by their staff, are matters which should be taken into consideration in assessing academic standing and promotion. The policy on this vital matter is one which requires clear definition and regular publication. Staff must know exactly where they stand, and what rewards (or penalties) they face when they participate in cooperation.

(ii) It would also appear that only "lip service" is being paid to the concept of cooperation with Industry in some institutions, and that some administrtive staff are perhaps concerned about the effect of commercial disciplines being introduced parallel to present academic structures through, for example, the establishment of an institutional company.

This problem was recognised in a comprehensive study on the Scottish institutions in 1983 "Whilst in the main Principals (Vice-Chancellors) give firm support to industrial liaison and interaction, this is not necessarily mirrored throughout their organisation, either amongst all academic staff, or just as important administrative and support staff." (2)

(iii) There still appears to be an ignorance of what cooperation and technology transfer can do for an institution in the most influential circles of academe. It has been very noticeable that, where the background of a Senior Officer, or Officers of an institution, has provided a practical knowledge and appreciation of the actual benefits which could be derived from cooperation, that institution had established far stronger, and more beneficial links with Industry, than other institutions with Officers who have followed specialist academic careers.

(iv) The suspicion with which some academics, already having their own well established cooperative ventures, view the introduction and development of an institutional programme, and the apparent jealousy which has been encountered from senior staff when a cooperative programme with Industry has been "too successful" - these are matters which have also been raised during the compilation of this Study. It would appear that there is some substance to the above statements, and these attitudes have obviously been direct impediments to the generation of beneficial, and strong institutional links with Industry.

These are also problems which could all be obviated, or at least ameliorated, by consultation on, a clear understanding of, and finally, the introduction of the required objectives and policies for cooperation with Industry within an institution.

(b) Policies and procedures for staff consultancy

With very few exceptions, all the institutions have introduced policies and procedures allowing their staff to carry out consultancies with Industry and other relevant Sectors.

Most institutions require some form of reporting by its staff of "outside" work undertaken. This is a very important source of information in developing cooperation with Industry. It provides up-to-date data on the actual expertise available within an institution which can be marketed on behalf of the staff, and the institution. In many cases a person's research interests may not reflect his or her consultancy expertise, and correct and current knowledge is essential in presenting academic expertise to the public.

A form of reporting is also necessary to ensure that the work being carried out is compatible with the research interests and standing of the staff concerned.

The remuneration received by staff, where institutional facilities are utilised vary in individual institutions. Some ignore annual consultancy fees below a certain figure, and many institutions deal with these earnings on a consultancy to consultancy basis. The amounts to be paid to the relevant Department and the institution, being agreed on equitable terms to reflect the "back up" received, central funds therefore do not normally appear to benefit to any great extent. Costs are clearly defined and agreed.

There are still some institutions dealing with consultancy income on a varying percentage basis, but this practice seems to be declining in favour of a consultancy-to-consultancy approach.

With very few exceptions, members of staff who undertake consultancies where no institutional facilities are utilised, and the consultancy has not interfered with academic duties, are allowed to retain the relevant fees in full.

Advice would however appear to be required from time to time on the fees which can be charged for consultancy and the actual disbursements and overheads which should be included when rendering a note of charges to clients.

There are limits to the time that can be spent on consultancy within certain periods, in some institutions. Again there are great variations on this restriction between the various institutions.

The trend in the U.K., however, appears to be following Government's encouragement to consult with Industry and financially benefit therefrom. Consultancies would therefore appear to have increased, particularly over the last five years. Most institutions have been accommodating their staff in this development as long as it has not an adverse effect on the consultant's academic duties, and, in particular, the work load of other members of their Department.

In view of the apparent increase in the number of consultancies, and the fact that some of the relevant policies and procedures have not been reviewed for several years, there may be a need for some institutions to consider if their present policies and procedures are as equitable as desired, directly encouraging staff to better their teaching and research interests, through this interface with Industry.

In reviewing their present policies and procedures, the terms of existing guidelines in similar institutions, both nationally and internationally, should be considered. It is proposed, later in this Study, that this facility could be provided at an EEC level, together with other relevant information on intellectual property and structures.

(c) Policies and procedures on Intellectual Property

An increasing number of institutions have now published policies and procedures to deal with the development of intellectual property, generated within the institution, and the monies which are received by the institution as a result of this work.

In the case of intellectual property generated directly by public funds, the ownership of the property normally belongs to the institution and is subject to the employees' statutory rights. Ownership of intellectual property arising from other funds would depend on the terms of that funding contract.

The Patents Act of 1977 defines the basic rights of an employee/inventor. The employer (the institution) is registered as the owner of a Patent, and the employee or employees, as the inventors.

After the Second World War, to stem the industrial decline which the U.K. had been facing since the last quarter of the nineteenth century, the Government wished to improve scientific and technical education, and also to improve the transfer of technology from the H.E. Sector in to Industry.

The National Research Development Corporation (NRDC) was therefore established in 1949 to develop beneficially research results, generated in the H.E. Sector, and Research Establishments, which had been funded by public funds. The institution had to inform the Corporation if a patentable invention had developed.

NRDC was given a statutory right to exercise an option allowing it to take an assignment of any patentable idea within six months of its notification. If the assignment was exercised an agreement was entered into with the institution and the inventors as to the division of the net income, after NRDC had paid its expenses.

Subsequently the NRDC was merged, in 1980, with the National Enterprise Board (NEB) and a new organisation, the British Technology Group (BTG), was formed in 1981.

Up to 1982, NRDC had handled over 20,000 offers of inventions from public sector resources, including the H.E. Sector; of these offers, 7,000 had been accepted. About 1,000 offers had become revenue earning inventions, but very few had ever earned significant royalties for NRDC, the employers, and the inventors. The amount received in royalty was apparently in the region of 156m, mainly coming from two or three inventions.

Over the years, however, there was mounting criticism, particularly from the H.E. Sector, of the work of NRDC. Charges were made that it had become too remote and complacent due to the substantial sums which it was collecting from one or two inventions such as cephalosporin antibiotics and the hovercraft. This allowed NRDC to live on the income of these inventions. Its marketing policy had therefore not been aggressive enough, nor apparently had its licensing policy. The needed entrepreneurial spirit appeared to be lacking.

It is interesting to note that these complaints are basically the same as the complaints levelled by the H.E. Sector in the U.S. against such bodies as the Research Corporation, who have now established an office in the U.K., and also in France against ANVAR.

In September 1983 the Prime Minister announced that the NRDC/BTG right of first refusal to inventions funded by public monies in the H.E. Sector was to be removed. This, however, did not actually take place until the end of 1985.

The new role of BTG is seen as assisting the translation into commercial products of new research ideas, particularly those from the public sector where the Government is the ultimate owner of the intellectual and industrial property. In particular BTG is to bridge the transitional phase between a research idea emerging from an institution, and its commercial exploitation.

To carry out its new role, BTG will enter in to agreements wth the owners and inventors, whereby it retains 50% of the income generated, after the expenses it has incurred, in the development of the invention have been paid.

In 1985, the Science and Engineering Research Council (SERC) wrote to all the Universities on behalf of the Research Councils asking them if they would wish to assume the rights and responsibilities relating to the exploitation of inventions arising from work funded by the Councils. A similar letter dealing with inventions arising in the Polytechnics and Central Institutions was issued in 1986.

The majority of the institutions, in the H.E. Sector, have now confirmed that they would wish to assume these rights and responsibilities. The SERC has evaluated the policies and procedures in the individual institutions and has now given its approval to the majority of institutions who applied. Annual Reports on the actual exploitation of the relevant inventions will be forwarded to the SERC from Septeber 1987 onwards by the approved institutions.

The main criteria for approval was apparently not the professional ability of the institution to protect and develop the invention, but its support to the staff in this activity, in particular that equitable terms had been agreed for the division of any monies received.

Although some institutions have established central offices which *inter alia* deal with intellectual property, most however do not have the trained staff to deal with this property, and many have therefore had to enter in to non-exclusive arrangements with BTG and the Research Corporation.

There appears however to be a growing feeling that the previous complaints regarding NRDC/BTG are still valid, and that the required advice and facilities should be provided locally through a consortium of professional experts. This would enable institutions to have regular and direct contact with their advisors, who should therefore have a more personal appreciation of the individual problems and needs of their clients.

Proposals of this nature have already been acted upon in some areas, and have led to the setting up of companies in Manchester and Newcastle. The same developments appear to be occurring in the U.S.

With the passing of the Further Education Act 1985 allowing Polytechnics to set up their own companies, Government has now given all the institutions the basic legal rights that are needed for the development of their intellectual property. It also means that the onus has now passed to the institutions, who will have to deal with the development of innovation more professionally than some have done to-date.

From its approach to the development of intellectual property in institutions, the Government clearly expects that the new arrangements will directly lead to an increase in the number of inventions exploited in institutions, and that institutions must ensure proper exploitation. If this expectation is not realised, then the "utility value of research could be questioned."

Outstanding problems

As a result of the SERC exercise the majority of institutions would appear to have, in place, policies and procedures which can deal basically with the rewards that can be derived from exploitation of intellectual property. Most of the institutions have a sliding scale of payments - reducing the inventor's share as income increases. However, if it is expected that the new arrangements will increase the number of inventions, no consideration appears to have been given to the following basic problems:

(i) There appears to be at present a lack of knowledge in institutions of the meaning and application of Intellectual Property Rights (IPRS), which in this context are the rights resulting from intellectual activity in the scientific and technical fields. There is therefore the resulting unawareness of the benefits that these rights can bring to the individual, the institution, and the national economy.

The Patent Office has now produced a video dealing with the background to the development of intellectual property, and speakers from this Office can be made available to institutions to give talks of a general nature. There would however still appear to be a definite need to train I.L.O's, and relevant research staff, on the identification, and development of Intellectual Property, so that regular and up-dated lectures can be given to both relevant staff, and students.

(ii) The establishment and maintenance of the correct structure to carry out early identification, full protection and ensure beneficial exploitation. Without defining the objectives of the institution, the required structures can not be properly identified.

(iii) "A commercially viable patent can disseminate knowledge for the public good, just as effectively as an academic paper of merit." Work of this nature should therefore be recognised as an element in academic recognition and promotion, this recognition would help to establish the required environment.

(iv) The SERC survey apparently brought to light the fact that - "a number of academics were not interested in following their research through to exploitation".

To ensure that the national economy obtains the maximum benefit from the flow of academic science and technology to Industry, it will be essential to establish the correct environment in institutions which will generate and maintain this flow. This task should be one of the main duties of an I.L.O.

(d) Structures utilised for general cooperation

(i) Liaison Committees

The questionnaire which was forwarded to all relevant institutions, indicates that the majority have established internal "committees", including company boards, which are directly responsible for, or concerned with, cooperation with Industry.

The composition of the membership of these "committees", however, varies considerably, and in many cases industrial representation is still minimal, or absent all together.

It is suggested that to forge the first link in the chain leading to beneficial cooperation, that committees, where presently absent, should be established when the objectives of the institutions have been identified and decided.

All committees should have the optimum number of members from Industry, Commerce and the Professions with the Chairmanship held by a non-academic. Direct lines of communication should be established and maintained with the

Governing Body of the institution. It has been noted, on several occasions, that problems have arisen which could have apparently been quickly and successfully dealt with, if the committee had been able to express its unadulterated opinions directly to the Governing Body.

It is also suggested that Government should review the composition of statutory Governing Bodies of institutions, to satisfy itself that they actually reflect the advisory expertise required to assist the institution in fulfilling its present role in society, and in establishing its true position in the nation's economy.

(ii) Industrial Liaison Bureau (ILB)

These were, in the 1960's and 70's, together with Industrial Liaison Centres, the principal structures utilised in the UK to develop cooperation. Some were funded initially by the UGC or the Wolfson Foundation. There is at present no direct governmental funding of any internal liaison structure in institutions.

Originally these structures were basically to provide a "window" in to the institution, whose primary purpose was to show the commercial relevance of research and teaching. Thereafter to put the two interested parties, the academic and the industrialist, in touch with one another, then stand back and allow the relationship to develop. The I.L.B's services would only be necessary thereafter, if called upon, in a facilitating role. The I.L.B. at Oxford University appears to be a structure of this nature, where relationships have to-date developed through more informal than formal methods.

During the compilation of this Study it was noted, however, that there has been a definite change of approach in these structures particularly over the last five years as can be seen from the duties recently set down for the I.L.Os in charge of ILB's in that these I.L.Os are now required to have the following common skills:

* The establishing and maintaining of data bases for internal and external utilisation, resulting in the production of relevant publications.

* Advise on and negotiate contracts

* Advise on intellectual property, including licencing and "related matters"

* Advise on sources of funding

* The coordination of financial, legal and other necessary expertise

* The holding of conferences and seminars involving Industry.

As the services required by academic staff cooperating with Industry become more and more sophisticated, the supply of many of these services is apparently moving from institutional administration, to the I.L.O., as the person nearest to the problems.

Since the UGC's financial cuts involving institutional funding in 1981/82 the ILB's have also had to market their services in a more professional manner. As the original funding sources have now ceased, many of the ILB's have been forced to become self-financing.

A 1985 Special Report by the Economist Intelligence Unit, in considering the work of ILB's commented: "Judging by the continued level of concern in the public reports of recent years, they have not in general been very successful in changing attitudes on either side of the divide, or in increasing technology transfer." (3)

This comment does not, however, mention the direct role that many ILB's have played in strengthening their institutions links with Industry, but it does highlight two major problems that have to be dealt with, not only in the UK but throughout the Community, namely bridging the attitudinal gaps that exist between both academe and Industry, also, the need to understand, and appreciate the benefits derived from intellectual property.

The work undertaken by a Bureau has now become basically the same as an Industrial Liaison Centre.

(iii) Industrial Liaison Centres (I.L.C's)

These are the Centres, mainly set up in Polytechnics and Scottish Central Institutions under the then Ministry of Technology Scheme mentioned in Part II.

The Scheme was established to assist SMEs, particularly in the manufacturing sector to improve their efficiency and technological strength. Although the Scheme was disbanded in 1973, the ILCs that survived have continued to carry out the basic objectives of the Scheme.

I.L.Os have continued to call personally upon local companies to advise them on the sources of academic, technical, and financial assistance available to them, and which are applicable to their specific needs. The Officers concerned must therefore be aware, not only of the needs of Industry, but also have the ability to correctly assess an institution, as to its actual usefulness to local companies.

As apparently only 20% of management in the UK have obtained qualifications in the H.E. Sector, there is still a strong image of the academic "ivory tower" in the SMEs which requires to be overcome by the work of the I.L.Os.

The original objects of an I.L.C. have now been expanded, in many institutions, to deal with short courses, training at all levels, and sandwich training placements.

Direct links are still maintained with D.T.I. Regional Offices allowing the I.L.O. to be updated on all the Department's new schemes available to assist Industry. Visits to Centres of excellence, Research Associations, trade fairs etc, are also organised by the DTI.

From enquiries it would appear that some of the I.L.C's have provided a most valued service in their areas. This has been particularly appreciated by SME's during the economic problems faced by the UK since 1973, the year the Scheme was officially disbanded by Government.

Although some of the more "glamorous" projects in the Universities may have claimed the headlines in the press over the past years, the work of the non-University I.L.Cs has been forging and maintaining strong and lasting links with Industry, making it one of the most directly beneficial liaison functions in the H.E. Sector.

The effectiveness of the work of I.L.Os in both previously mentioned structures, has, as already noted, been criticised from time to time in recent Reports and articles. Remarks such as "not always enjoying the esteem of their academic colleagues" are not unfrequently published, and, during the course of this Study references to the "parasitical" role of the post were made on more than one occasion.

It would appear that whilst some I.L.O's may not have performed for their institutions as expected such criticisms must be viewed against the present background where institutions: -

* have not considered their objectives for cooperation and have therefore not been able to properly define the role and duties of an I.L.O.

* have not provided the needed environment for staff participation in cooperative ventures

* have not given the I.L.O. the status required for the implementation of his duties

* have not consulted with the I.L.O. before the implementation of programmes, in which these Officers will be directly involved.

The reasons for some of these attitudes would appear to be tied to the present lack of expertise and experience of some I.L.Os, applicable to aspects of their duties, particularly technology transfer. Without ensuring that the relevant staff have had the opportunity of obtaining the required training, to provide them with the necessary credibility and authority, such criticisms would appear to be somewhat unfair and injust.

There are now several structures in institutions which combine some of the objects of both ILBs and ILCs as set out above.

(iv) Consortia

The optimum use of academic resources by combining the expertise of several institutions has seen the establishment of several Consortia in the U.K. over the past five years.

One example of this structure is the Coventry Consortium consisting of the University of Warwick, Coventry Lanchester Polytechnic, Coventry Technical College, and two Colleges of Further Education.

The Consortium provides "the professional service which links commerce and industry to the research, consultancy, development, design and training expertise of academic institutions."

The consultancy expertise covers such matters as feasibility studies, product design and development, prototype making, technical problem solving and management advisory techniques.

Facilities which are available include - metrology equipment; CAD facilities including stress analysis and finite element modelling; electron microscopes; mainframe and micro computers; product modelling facilities; computer aided circuit design and PCB manufacture, and material testing, including tensile, compression and tension.

Cost effective solutions to the training needs of companies are also one of the main services of the Consortium.

The I.L.O's of the relevant institutions play a major role in the development, and marketing of these services, which also entail regular face to face discussions with clients and potential clients.

(e) Structures assisting technology transfer

(i) Industrial Liaison Programmes

To produce a formal communications channel to its expertise an institution may establish a "Club" open to companies who can join by the payment of a fee, possibly fixed in relation to the company's annual turnover.

For this fee the company obtains the services of an I.L.O. who arranges that access to research results and consultancy expertise be made available to the "club member". The programmes at M.I.T and Stanford in the U.S. establishing this approach, have become internationally known and accepted.

This structure has also been adopted in the UK, and has led to the establishment of Industrial Liaison Programmes, such as the Campaign to Promote the University of Salford (CAMPUS) at Salford in 1981, and the Surrey Network at the University of Surrey in 1984.

Basically both of these Programmes make available the services of relevant Departments and institutional facilities to the members. Information is regularly supplied through "newsletters" and the publicity material produced has been most impressive.

The work of the members of staff in these Programmes is accepted towards academic recognition and promotion. Liaison Officers, attached to members, usually senior academics with interests in relevant areas, pay regular visits and make reports thereon.

CAMPUS has been set up as a Charitable Trust, run by a

Board of Trustees representing Industry and local government, as a totally independent body.

The establishment of CAMPUS arose directly as a result of the 44% cut in grant from the UGC which Salford faced in 1981. Originally the role of CAMPUS was to provide a focus for the campaign to fight these cuts, however, it soon assumed the role of "fostering and strengthening" the links with Industry. The primary aim is now "the advancement of education and learning especially in the basic and applied sciences through the medium of the University of Salford".

The income received by CAMPUS is divided between the University (40%), Reserve funds for long term projects (30%), and the balance earmarked for administration expenses and support for exhibitions etc.

Three interesting features of CAMPUS are : -

* **The Venture and Enterprise Fund**

Researchers in the institution may apply for grants from this fund. These applications are assessed by member companies, ensuring that the work is "better attuned to the requirements and aspirations of CAMPUS member organisations in particular, and to the technological world in general."

* **The establishment of Integrated Chairs**

The Professors appointed under this scheme through CAMPUS have "substantial academic responsibilities at the University, and also hold senior managerial roles in their own organisations, so creating the kind of close link between industry, commerce and the University that CAMPUS seeks to promote".

*   Links with alumni

Salford University is one of the few institutions in the UK which appears to be making direct utilisation of one of its main links in Industry, namely its graduates. Individual membership of CAMPUS is open to alumni for a fixed annual fee, allowing them to keep in direct touch with ongoing developments and the institution.

(ii) Research Centres

It has been found that in some cases the normal institutional approach to highly specialised, interdisciplinary research, has not been sufficient to meet present day needs.

This problem has led to the establishment of several "Centres" throughout the UK dealing with a wide range of subjects.

Some of these Centres have been funded wholly or partially by Industry, others by SERC or from charitable funds, such as Wolfson. They are involved in both basic and applied research projects. The development of Centres has, in many institutions, been assisted by the work of the I.L.O.

The number of Centres has been steadily increasing over the past ten years, and their interests range from - Engineering Applications at Strathclyde; Robotics at Imperial; Biocentre at Leicester; Industrial Research at Warwick; Medicine at Bath; Bioengineering at Brunel; Automation at Queens, Belfast; to Biotechnology at Cranfield.

Centres involving more than one institution, such as Marinetech Northwest established at the University of

Manchester providing access to the marine technology capability of the Universities of Liverpool, Manchester and Salford, the University College of North Wales (Bangor), and the University of Manchester Institute of Science and Technology (UMIST), are a logical development of this type of structure.

A further development of this nature was publicised at the end of April this year, when the government announced a reorganization of its support for research and development through the launching of a Centre for the Exploitation of Science and Technology, likely to be based on the campus of Warwick University.

The apparent aims of this Centre will be: -

* "To identify future developments in world markets
* Explore opportunities offered by new advances in science and technology
* Guide the national R&D effort
* Stimulate the exploitation of science and technology for the benefit of the national economy" (4)

(iii) The utilisation of the limited liability company

(a) Wholly or majority owned institutional companies

Although Industrial Liaison Units were the most utilised structure for cooperation with Industry, up till the beginning of this decade the structure now being increasingly utilised for cooperation, in particular technology transfer, in the 80's, has been the limited liability company, or group of Companies. The reasons for the utilisation of companies were considered in an article, published in 1985, and based on developments at the University of Aberdeen (5).

Over 20 institutional companies have been incorporated in Britain over the past years. The trend is now to the incorporation of companies who will actively market the resources of their institution, with an increasing multi-disciplinary approach. The separateness and flexibility of the company structure allows the introduction of a commercial approach which is needed for beneficial development of cooperation, particularly technology transfer, and which apparently can not be presently supplied by academic administration. The structure also allows for direct participation of professional partners who could not otherwise deal with academe in such a direct and active manner. Examples include:

* <u>Vuman Ltd.</u>

A wholly owned company of the Victoria University of Manchester incorporated in 1982 which has established several internal Divisions and also subsidiary companies. The holding company was initially set up to carry out contract R&D with its own directly employed staff.

The computer division of the company became Vuman Computer Systems Ltd in 1984. The other divisions are dealing with robotics, lasers, model analysis and industrial controls.

A second subisidiary company Medeval Ltd was incorporated in 1985 and carries out tests on medicines for drug companies.

The turnover of this group had also exceeded 1,000,000 by 1985.

* <u>Cranfield Research and Development Ltd.</u>

Again formed as a holding company to exploit institutional expertise and technology, this company has set up subsidiaries linked with Departments. These subsidiaries include, Cranfield Precision System Ltd - exploiting products developed in the Unit for Precision Engineering. Cranfield Aeronautical Services Ltd - manufacturing and selling aircraft spares and components. Cranfield Moulded Structures Ltd, manufacturing products from a synthetic granite material, and, Cranfield Data Systems Ltd - producing sophisticated computer software systems.

The annual turnover of this group has now exceeded 2,500,000.

* <u>Aberdeen University Research and Industrial Servies Ltd (AURIS)</u>

A group of institutional Companies established in 1981 and now consisting of a holding Company and six wholly owned subsidiary Companies. The subsidiary Companies offer services ranging from Marine Studies to Computing Services.

The annual turnover is now in the region of 1,200,000.

* <u>Salford University Business Services Ltd.</u>

This company was previously Salford University Industrial Centre Ltd incorporated in 1976, and renamed in 1986. This is probably the largest University owned Company in the U.K.

Initially established to set up commercial contracts between the institution and Industry, the new structure is divided in to three main Divisions.

The Technical Consulting Division offers high quality design, production and advanced manufacturing advice : 20 full time consultants are employed by the Division, backed by the expertise in relevant Departments.

The Business and Computer Services Division incorporates the Manchester Microsystems Centre, and the Business and Technical Advisory Unit, which admnisters the Productivity and Quality Advisory Schemes on behalf of the D.T.I. This Division has been set up basically to assist SMEs in such fields as microsystems.

The Business Development Division deals with technology transfer and commercial exploitation.

The developments at Salford are looked upon as being one of the most interesting examples of cooperation with Industry. As already noted the institution faced a massive 44% cut in grant support in 1981, but due inter alia to the wholehearted support of its Vice-Chancellor, and Government backing in appointing the company as an administrator for DTI and other schemes, this institution in 1984/85 earned 2-3m by industrial work from UK customers, and 700,000 from self financing, special and short courses. This was considerably more than the comparable incomes of any other University in the U.K. in this area.

* City Technology Ltd.

This company is wholly owned by the City University, London and has established an international reputation in the development and manufacture of electrochemical gas sensors since its incorporation in 1976. The company won the Queen's Avard for Technological Achievement in 1982.

The institution decided that it would benefit more directly if it was to develop its intellectual property and manufacture in this area of research, rather than carry out exploitation through licensing. The annual turnover of the company is now in the region of 2m. About 20% of this turnover is spent on further R&D to extend the product range and to produce improvements to meet ever widening applications. About 40% of its products are exported.

The company has established its own autonomy but maintains very close links with the parent institution and provides places for its sandwich students.

* <u>South Western Industrial Research Ltd (SWIRL)</u>

This company incorporated by the University of Bath in December 1970, is one of the oldest existing University Companies. The principal activities of the Company are "to undertake industrial research and development for clients on a contractual basis where this can be done using the University's resources of brain power and equipment, but without interfering with the normal business of the University."

Over the past sixteen years this Company has marketed the services of the institution, generating an annual turnover, now in the region of 300,000. This has provided net annual income to the institution varying from 10,000 to 15,000.

The majority of University Companies incorporated in the lae 60's and early 70's, including SWIRL, were companies limited by guarantee, a vehicle normally utilised for non-profit making ventures.

SWIRL decided to carry out major restructuring in 1986, to increase substantially the level of activity, and has now changed to a normal trading company with the institution as the major shareholder, having invested 100,000 in the equity. The Board is now chaired by an industrialist, with representatives of both the institution and Industry, as fellow directors.

Several other University Companies originally incorporated as limited by guarantee, have also restructured themselves into trading companies with limited liability.

* <u>Impel Ltd</u>

From one of the oldest, to one of the latest institutional companies. This Company commenced operations on the 1st of January 1987. It is a joint venture with Imperial College of Science and Technology (Imperial), Investors in Industry plc (3i) and Research Corporation Ltd (RCL).

Imperial has the majority shareholding (51%), 3i has 44% and RCL 5%.

This company brings together the research programmes of Imperial, the venture capital and management expertise of 3i and the experience in the US of academic technology transfer generated by RCL over the past 70 years. The Board contains representatives of the three partners.

The main objective of Impel is to play an enabling role in arranging commercial exploitation of inventions owned by Imperial. A further objective will be to promote the wider use of the institution's research resources in the following ways: -

* by attempting to increase the amount of commissioned research undertaken at the College including multi-disciplinary projects involving more than one Department;

* by seeking more favourable financial and other terms of work;

* by advertising the availability of facilities at the College for use under contract;

* by assisting in the launch of Industrial Affiliates Clubs with members paying subscription fees in return for information on selected technical topics supplied through seminars and mailshots;

* by maintaining a register of academic, and other research staff who wish to be considered for personal consultancy opportunities which will arise through the promotional activities of Impel;

* by administering, on behalf of the College, entries from its academics in the national database of University research run by Longman Castermill.

The arrangements between the institution and Impel are non-exclusive, allowing the institution to develop its intellectual property and services through any avenue open to it. Impel itself is also free to utilise the services of any other relevant sources of assistance besides 3i and RCL.

* <u>Poly Enterprises Plymouth Ltd</u>

This is a company limited by guarantee and incorporated in 1984 as Plymouth Polytechnics commercial arm and as an independent consultancy operation.

The two major objectives of this Company are:

* To engage in Consultancy, Research and Training

projects relevant to the solution of business problems encountered by commercial and public sector organisations

* To market the specialist resources - technical facilities and staff expertise - of the Polytechnic, and provide project management services.

The Company has undertaken consultancy work covering: production and materials management; marketing strategy and research; scientific and technical testing, and analysis and design.

Research projects have dealt with: ships navigation systems; satellite communication; metrology; antifouling paints, and organic tracers and testing methods.

The Company has also provided training programmes on chemical instrumentation and computer aided engineering.

With the increased generation of commercially applicable research results in Polytechnics in England and Wales, and Central Institutions in Scotland, the fact that some of these institutions had legal problems in protecting their own intellectual property was an obvious impediment to technology transfer.

The Local Government Act 1972 also impeded the setting up of companies by some of these institutions through their Local Education Authority (LEA). Following government policy to encourage developments of this nature, the relevant restrictions have now been removed by the Further Education Act of 1985.

There has therefore been considerable discussion in these institutions on the incorporation of a Company to exploit their resources, including intellectual property.

It would appear that several institutions may be awaiting the result of the forthcoming General Election to ascertain if their relationships with their LEA is to change, before taking the final steps to incorporate their own companies.

b) Companies on the Campus with the institutions permission

The establishment of "soft" companies at UK institutions has also increased very rapidly in the 1980's. Some examples of this method of technology transfer are: -

At Sheffield University, Plant Sciences Ltd, a company concerned with new biotechnological processes that can be developed through licensing out. The funding of the Company comes from the institution, Technical Development Capital Ltd and two Directors, one academic and one from Industry.

Salford has produced two good examples of companies in this category, Vertec Ltd in the Department of Electronics, producing an extensive range of micro computers and compatible interface cards. Also Salford Ultra Fine Chemicals Ltd in the Department of Chemistry, synthesising small amounts of speciality chemical compounds for research laboratories.

Imperial Biotechnology Ltd at Imperial College, London incorporated in 1982 with the institution, Technical Development Capital Ltd and the staff of the Company as shareholders. This Company manufactures and sells high value fermentation products from the pilot fermentation plant set up in the institution.

At Bradford, on the University's Science Park, Bradford

University Software Services Ltd is one of several University companies exploiting high quality computer graphics software.

(c) Companies situated off the Campus, but with direct links to the institution

These are "hard" companies which have physically left the institution but which have retained direct links with its "mother" either through equity participation, staff participation and participation on the Board of Directors.

The number of Companies in this category has increased dramatically over the past ten years and it would be difficult to select individual examples.

The details of the relevant companies whose development has been assisted by the Scottish Development Agency, as set out in Appendix No.7, do indicate the wide range of products and services being placed on the market as a result of institutional research and other expertise.

(d) Other structures, both on and off the Campus

(i) Innovation and Incubation Centres

There appears to have been, in some instances, an amalgamation in the UK of the two structures defined as Innovation Centres and Incubation Centres in the US. Basically the former is to provide the innovative background for the identification and development of technology, the latter should provide the physical needs for the gestation period required to bring innovative technology fully on to the market place.

Some institutions have set up, or are directly associated with Centres, which are only supplying the advice and necessary facilities, these would include the Innovation Development Centre established by Survey University together with Grand Metropolitan on campus. The Centre develops inventions until they are ready for the market through the managerial advice, and financial assistance of Grand Metropolitan.

AURIS, the Aberdeen University holding company was directly responsible for the incorporation of the North of Scotland Innovation Services Ltd. This Company acts as an interface between business and industry in the region and the academic and research institutes, through such services as feasibility studies and project management. The members of the Company include local and regional government, the Scottish Development Agency and the relevant academic and research institutions.

Liverpool University is associated with the Merseyside Innovation Centre which is giving advice, assistance and premises to small firms for hi-tech start-up businesses.

Institutions which are also offering premises for development include the City University Innovation Centre, London, providing technology transfer opportunities.

At St. Andrews University there are individual units available at the Technology Centre to assist the development of new hi-tech companies.

(ii) Industrial, Technology, Research or Science Parks

As in the case of Innovation and Incubation Centres there appears to be some confusion as to the basic function of some of these Parks due to the fact that the descriptive word has been utilised, in many cases, to promote a commercial property speculation, not the transfer of science and technology.

In the US, the N.S.F. refers to these structures as Industrial Parks and this would appear to be the more accurate decription in many Parks in the U.K. as many are either introducing Industry on to the Campus, or facilitating the industrial development of institutional science and technology.

The utilisation of Industrial Parks in the US has only provided a significant stimulus to technology transfer at very few specific institutions, such as Stanford. However, even in these cases, the presence of the Park, in and of itself, apparently did not necessarily strengthen institution/industry research programmes.

As in the US, despite the development of the facility at the Ricarton Research Park on the Heriot-Watt University's campus outside Edinburgh, since the 1960's, followed shortly afterwards by the Science Park established by Trinity College, Cambridge, there has been very little evidence to-date that these structures are the tool for technology transfer, directly benefitting the relevant institution, that the popular press and land developers would have one believe.

In 1985 an independent assessment stated - "University based Science Parks in the UK are not yet significant generators of new employment, and are not occupied by many companies which have emerged from their associated universities. It has to be asked whether Science Parks can be successful embryonic centres for economic development and employment growth in the future". (6)

These doubts have again been echoed more recently by two Reports which have been brought to the public's notice in January and April of this year.

The first was prepared for the Committee of Vice-Chancellors and Principals and the second for the Manpower Services Commission. As reported in the Press both these Reports cast doubt on the significance of "Science" Parks as a directly beneficial element in developing technology transfer.

(e) Associations representing the I.L.O's

In the United kingdom there are three bodies representing the I.L.O's, the first two in the Universty Sector of Higher Edeucation - the University Directors of Industrial Liaison (UDILS) established in 1967, representing all of the UK, and, the Scottish Universities Industrial Liaison Executives (SUILEX) established in 1984, representing the Scottish I.L.O's.

Both these associations have been set up to develop and promote the professional activities of University Industrial Liaison Officers in serving the interests and aspirations of their institutions. All the members of SUILEX are members of UDILS.

Representing the I.L.O's in Polytechnics - the Association of Industrial Liaison Offices was established in 1979. This Association's aims and objectives are: "to promote understanding and collaboration between its members, and between educational establishments and industry, and to keep its members and others informed of current development relevant to industrial liaison work".

These three bodies have regular meetings at which subjects of mutual interest are discussed and talks given on specific subjects. UDILS has over the years issued some practical and very helpful Reports on such matters as Intellectual Property, Costings, Science Parks, Consultancy fees and other matters dealing with practices common to the work of all I.L.O's.

AILO regularly provides most useful information to its members on all aspects of Industrial Liaison, not only in the U.K. but throughout the world.

No formal training has been carried out by any of these bodies to-date but UDILS has recently initiated some in-service training through the running of workshops dealing with Intellectual Property. It has also commenced the holding of Forums on Technology Transfer, throughout the UK, in collaboration with government departments and other interested bodies. These Forums allow the Universities to present to Industry their expertise in certain technologies, such as Electronics.

A copy of the paper on the Role and Functions of UDIL and University Industrial Liaison Services published by UDIL in 1986 is annexed as Appendix No.9.

This is a comprehensive document looking at both the functions of an Industrial Liaison Services Unit, and the duties which arise from these functions.

The perceived functions include: -

(i) Promoting and publicising the institutions facilities and expertise

(ii) Obtaining and negotiating contracts for training, research and consultancy

(iii) Organising beneficial cooperative ventures

(iv) Acting as an initial contact point through which external organisations can contact the relevant part of the institution

(v) Acting as the professional facilitator for cooperation

(vi) Assisting in the protection, and development of the institutions intellectual property

(vii) Representing the institutions industrial liaison interests both locally and nationally

(viii) Assisting local businesses in their development.

UDIL also produce a well presented Directory of the Services of its members. The details in this publication have been of great pratical use to Industry and its 10th edition has just been issued.

It would appear that both UDILS and AILO would directly benefit by closer cooperation, and an increase in the exchange of experiences, on both a formal and informal basis.

* * *

3. FRANCE

(a) Objectives of general cooperation and technology transfer

Of the institutions covered by the survey, as many as 28 out of 31 said they possessed a published policy outlining their objectives for cooperation with Industry. However, in most cases this claim was not backed up in any detailed way. Indeed documentation outlining in detail the official position on cooperation, and more particularly on technology transfer, is not usually available. Often an institution's intentions regarding cooperation take the shape of a mention in a speech of its president rather than form part of a systematic policy.

The absence of clearly-defined and systematically-organised objectives at first seems paradoxical in view of the many forms of cooperation currently linking the H.E. Sector to Industry. These include :

* the participation of business in the conception of certain courses and syllabuses, e.g. via
  - business membership on the boards of HE institutions;
  - sponsorship of chairs in HE institutions by business;

* secondments of representatives of Industry to institutions as teaching staff;

* secondments of teaching staff to Industry;

* student traineeships in companies;

* continuing education for business representatives (either in the form of standardised programmes or custom-designed courses);

* use of university (laboratory) material by Industry;

* university research for Industry;

* university consultancy work for Industry.

Reasons explaining the lack of cleary-defined objectives - be they for the purposes of informing the teaching staff or potential partners in Industry - are various. By and large these reasons take the form of impediments which grow stronger the further one moves down the road from general cooperation towards technology transfer. These obstacles include :

* the absence, in most instances, of any attempt to carry out a systematic audit of the resources of the institution, in particular its technology and know-how, in relation to the potential requirements of business. Without a clear idea of the appropriateness and the transferability of the technology at its disposal, the institution's difficulties in clearly stating its objectives are understandable. Many H.E. institutions do, it is true, provide manuals listing heads of laboratories, contact points, principal research areas and even research results. However, for the purposes of marketing the institution's resources to Industry, these manuals show significantly more knowledge of the resources than of the resources' potential market. In short, there is insufficient identification of the commercially-viable ideas being developed in laboratories. Moreover, the presentation of information in manuals comes in for strong criticism - both from Industry and from liaison personnel - as tending to be both out-of-date and not user-friendly, particularly when the users are SME's.

* the absence, until recently, of any clear statement of government policy establishing cooperation with Industry as an objective for the H.E. Sector. Until the passage of the Savary Law in 1984, there existed widespread doubts, according to the institutions surveyed, as to the permissible extent of their relations with Industry.

* the bias, particularly in universities, against applied research and in favour of fundamental research. This reflects more than just the institutions' traditional preference. Representatives of some major French-based multinational companies contacted for this Study appeared to reinforce this by insisting that universities should stick to cognitive research, albeit if possible of an oriented nature, leaving applied research to the big company laboratories.

* for some institutions, the self-evident nature of the benefits of cooperation, and the clear understanding of these benefits in both Sectors. In institutions outside the state sector, often with close traditional ties with Industry (eg the "écoles" linked with chambers of commerce), clearly stated objectives outlining the benefits and modes of cooperation are often considered unnecessary.

Some qualification is needed regarding the impediments outlined above, since the picture is not uniformly bleak, as a few examples will serve to illustrate. The Ecole Centrale de Lyon, for example, following the advice of the Ministère de l'Education Nationale (MEN) and ANVAR, has been applying a standardised procedure for the detection of laboratory innovations to assess the transfer potential, and to see if, for example, the formation of a university subsidiary might be justified by the results of the audit. In Nancy, PROMOTECH (see also under (c) in this section) has performed an audit for the Institut National Polytechnique de Lorraine, and appears to be a particularly effective link between INPL and SME's. The Université de Compiègne, meanwhile, was set up to provide a bridge with Industry and has, inter alia, gone some way to meet the need of oriented fundamental research - oriented towards areas that Industry judges to be of future interest.

A more general qualification on the audit question is that it is performed relatively widely, but not on a systematic basis. Indeed, the general procedure for the detection of viable ideas for Industry comes typically from the individual professor concerned (eg head of laboratory). He will have his own contacts with business, or he may be assisted in this by the institution's "cellule de valorisation"; he may be more or less aware of the commercial potential of the resources he directly controls, and again he may be helped in this by the "cellule" or liaison unit. However, particularly in institutions where this unit has only been recently introduced, heads of laboratories are often reluctant to accept the interference from central authority that such assistance may imply. This in itself poses one of the key problems faced by the liaison unit official, or I.L.O, when dealing with long established patterns of behaviour.

(b) <u>Policies and procedures for general cooperation and technology transfer</u>

The vast majority of institutions said they had policies and procedures for general cooperation with Industry - eg on matters like continuing education, refresher courses, and affiliation arrangements with companies (whereby the latter are informed about research results). On consultancy contracts - which in some cases may be better classified as technology transfer than examples of general cooperation - a smaller majority said they had policies and procedures.

However, as regards transfer of technology proper, the picture that emerges is different. Only 17 out of 31 indicated they possessed policies on intellectual property rights. And in most cases there appeared to be an even less developed approach to the structures to be used for transferring technology.

i) <u>Policies and procedures for consultancy</u>

Concerning consultancy work carried out by members of the teaching staff 19 out of 31 HE institutions surveyed said they have a policy. This statistic is to be viewed against the fact that consultancy is a widespread feature in the life of the French H.E. Sector.

Policies on consultancy in the state sector, while varying from institution to institution, must all respect the national regulatory framework regarding the exercise of the activity. Generally speaking, a staff member may earn up to between 50% and 100% again of his basic salary level (the "cumul"). There are also nationally-set framework guidelines on the pricing of research contracts (1), on the distribution of fees between the institution and the staff member (2), and on respecting minimum levels of research and teaching duties (3).

Within this general framework, institutions have a degree of flexibility in determining their own policies. By and large, however, authorisations for consultancy contracts must be given by the Head of the institution. This may be accorded either on a "once-and-for-all" basis for a given type of consultancy or may be applied more strictly. However, the general impression gained from the interviews conducted is that teaching staff seeking authorisation generally receive it on a quasi-automatic basis.

So, wherever final authority may lie, it appears that traditionally it is the individual staff member involved in consultancy work, rather than the institution's central administration, who effectively controls the development of consultancy work. This situation may now be subtly changing, as the institution's liaison office (eg its "cellule de valorisation") gradually becomes more involved in providing assistance to staff members, in particular in the drawing up of model consultancy contracts.

Outside consultancy work is by and large not recognised for advancement in a career in the state-run HE Sector. The incentive for undertaking it is thus financial rather than professional.

(ii) <u>Policies and procedures for technology transfer, in particular regarding intellectual property</u>

There appears, on the basis of interviews conducted for this Study, to be few examples of systematic policies and procedures covering the whole range of an institution's technology potential, from the standpoint of its transferability to Industry. An exception is the particular question of intellectual property rights, where a majority of institutions indicated they had developed policies and procedures (see subtitle below in this section).

In particular, institutions seem to have little coherent policy towards the use of various corporate or collective structures for channelling or exploiting institutional technology - eg spin-off companies, participation in science parks, formation of university subsidiaries. This is not to say that initiatives are not taken but that, where they are, it is largely as a result of efforts by individual members of the teaching staff.

In the case of university subsidiaries, the lack of a coordinated approach may be explained by the fact that this legal possibility has only recently existed. Moreover, in the view of many institutions, it is still unclear just what the permissible scope of such companies might be.

Some clarification of the uncertainty concerning university companies appears, however, to have been provided by the authorities in response to a specific request from one of the institutions surveyed. The institution was seeking to see the extent to which it might use a subsidiary for carrying out its liaison and technology transfer functions. According to the institution, the MEN provided it with the following guidelines :

- the institution may not sub-contract to the subsidiary research activity financed by the State;

- the subsidiary may not sign, in the name of the institution, contracts regarding publicly-funded research;

- the subsidiary may conclude contracts with private clients within the scope of its defined activities;

- the subsidiary's activities may include: identification of the institution's commercially-viable ideas; analysis of their commercial potential; ensuring that this potential is presented in an appropriate and transferable form for Industry, in particular SME's.

Intellectual property rights:

With regard to intellectual property rights, 17 out of the 31 institutions surveyed said they had a policy. But the shared background to these institutional policies is complex.

The legal situation on intellectual property rights in France is that where research contracts are carried out with State funding, the property rights belong to the State. However, for research carried out in the normal course of university duties, professors claim that in principle property rights are individual, belonging to the inventor, ie. the professor, in the absence of any specific contract indicating otherwise. But a further complication arises: institutions surveyed claim that they have the right to exploit inventions if they depended on the use of the institutions' equipment for their discovery.

For institutions, intellectual property arrangements usually fall into two types - those with the CNRS or direct with Industry.

If the institution has CNRS laboratories, or CNRS-associated labs, it is the convention between the CNRS and the institution which stipulates the distribution of intellectual rights, and of the revenues accruing from those rights. The share-out of revenues follows standardized CNRS rules (see Appendix No. 12b). Usually CNRS conventions stipulate that the inventor's name should be recognized.

In research contracts with Industry, the policy traditionally followed by institutions has been to cede the patent rights to the industrial partner against remuneration (eg a one-off payment, or payment in kind). Again, nominal attribution would be given to the institution and the inventor.

However, among institutions surveyed, particularly the larger ones, there appears to be growing dissatisfaction with their part of the bargain.

As a result, a trend is emerging for institutions to adopt a more structured approach to intellectual property arrangements with Industry. This has led to their liaison centres (often the "cellules de valorisation") drawing up model contracts on intellectual property. In addition, while there remains a preponderant feeling that the industrial partner is better placed to exploit the patent, institutions are beginning to take out more patents in their own name. Awareness of the benefits of a more systematic approach - both financial and in terms of reputation - is growing.

Institutions seeking to register directly their patent rights may, typically, consult ANVAR for assistance, for example, in patent search. In the case of international patents, CNRS laboratories may benefit from the advice of CNRS' central legal services in Paris, while other institutions say they pay for the services of patent offices.

The most common procedure for an H.E. institution seeking greater control over its own intellectual property right is to register it nationally, which it can do without incurring major costs. This gives it a year in which to find an industrial partner and to negotiate the terms of the patent's exploitation. Several institutions contacted, however, felt that negotiations with potential industrial partners were sometimes prolonged beyond the initial period where their own rights were guaranteed protection.

Institutions are not just using national and international patents to protect their intellectual property rights. Licencing and franchising arrangements have also been mentioned during the course of this Study. However, the patent route is clearly much used.

A particular problem facing institutions in the exploitation of patent rights is the question of the confidentiality of research results. As mentioned in Part II, career advancement of H.E. Sector teaching staff still depends mainly on publicizing the results of their research, and is only to a limited extent favourably influenced by efforts in the field of cooperation with industry (eg patents). There is thus a conflict between the professor's need to publish and Industry's need for confidentiality.

The problem of confidentiality is one which is increasingly being treated in the model contracts being drawn up by the I.L.O. or the director of the "cellule de valorisation". While such contracts may concede the industrial partner's right to exploit the patent, a time-frame is sometimes stipulated beyond which the patent rights revert to the institution.

(c) Structures for cooperation and technology transfer

There are a wide variety of structures for general cooperation and for carrying out technology transfer towards business - some of these structures being agents for both processes. At least until recent years, there has been little explicit governmental action designed to encourage and formalize these structures. As a result (as mentioned in Part II), the situation in France traditionally differs from, for example, that in the UK where industrial liaison units were specifically prompted by public policy in the early 1960's.

However, the position in France has changed significantly with the growth of the "cellules de valorisation" following adoption of the Savary Law (1984), which also created the opportunity for Universities to set up subsidiary companies. As the "cellules" spread, they appear, on the basis of the survey undertaken for this Study, to be rapidly becoming the most utilized structure, for both cooperation and technology transfer, within H.E. institutions.

According to the enquiry conducted for this Study, the "cellules" are the most common form of industrial liaison bureaus or centres in the H.E. institutions surveyed (see also Appendix 16). Of the 30 respondent institutions, 24 indicated they possess industrial liaison units (mainly of the "cellule" type). Other structures mentioned include spin-off companies (eg created by university staff), incubation centres ("pépinières d'entreprise"), technology and science parks, and innovation centres.

Outlined below is a sample list of the structures in use, starting with consideration of the "cellules de valorisation", followed by other structures utilized by H.E. institutions surveyed. Broadly speaking these structures may be divided into those which are internal to the institution (ie. set up within its framework) or external (albeit often with close links to the institution).

i) Cellules de valorisation

As indicated by the Ministry of Education (MEN) (see Appendix No. 10), the "cellules" are a voluntary service (ie. not an obligatory channel for cooperation) which may:

* draft research contracts between the institution and enterprises;

* prepare dossiers to exploit commercially the institution's technology;

* identify the needs of enterprises and detects viable ideas in the laboratories;

* develop proposals to be made to enterprises regarding technology transfer;

* organise the institution's relations with the various regional networks (ANVAR, ARIST, Chambers of Commerce etc);

* assist students' and researchers' mobility (encouraging industrial traineeships and consultancy activities).

The precise tasks undertaken by any individual "cellule" vary from one H.E. institution to another. However, as a general rule, the "cellule" will perform the functions of an industrial liaison bureau or liaison centre (as defined in Part I B). Most of the "cellules" visited in the course of this Study deal also with the transfer of persons from universities to industry (e.g. via the Government's FIRTECH Scheme). In addition, some "cellules" are beginning to consider encouraging their institution to create university companies for the purpose of transferring technology.

With respect to intellectual property, the role of the "cellules" is often determined by arrangements between the institution and the CNRS or the MEN. As already mentioned (in Part II), most institutions have an arrangement with the CNRS or the MEN and thus also with the services of ANVAR. In these cases, the office of the "cellule de valorisation", acts as an information centre between the CNRS/MEN and the laboratories.

If the links of the institution with the CNRS are less strong (or indeed inexistent), the "cellule" has a more important role to play as an advisor on how to proceed regarding intellectual property, and may be more directly involved in the intellectual property protection. Depending on the funds available in the "cellule", patent offices are paid for their services.

The major tasks to be fulfilled by the "cellule" with respect to patents, in this latter case, is to find a partner in business, and to conduct any ensuing negotiations.

The institution may also consider seeking to extend patent rights on an international basis. In this case, the "cellule" usually consults a professional patent office, as the financial implications may be considerable. Usually market research is carried out by an outside consultant before a decision on extending the patent is taken.

ii) Industrial Liaison Centres for relations with SME's

The development of such centres (eg. CEFE, see below) depend essentially on the nature of the business environment in the region where the institution is located. An additional factor in their development is the need to seek alternative resources for the institution in the wake of budgetary cut-backs. Also some centres have been encouraged by regional development plans supported by regional and local authorities.

In some areas of France, regions are making special efforts to increase the potential of local industry and to help its adjustment, and so are encouraged to cooperate with universities through these centres. Among the institutions interviewed, this was especially true for the regions around Lille (Nord - Pas de Calais) and around Metz and Nancy (Lorraine). In Lille, the CEFE (Centrale d'Evaluation et de Faisabilité Economique), which is part of the Université de Lille I, is fulfilling the specific function of liaison between academic research and the SME. From an organisational point of view, CEFE is set apart from the university's "cellule de valorisation", the two bodies existing side by side. Both, however, are completely integrated in the university's administration.

CEFE was created in 1982. Typically it identifies matching interests between university technology and SME needs, and contributes to the transfer of technology to Industry, directly or indirectly, in the following areas:

- identification of transferable technology
- pre-market research
- scientific and technical evaluation (via external advisors)
- patent research and deposit (via external advisors)
- search for an industrial partner
- organising contacts between researchers and industry
- market research
- problem-solving for the company
- development of SME strategic planning
- development of SME marketing planning
- SME financial planning
- identification of available finance
- company recruitment
- advice on education and training
- assistance in promotional activities.

In the above list, the first two tasks are completely performed by the CEFE, which is assisted in the performance of the others by various external organisations (e.g. ANVAR). The broad spectrum of tasks makes clear how relevant the qualifications and experience of the officer directing CEFE must be. Industrial experience is a prerequisite, a fact underlined both at this university and others contacted in the course of this enquiry.

iii) "Ateliers Service"

The "Ateliers Service" (e.g. at the Université de Lille I) are internal structures of the university having no legal personality of their own, and being directed by university teaching staff. They comprise researchers, engineers and technicians. Their principal and published vocation is to assist technology transfer via the development of prototypes. Outside representatives, often from business, are also members of the Ateliers' board.

University staff have said that the Ateliers are faced with many problems, not least the difficulties they encounter in recruiting outside personnel. This results from the inflexibility of university recruitment and of remuneration levels, and, last but not least, from attitudinal differences separating public administration from private enterprises.

iv) Groupings ("groupements") linking institutions and enterprise

These bodies, which may be either internal or external structures, can either be formalised with a legal personality ("Groupement d'intérêt scientifique" or "Groupement d'intérêt économique") or exist on an informal basis ("pseudo-groupement" and "Pôles" focussing the work of different sectors). Their task is to orient research in the different fields, eg. microelectronics, medicine and, biotechnology, transport etc. and to facilitate technology transfer.

Participants in the groupements are usually members and representatives of one or several H.E. institutions, of regional authorities, and of business and Industry. The groupements constitute a supplementary channel for cooperation with Industry for officers in institutions responsible for liaison.

v) <u>Programmes for creation of enterprises</u>

Transfer of technology from the H.E. Sector to business is also encouraged by institutions' programmes seeking to facilitate the creation of companies by staff, students and outside would-be entrepreneurs. Such programmes have been set up relatively recently. An example of this structure is that operated by the Ecole Supérieure de Commerce de Lyon in cooperation with Lyon's Ecole Centrale.

The programmes offered by these two institutions enable participants to work in project teams aimed at developing business plans for concrete projects. Advice on financial aspects may be provided by the Société Lyonnaise de Banque and other relevant experts (on financing, marketing, technology) drawn from the private sector.

If commercially viable, these projects may be located in incubation centres ("pépinières d'entreprise"), one of which is now being planned in Lyon. Once the Lyon "pépinière" is completed, participants in these programmes will also benefit from privileged access to the "pépinière".

The above scenario shows the need for continuity in the process of transfer of technology, if the technology is to move from the planning phase to its business exploitation.

Knowledge of entrepreneurship and of financing schemes, together with widespread contacts, were mentioned as being priority requirements for a liaison officer handling these activities.

Enterprise-creation programmes now exist in several H.E. institutions in France, eg. the Ecole Centrale de Paris, the Ecole Supérieure de Commerce de Toulouse etc (4).

vi) "Chaire Création d'Entreprise"

An outstanding example of this structure is also to be found at Lyon's Ecole Supérieure de Commerce (ESC), which has set up a special chair for the creation of enterprises with the financial support of the Société Lyonnaise de Banque. This structure is interesting from two points of view. The first is the relationship between the Bank and the institution for the financing of the chair. The second is the role played by this chair in providing a service for spin-off companies. The chair is an important element in the ESC's above-mentioned entreprise-creation programme.

vii) Spin-off companies

Many H.E. institutions have spin-off companies, ie. companies incorporated by present or former students and staff. Examples include those of the Université de Compiègne, the INPL at Nancy and the Ecole Centrale in Lyon.

The Ecole Centrale has several satellite enterprises (in the form of "Associations 1901") with which extensive cooperation agreements have been developed. The Ecole Centrale is considering changing the legal form of some of these enterprises and establishing them as subsidiaries of the Ecole Centrale, now that this option has become a legal possibility. The agreements between these companies and the institution are prepared by the ECS' "cellule de valorisation". The conventions fix the conditions for the use of the institution's infrastructure. The costing of these company/institution links can be an important factor in their relationship.

At Compiègne, some 70 jobs have reportedly been created by spin-off companies. One of these is Compiègne Science Industry (Société Anonyme Coopérative à Capital Variable), created in 1981. Its activities comprise the development, the industrialisation and the commercialisation of "progiciels de modélisation" via computers. Its turnover has increased from FF 1.3m in 1982 to FF 5.5m in 1986.

viii) Pépinière d'entreprises (Incubation Centres)

The first "pépinières d'entreprises" appeared in the beginning of the 1980's in France usually linked to an H.E. institution. They provide infrastructure and management support to nascent technology-oriented companies (often of the spin-off type), including access to university staff, laboratories and other resources. Generally, institutions establish detailed contracts with such companies concerning the conditions of use of the "pépinière".

Setting up "pépinières" appears to require thorough preparation, eg. the planned approach to the incubation centre being adopted by the Ecole Centrale and the Ecole Supérieure de Commerce in Lyon (see v) above). Typically the institution needs to undertake an audit of the resources it possesses to meet the requirements of technology companies located on a "pépinière", enabling strong links between the company and the institution's research units. Creation of enterprises in the area of Lyon is strongly supported by the risk capital facilities of the Société Lyonnaise de Banque.

In Compiègne, the University has "Divergent" as its structure for nascent enterprises. It is noted as a model for its support for enterprises in their maturation phase (management and financing assistance).

Other examples of "pépinières", either under way or in the planning phase, include: Pact 01 (Bourg-en-Bresse), Association Sophia-Antipolis (Valbonne), Synergie (Metz), Promotech (Nancy), Esim-Innotec (Marseille), Enstima (Alès) (5).

ix) Acceleration centres - the Grenoble example

An interesting structure for cooperation with industry and transfer of technology is under preparation in the Institut National Polytechnique in Grenoble (INPG). The new "Centre de Transfert Technologique", to be located within the INPG is envisaged by the head of the INPG's service for industrial relations as an "acceleration center" for established, but still young, SMEs. The person in charge of liaising with Industry in the institution will also be in charge of the centre. Calculations have already been made concerning the rates to be applied to companies using the centre. Contracts will also set strict limits concerning the time an enterprise may stay in the centre.

INPG's centre seeks to attract SMEs with established expertise in specific sectors: integrated circuits, robotics and microcomputers.The aim is to provide these companies with new guidance and contacts with laboratories etc. in order to accelerate and stimulate their business activities. Whereas there exist several schemes of support and assistance for companies during their nascent phase, little support exists to accompany enterprises after two or three years of operation. Statistics show that the failure rate of young companies is especially high in this early phase. INPG seeks to remedy this by providing technical management, financial and legal services, and also by identifying potential business partners. The centre is thus to be distinguished from the role played by "pépinières".

The acceleration centre will guarantee geographical proximity to the research units of the INPG and seek to provide an innovative climate for these enterprises: access to technical libraries, data-processing systems and general administrative services. Companies participating in this center will be able to profit from the services of "INPG Conseil", a service which already provides advice for different forms of links between the INPG and Industry, as well as administering the consultancy contracts of professors. One or several small units (office and laboratory space with the necessary infrastructure for two people) may be rented by companies. The aim is not to attract the whole company, but just its research department (or even only part of it).

x) Promotech-Nancy - innovation assistance, second generation transfer

For the INPL in Nancy, Promotech (an "Association 1901" created in 1980) is playing a significant role in the second-generation transfer of the institution's technology, as well as first-level transfer. Whereas first-level transfer seeks to convert invention into innovation, second generation transfer aims to spread the innovation more widely. As a first step in this, Promotech audits the INPL's resources, identifying the commercial potential and transferability of the institution's technology.

The idea of Promotech was born in the institution's college of industrial engineering. Promotech was deliberately concentrating on sectors that were regionally predominant, eg. foodstuffs and forest products.

Promotech's links with the INPL are very close and the head of Promotech is also involved in teaching the management of innovation and technology in the institute - a further factor in its success. It was indicated in various interviews that because of this Promotech's auditing activities were more readily accepted by INPL's staff.

However, Promotech's auditing of technology is not limited to the INPL but extends to some 300 laboratories in the Lorraine region. It also conducts market research and feasibility studies. Through its membership of ANCE (Association nationale pour la création d'entreprises) and EBN (European Business and Innovation Center Network), Promotech's search for company clients for Lorraine's academic technology extends nation-wide and Europe-wide.

Furthermore, Promotech is an important factor in the "Nancy-Brabois" science park, or technopole. The technopole offers among other resources incubation centres (Centres d'Entreprise et d'Innovation). Within the CEI, Promotech is associated with an engineering school for the management of technology. It has participated in the creation of about 30 enterprises and the diversification of some 20 more.

xi) Technology parks ("Technopoles")

The most common reasons for creating technology parks appear to be regional development and job creation. They are typically fostered by regional and local authorities which provide the necessary support (eg. financial support and land).

Universities and other institutions have in most cases in France not been directly involved in the creation of technopoles nor the selection of companies located on them, although there is now a change in this trend.

However, as institutions do become more involved, a preference seems to be emerging for attracting high technology companies and companies active in research.

xii) External Industrial Liaison Bureaus/Centres

Many universities and other H.E. institutions have created "Associations 1901" outside of their framework which have the task of assisting them in their liaison with Industry in the following areas:

- administration of research and consultancy contracts with third parties;
- hiring of personnel for a short period of time;
- legal and financial assistance for the institution's personnel.

The Associations are usually linked with the institution via convention. These conventions fix the conditions for using university material and infrastructure.

The tasks are mainly limited to acting as a bureau and assisting in the transfer process in response to demands from the institution's personnel.

The money from consultancy contracts, after deduction of a certain percentage for administrative costs and a payment to the institution covering its overheads, is then put at the disposal of the professors and departments. The latter may use these funds for activities linked with their research work eg. conferences, buying of equipment, hiring of personnel.

A perceived advantage of these external structures is their unbureaucratic procedures for all types of management of contracts with third parties. According to information provided by French institutions, some of these structures may disappear as the possibility of university companies/subsidiaries become more distinct. The advantage of companies or subsidiaries over the Associations 1901 is the stronger profile they project to Industry. Their cooperative activities can therefore be more easily enlarged.

xiii) Companies created by HE-institutions

Until recently, universities have been limited in the formation of external corporate structures to the "Association 1901" - a structure which has not always been accepted as an equal partner by business.

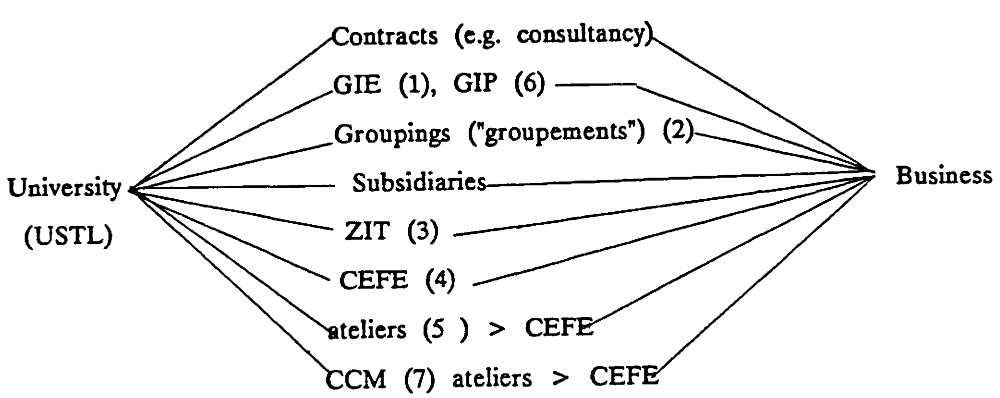
Only since 1985 have the H.E. institutions been able to create their own companies ("filiales"). It is thus impossible as yet to make any general assessment of this type of structure. However, many universities do intend to replace "Associations 1901" with fully-fledged companies. The procedures required to do this, and the advisability of doing so, are often being considered by the officers in charge of the "cellule de valorisation". The qualifications needed for this job appear to raise questions regarding appropriate training for ILO's.

xiv) Use of laboratories

When companies use the laboratories of the institution, e.g. in the university in Compiègne, it is perceived as important to fix a set of rules firm enough to cover the financial expenses of the institution and not to endanger the laboratories' academic activity. On the other hand, these rules need to be flexible enough to cater to needs of the business partner.

xv) Example of a university business cooperation network: Université Lille I

The University Lille I (USTL) relies heavily on a wide variety of structures and a complete regional network for its transfer of technology. The different means of transfer can be:



and they include the "cellule de valorisation" which, in the case of Lille, appears to deal more with the inside missionary work with the teaching staff on the advantages of cooperation.

(1) **Groupement d'intérêt économique** (Economic Interest Grouping)

(2) **Groupings** can either have a legal personality or not. Their mission is to coordinate research, teaching and industrial development. There exist several ones on a regional (e.g. transport) or national level (e.g. medical).

(3) **Zone d'innovation et de Transfert**: a project for a kind of science park in order to attract new industrial activities and newly created enterprises within the close orbit of the university.

(4) **CEFE (Centrale d'Evaluation et de Faisabilité Economique**, created in 1982): provides the missing link with SMEs;

(5) **Atelier services** of the USTL are internal structures of the university, similar to research units.

(6) **Groupement d'Intérêt Public**

(7) **Centre Commun de Mesure**: for administering all large university equipments (about 50), to facilitate access by third parties.

* * *

4. BELGIUM

(a) Objectives

Only four of the nine institutions surveyed (whether via interview or by questionnaire) have indicated they possess a published policy stating their objectives as regards cooperation with Industry and transfer of technology.

The uneven result reflects in part a situation where no concerted attempt appears to have been made in most institutions to identify the resources available nor the technology available for transfer. The absence of such a systematic audit would, as in the case of other countries, appear to hinder the formulation of clear objectives. This problem is further compounded by the reserve felt by individual members of teaching staffs active in technology transfer and cooperation at the prospect of interference from the institution's central administration.

However, this assessment needs some qualification. A significant number of institutions indicate that their liaison offices have been given a clear remit to pursue cooperation and technology transfer.

When published objectives exist, these tend to take the form of brochures outlining the institutions resources and introduced by an official statement of the Head of the institution.

(b) Policies and procedures for consultancy

Five out of the nine institutions surveyed said that thay have a policy on consultancy within the framework provided by law (arrêté royal, 8 April 1976). However, in some institutions it is not clear whether their policy is simply one of drawing to the teaching staff's attention the constraints imposed by the legal situation or whether consultancy is actively encouraged. Little evidence has been gathered during this Study to suggest that any premium, e.g. in terms of carreer advancement, was attributed to consultancy activity.

According to the above mentioned law, no consultancy activity is allowed without authorisation by the institution's administrative council. Sometimes authorisation is given on an unlimited basis, sometimes it is reviewed at regular intervals. Some business-related activites are considered incompatible by law with full time teaching.

Two distinct procedures exist for staff seeking to engage in remunerative consultancy. It can either be undertaken on a private basis (after having fulfilled the education and research obligations) or under the umbrella of the institution. The advantage of the university route is of a fiscal nature. University revenues are less heavily taxed than private ones. The funds generated by such consultancy may be used for university-related purposes (expenditure on conferences, laboratory technicians, equipment, etc).

(c) Policies and procedures for intellectual property rights

In the present situation there is considerable confusion as to the ownership rules concerning intellectual property rights in the H.E. institutions. As a result, there has been a groundswell of pressure from the H.E. Sector for government to clarify the legal framework. Virtually all universities are now discussing a draft proposal for a law which would give the intellectual property rights in essence to the H.E. institution, while leaving the "moral" rights still with the inventor (member of the teaching staff) (see also Part II of the study). If adopted such a law would clarify the legal situation. Teaching staff would still have their right to publish, after consultation with the university administration. Furthermore the teaching staff would participate in the financial results of the invention and could also exploit the property rights if the institution refuses to do so. Most institutions have already incorporated parts of the provision of this draft proposal into their policy.

So, in the present situation, most instituitons have drawn up a policy that states that intellectual property belongs in the first place to the institution, if its equipment has been used and no third parties have given financial support. Six out of the nine institutions surveyed have indicated that they have a policy of this nature. If outside financing has been obtained for a research contract, the decision is taken on a case-by-case basis and clauses will be included in the research contracts and conventions with third parties.

An example of this policy is provided by the University of Louvain-la-Neuve, which published in 1982 detailed provisions concerning inventions. This policy states that a central committee has to be informed of each invention which has commercial potential:

> "Le Comité de Gestion de la Structure de Gestion des Ressources Extérieures assure l'application de la politique de l'UCL en matière d'invention. Il doit être averti de toute invention résultant de recherches effectuées dans les laboratoires et unités de l'UCL lorsque l'invention est susceptible de valorisation."

Should the university refuse to use the property rights, the inventor is free to exploit them. In the case of a university patent, the institution carries all the costs.

The Belgian universities tend to opt for a Luxembourg or Dutch patent. Patents are seldom exploited by the institutions themselves in the form of licences. Mostly they are taken in order to have more negotiating power vis-à-vis industry during the initial one year of protection. Few patents have been extended after this initial year.

It is difficult to evaluate the importance of HE Sector property rights in financial terms. As interviewees mentioned, intellectual property rights are exchanged against contributions in kind by companies.

The survey also provided examples of institutions' procedures and policy towards other channels for transfering technology, e.g. science parks.

(d) Structures for general cooperation and technology transfer

According to the responses to the questionnaire, a variety of structures exist in H.E. institutions for cooperation and technology transfer. All nine respondents say thay possess industrial liaison units (as defined in Part I B above), often referred to as "cellules d'interface". Five institutions use spin-off companies for their transfer of technology and three have very close links with science parks (some other institutions are considering the creation of science parks). The following description of structures is in many instances done by reference to specific examples.

i) "Cellules d'interface"

H.E. Sector "cellules d'interfaces" in Belgium nearly always form part of the institution's administrative structure

(A temporary exception, that of K.U.L. Leuven, is discussed below). Their tasks consist in:

- giving advice in the drafting of contracts for research and exploitation
- taking out patents
- making market studies
- establishing business plans.

The officers in charge of the "cellules d'interface" have different titles, e.g. "directeur de recherche", "coordinateur du centre de recherche industrielle". Sometimes they are also acting within the "Service de relations extérieures". Most of them report directly to the head of the institution. Whatever their titles, their roles are similar to those of an I.L.O. as difined in Part I B.

The Government's preference appears to be to provide funds, not for direct financial support to the interfaces, but rather to help meet the costs they incur when seeking the advice of external expertise (eg. "technology brokers", see Part II 4).

One of these interfaces, "Leuven R&D" (of the KUL), was founded in 1972 as a non-profit organisation and was the first transfer point in its region. Its primary objective, as defined in its brochure, was to "form a service organism for the University that could improve the managament of contract research. The protection of discoveries made in the university and their industrial or commercial exploitation also pertained to its task. In this way, the University could contribute to the industrial and socio-economic progress of the community".

It faced many problems and obstacles in the beginning. It appeas however, to have been successful. Mr. Declercq, former vice-chancellor in the KUL, (and now President of IACHEI) explained: "When I started I took, as president of Leuven R&D an old, very wise banker, who is one of the big figures in the banking world. He said, 'Let's keep it very quiet, because do not believe that all these things can be created without problems.' A number of people in the university, ten years ago, did not understand what we were doing. Jealousies and tensions were created and it takes a great deal of diplomacy to keep such a structure alongside the university. The profit motive results in money being given to some of the individual inventors. For practical and diplomatic reasons, we kept the whole thing very quiet for a long time."

"Leuven R&D" was transferred into the "K.U. Leuven Research & Development" and became again part of the university in 1985. Its task, to create opportunities for the exploitation of the scientific potential of the university by Industry, is fulfilled in three ways: to act as a broker for R & D agreements, to exploit and commercialise university know-how e.g. via patents and licences; and to stimulate new industrial and commercial initiatives, e.g. via a limited participation in new industrial or commercial ventures during an inital phase of an enterprise. The I.L.O. participates in the revenue accruing to K.U.L.'s interface.

In other institutions, the tasks of the "cellules" are generally similar to the ones mentioned above, with the exception that some institutions are directly involved in science parks. The services provided by "cellules" are voluntary, i.e. the teaching staff may use them but is not obliged to. The interface usually obtains a certain percentage from the value of contracts it assists the staff in negotiating.

However, the situation is different in the Université

Catholique de Louvain-la-Neuve (UCL), which also possesses a very active interface center too, the "**R&D Liaison Unit**". The unit is not responsible for the management of contracts, it only assists in their negotiation. Their services are provided free of charge to the teaching staff and the costs of providing them are covered from the university's budget, not from any percentage fee on the contracts.

In the composition of these liaison units, more importance appears to be given to legal and commercial qualifications than in France. The explanation may be that many specialised services in France are provided by the CNRS and the MEN.

The results from the interviews and answers to the questionnaire indicate that - with the exception of two university interfaces - there was always at least one member of these interfaces or liaison units who had industrial experience. Political influence and links with the regional or national goverment were mentioned as very important factors for the success of the interfaces.

Furthermore, all units possessed at least one full-time member, sometimes assisted on a part-time basis by the teaching staff. The latter's role is to maintain contacts with the laboratories and to identify viable ideas and inventions. The links with Industry are mainly in the hands of the unit's full-time officer.

According to the infomation given, only in Louvain-la-Neuve are members of the teaching staff are obliged to inform the liaison center about the inventions which have been made in the laboratories that have commercial potential. In other institutions, use of liaison services appears to be optional.

ii) Combined research centres

The Industrial Research Centre (Centre de Recherche Industrielle, C.R.I.) of the Université Libre de Bruxelles (ULB) is one example of this structure. It forms an integral part of the university and aims at achieving "industrialization through applied research and research-development, starting from an idea coming either from the university or elsewhere." This is partly achieved by the circulation of a booklet publishing the university's services to business. The C.R.I. defines the research costs, the types of contracts to be established and helps to find the necessary financial aids.

The C.R.I. has initiated several research groups, e.g. the robotic group, the composite materials group, the medical engineering group, the mathematical modelling cell or the genetic engineering group. The last one was created in 1978 and is structured in a way to undertake a coherent applied research programme in collaboration with the industry and the public authorities.

Another example is the "Centre d'Etudes et de Recherches en Hautes Technologies (CERHT)" at the Faculté Polytechnique de Mons. It should be operational from September 1987. Its major objective is to stimulate inter-departmental research e.g. on robotics, bio-technologies, new materials etc. The management of this Centre will be assured by the commission "Relations Industry - Université", as the industrial liaison centre of the institution is called.

iii) Pilot laboratories

The UCL has also encouraged the development of pilot laboratories for the purpose of verifying laboratory research findings on a semi-industrial scale: the polymer applications laboratories, the chemical engineering pilot plant, the ore processing plant and the engineering production pilot plant. The engineering production pilot plant provides technical assistance to laboratories and companies who want to develop new tools and pre-production prototypes. Its success has led the university to change the structure of the pilot plant and to change it into a limited-liability company.

iv) Associates and affiliates programme for companies (Ghent)

This is a structure whereby companies can take an "associate" of "affiliate" status with institutions (against payment of a certain fee) and thus benefit from research work. This structure is very widespread in the US, but less known in Europe. One example of this is the Babbage Institute for Knowledge and Information Technology, which brings together three university laboratories and is itself associated with the University of Ghent. It provides a bridge function between university and Industry by promoting investigation into artificial intelligence, applied epistemology and information technology. The affiliates programme is a very important instrument for developping a long-term relationship. It is a relationship mainly based on confidence of the partners.

v) Soft companies and spin-off companies

Several institutions use this structure for technology transfer. Some of these companies have started as soft companies in the institutions' laboratories. The example given below concerns the Vrije Universiteit Brussel (VUB) where spin-off companies have been created without any direct financial investment of the university. Nevertheless, the VUB has shares in some companies in exchange for know-how and technology transfer from the university.

Companies are established on and off campus. One of the VUB's spin-offs, BIORGAN, is still established at the university but appears to have reached a size that would suggest a transfer to another location. Spinnov, (Signal Processing Innovations), another of VUB's spin-offs, was founded in 1985 and is involved in the development and marketing of sophisitcated signal acquisition and processing systems for the growing industrial automation market and applied research.

vi) Pépinières d'entreprises - incubation centres

The VUB, again our example, is considering creating a "pépinière d'entreprise", or innovation centre, close to its main buildings. The university wants to provide logistics and scientific support. This center could also be used for university spin-off companies.

vii) Companies created by the university

The UCL has created 5 enterprises in collaboration either with the public authorities, private partners or venture capital specialists. There is little direct involvement of the teaching staff in these companies.

With reference to the creation of university-companies, the UCL laid down the following policy in 1984:" The University has no ambitions whatsoever to become an industrial operator. Its role is limited to the transfer of technology and the administration of scientific and technical consultative bodies. The financial returns obtained by the UCL from its holdings in new companies will permit the financing of new basic research which, one day perhaps, may in turn give rise to the creation of a new company. It should also be pointed out that the University does not wish its teaching staff to be involved in the managament of such companies. Where the University is entrusted with the tasks of an administrative nature, these tasks will be assigned not to the scientist responsible for the invention but to a management specialist, whether he be a member of the University or not."

viii) <u>The Centre of Technology and Business Management (C.T.G.A.) - ULB</u>

The Centre de Technologie et de Gestion des Affaires (Centre of Technology and Business Management, C.T.G.A.) of the ULB provides similar services as an innovation center as defined in Part I B. It is a non-profit association with the aim of assisting in the creation of companies. Its assistance covers scientific, technical and management advice.

ix) <u>INNOVI - common technology transfer for Belgian universities</u>

The idea for the creation of INNOVI can be traced back to the KUL (1). It was established in 1983 as an independent limited company, dealing with brokerage of technology covering the whole national potential. The capital was subscribed by three groups of companies. Its first role was limited to act as a broker for transfer of technology from all Belgian universities to Industry. Over the years its activities have expanded horizontally (know-how comes not only from universities but all kinds of individuals and groups) and vertically (its role is not limited to brokerage but incudes all stages of the innovation process: searching for innovations, bringing together innovators and managers, establishing and temporary managing of new companies). INNOVI is now active in technology consultation, technology transfer and technology management.

INNOVI has participated and assisted in the creation of several companies based on Belgian scientific research results.

x) SOCRAN (Société de Création d'Activités Nouvelles) S.A. (Liège)

Socran's activities are concentrated in assisting the creation of enterprises and in providing some kind of an incubation centre. Created on the initiative of IRI asbl (Innovation et Reconversion Industrielle), which also involves Liège university, and which is based on a regional development and reconversion concept, it has already assisted in the creation of several enterprises. In its "Centre d'affaires", collective services are offered (secretariat, telephone, telex, informatics, documentation) which help to cut overheads for new enterprises. Nevertheless, this initiative is mainly based on the support of large companies, which hold 85 % of its capital and participate in an information network for newly created enterprises.

xi) Science Parks

The ULB has links with three industrial research parks in Evere, Anderlecht and in Nivelles. The university is involved in the management of all three parks and co-decides about the selection of companies. The science park accommodates a high number of companies in advanced technology fields. The ULB has established a policy and criteria concerning companies that may be accepted in the science park. Research activities and the development of prototypes have the priority. No non-productive activities, such as storage or assembly, are accepted.

The UCL is involved in two scientific parks (Louvain-laNeuve and Woluwe) via its "interface". The primary objectives are transfer of technology from the UCL to industry and the furthering of regional economic development.

In the UCL case, selection criteria for acceptance of companies into the science park have been laid down by the university. Eligibility criteria include:

- the companies must be research undertakings, or
- manufacturing concerns provided that the use of advanced technologies is essential to their activities, or
- companies marketing goods and services that are considered to be complementary to the former two or necessary for the functioning of the park as a whole.

Two research parks are indirectly linked with the VUB and the university in Liège is linked with the Parc Industriel de Recherches du Sart Tilman. It is on this park, that SOCRAN, (see above) has been established.

* * *

5. SUMMARY OF SITUATION IN OTHER COMMUNITY COUNTRIES

This summary outline of the situation in the eight other Community countries is based on two main sources of information: replies given by H.E. institutions to a questionnaire sent out as part of this Study's investigation; and other, generally documentary, material. The detailed results of the response to the questionnaire are outlined in Appendix 3.

(i) DENMARK

(a) Objectives of general cooperation and transfer of technology

Only one of the responding institutions indicated that it had a published policy on cooperation with Industry. The brochures included in the replies did, however, indicate the services and know-how the institution could offer to Industry.

(b) Policies and Procedures for general collaboration and technology transfer

The Ministry of Finance has fixed special rules concerning H.E. Sector's treatment of business-related resources (budgetvejledning). The institutions seem to have based their procedures on this. Danish teachers are entitled to do consultancy work on certain conditions (eg. no conflict of interests, no encroachment on research freedom).

Based on the information provided, intellectual property rights in Denmark appear to belong to the teaching staff.

The only institution providing information under this heading outlined detailed rules for the various forms of technology transfer it undertook.

(c) Structures for general coopertion and technology transfer

There does not appear, on the basis of the replies to the questionnaire, to exist any structutre common to all H.E. institutions in Denmark, dealing either with general cooperation or technology transfer. However, several institutions have established their own structures. There exists also the Danish Invention Centre which deals with technology transfer on the national level, which is included in the list below.

Information Office

This structure provides general information for students, as well as information about research results suitable for business application (eg.at the Technical University, Copenhagen, the "informationskontor" of the Danmarks Techniske Hoskole).

Project Promotion Office

This structure is meant to handle more specific tasks of transferring technology to Industry. It deals with the formulation of contracts between institutions and Industry (eg. at the Technical University Copenhagen, the Danmarks Techniske Hoskole (Projektkontor)).

Science parks

As indicated in Part II (A.5.), the existence of two science parks has been mentioned, one in Aarhus and one near Copenhagen. The science park in Aarhus was created in 1985 by an association representing 21 institutions, companies etc. It now has some 125 members. The objective of the association is to create a centre for high technology, development and research.

The Danish Invention Centre

The Danish Invention Centre's "technology scout programme" appears to have represented for many years the only formalized structure in Denmark for technology transfer.

The major tasks of its industrial liaison officer are described as being to:

- gain the confidence of scientists through discussion of work carried out at institutions
- offer assistance in patent searches and in market research
- conduct cost-benefit analysis on patents
- present scientific documentation in a technical and market-oriented way
- assist in the development of prototypes.

(ii) GERMANY

(a) Objectives of general cooperation and transfer of technology

Relatively detailed information was provided in written form about Germany. Much of this, however, was obtained from the Central Liaison Units of institutions (eg. the transfer offices). It proved more difficult to obtain data on the activities not centrally administered. For example, the lack of mention of spin-off companies in the replies does not necessarily mean that there do not exist any, but that central records including them may not exist in all H.E. institutions.

Most institutions in Germany possess publications which indicate the services they offer and the research work being undertaken. Nevertheless, only half of the institutions surveyed indicate having a published policy for collaboration with Industry.

Much less continuing education activity is organised by universities than in French HE institutions. Consultancy is very important, but relations with SME's appear weak. (See also Part II 5.A.)

No specific reference has been made in any replies to a special audit of institutional resources and transfer potential.

(b) <u>Policies and procedures for general cooperation and technology transfer</u>

As regards service and consultancy contracts with outside interests, two thirds of the universities and one third of the Fachhochschulen (FHS) replying indicated they do not have a special policy in this respect, and some of them who indicated that they do have one referred to the laws of the Länder, e.g. "Richtlinie des Landes Niedersachsen für Übernahme von Drittmittelaufträgen" or "Nebentätigkeitsvorschriften für den Hochschulbereich des Landes Nordrhein-Westfalen".

Procedures concerning technology transfer are very much influenced by intellectual property rights. As already indicated in Part II (A.5.), the property rights of professors and scientific personnel (Professoren, Dozenten and wissenschaftliche Assistenten) at German universities are set out as individual, i.e. they do not belong to the universities.

Only under very specific circumstances may the university claim some participation. This factor explains why most of the answers to the questionnaire from the universities in Germany indicated the absence of special policies and procedures concerning intellectual property rights, and the few institutions (10 - 15 %) mentioning that they did have a policy in this area referred to the national legislation. None of the institutions surveyed has indicated revenues from intellectual property rights. As pointed out in Part II, the "freedom of research" and the "privilege of professors" (Professorenprivileg,) only come into play for universities (wissenschaftlichen Hochschulen: Universitäten, Pädagogische Hochschulen), and not, for example in the FHS, nor for personnel at universities other than those specified.

(c) Structures for general cooperation and technology transfer

19 of the universities surveyed said they possessed a structure similar to the industrial liaison bureau or centre (as defined in Part I.B.) Six FHS said they had established a similar body. Most of these bodies had only one officer. Apart from these centres or bureaus, a wide variety of other structures exists.

The Ruhr-University of Bochum issues a publication which is an important source of information on the structures used in the German H.E. Sector for cooperation and technology transfer (1). It contains information on technology transfer centers and bureaus as well as science and innovation parks. It provides the addresses of contact persons, and a short description of their tasks. The names of these transfer bureaus and centres differ, sometimes "Kontaktstelle", sometimes "Transferstelle" or a similar expression. This publication is available to companies and thus is a valuable reference for business contacts with H.E. institutions. The latest version available in the course of this Study was dated February 1986.

Bureaus and centres for general information transfer ("Hochschuleinrichtungen des 'Allgemeinen Informations-transfers'")

The Ruhr University publication mentioned above lists a variety of structures corresponding to industrial liaison bureaus or centres linked to German H.E. institutions.

Industrial liaison bureaus:

Based on the analysis of the activities indicated by the transfer officials in the H.E. institutions concerned, the following institutions appear to possess transfer bureaus:

RWTH Aachen
Freie Universität Berlin
FHS (Fachhochschule) Bochum
Universität Bremen
Universität - Gesamthochschule Duisburg
FHS Flensburg
Albert-Ludwigs-Universität Freiburg
Universität Karlsruhe
Technische Universität München
Universität Münster.

Industrial liaison centres:

Based on the information provided, the activities of the transfer officials in the following institutions are similar to those performed by an industrial liaison centre:

Universität Bayreuth
Technische Universität Berlin
Technische Fachhochschule Berlin
Fachhochschule Bielefeld
Ruhr-Universität Bochum
FHS Darmstadt
Universität Dortmund
Hachhochschule Dortmund
Universität Erlangen
Universität - Gesamthochschule Essen
Fachhochschule Frankfurt
Fachhochschule Furtwangen
Technische Universität Hamburg-Harburg
Universität Kaiserslautern
Gesamthochschule Kassel
Universität Oldenburg
Fachhochschule Wiesbaden

Clearly all these centres have their individual specialities and services to offer. Further details on some of these centres are given below by way of example:

* Gemeinsame Innovationsberatungsstelle (GIF),Furtwangen, Villingen-Schwenningen

  This centre is managed jointly by the FHS Furtwangen and the chamber of commerce and industry (Industrie- und Handelskammer Schwarzwald-Baar-Heuberg).
  It provides assistance in the contacts between the professors and Industry; contacts with other research institutions; "complete" ("ganzheitliche") advice ranging from product identification through access to funds, to product management; information on the use of the institution's equipment and resources by companies. Up to 8 hours advice per year are free of charge for members of

the chamber of commerce, for other firms this is limited to 5 hours a year. Additional advice has to be paid for.

* Technologie- und Innovationsberatung, Frankfurt

This body belongs to the FHS Frankfurt am Main and provides the following services:

- information to Industry about the transfer and innovation potential of the institution;
- contacts between professors and Industry for general cooperation and know-how transfer;
- innovation assistance in particular to SMEs;
- advice and management concerning public research funds;
- organisation of seminars, information sessions, fairs and exhibitions;
- information services concerning organisation, management and markets;
- advice and support for the creation of companies (finance, management etc.).

* Technologievermittlung, Hamburg-Harburg

This centre is part of the Technische Universität Hamburg-Harburg and has, in addition to the general tasks of an industrial liaison bureau, the special task of identifying the needs of institutions and enterprises with respect to technology. Special attention is given to enterprises that do not possess their own research departments (in particular SMEs).

* Hamburger Institut für Technologieförderung e.V. (HIT)

The HIT is already on the borderline of an industrial liaison centre and an innovation centre. It has the status of a non-profit association, its mission being to give advice concerning the creation of enterprises in technology-oriented fields. It deals with issues like company creation, financing, product launching, transfer of technology.

* Technologie- und Innovationsberatung (TIB), Kassel

  The TIB (a part of the Gesamthochschule Kassel) performs a variety of services, including:

  - advice on the institution's role in technology and innovation;
  - assistance with the management of innovation;
  - information about funds, technologies and management related to the creation of enterprises;
  - information on new technologies, management, organisation and markets;
  - advice on R&D contracts for third parties;
  - advice on product and process innovation.

Transfer bureaus and centres with special tasks - ("Hochschuleinrichtungen mit besonderen Aufgaben")

Under this group of centres and bureaus the Ruhr University publication mentions eg. the Technische Akademie Esslingen, which offers some continuing education programmes (linked with the Universität Stuttgart, the Universität Hohenheim and the FHS für Technik Esslingen); the Technologie-Transfer-Stelle des Nordrhein-Westfälischen Handwerks am Institut für Kunststoffverarbeitung in Aachen, whose special advice is directed towards SMEs in a selected number of professions; the Centrum für Technologietransfer Clausthal e.V., which offers particularly programmes and assistance for personnel and technology transfer to third world countries (linked with the Technische Universität Clausthal); the Zentrale zur Foerderung von Entwicklungsarbeiten im Handwerk, which advises craft industry ("Handwerk") on innovation problems; and, last but not least, the INEX (Institut zur Foerderung von Existenzgründungen, which is part of the FHS des Saarlandes). The INEX has the special task of helping with the creation of enterprises. It entrusts the FHS with testing the technical and economical feasibility of ideas for new products which could serve as a basis for the creation of new enterprises and spin-offs.

Spin-Off companies

Relatively few H.E. institutions have indicated - either in response to our questionnaire or via the Ruhr University publication mentioned above - that they are involved with spin-off companies or that they offer special services to assist spin-offs. The few exceptions are:

- The FHS Dortmund in collaboration with the Technologiezentrum Dortmund, which is oriented towards the development of prototypes and specific areas;

- The GHS Kassel works closely together with Job Creation Ltd. with the aim of supporting the creation of new technology companies;

- AGAFE (Arbeitsgemeinschaft für angewandte Forschung und Entwicklung von Mitgliedern der FHS) Wiesbaden has among its other tasks the job of assisting its former students in the creation of enterprises.

Gründerzentren

Two "Gründerzentren", which are similar to incubation centres, have been initiated in Berlin. The Berliner Innovations- und Gründerzentrum (BIG), which is linked with the Technische Universität Berlin, has been in operation for just over three years. The idea for its creation came from the university. Similarly, the idea for the "Center für Innovation und Produktion" (CIP) at the Technische Fachhochschule Berlin, was presented by its ILO in 1985. This model is now widespread in Germany. Some 25 similar centres are in operation already and some 15 are in the planning phase (2). Not all of them have the same characteristics. Very often "Gründerzentren" are linked with science parks which makes it difficult to draw the line between a "Grüderzentrum" and a science park. 34 "Unternehmens-Gründerzentren" have been mentioned in the booklet "Technogietransfer- Einrichtungen in der Bundesrepublik Deutschland" (Bochum, 1985), but not all of them have links with HE-institutions.

The BIG (Berlin) offers special administrative assistance and management services. Contract terms are advantageous with short-term leases at moderate rates. The idea is to decrease the financial burden of companies established in the centre by cost sharing, especially as regards administrative costs. However, little public funding is available, so companies can be put on a realistic competitive basis. The step from the centre into the economic environment of "the real world" is thus less of a shock.

For other similar structures linked to H.E. institutions in Germany see Appendix No. 17.

Science Parks

It is difficult to draw a line between the "Gründerzentren" and the science parks, because many of them offer similar facilities. Below are listed those parks and centres which do not indicate they are directly concerned with the creation of enterprises.

Not all of the German science parks have links or cooperation agreements with H.E. institutions.

The Technische Universität Berlin has (as mentioned above) very close links with its science park and also the "Gründerzentrum" BIG. Both of these structures are managed by Mr. H. Fiedler, who is the ILO of the Technical University in Berlin.

Other examples of science parks that cooperate with universities and FHS are:

Technologiezentrum Buxtehude	cooperation agreements with: Technische Universität Hamburg-Harburg, Hamburger Institut für Technologietransfer e.V., Fachhochschule Niedersachsen Nord, Buxtehude (Architecture, Construction);
Technologiezentrum Freiburg	cooperation for use of university installations and equipment
Technologiepark Heidelberg	University Heidelberg is member of the board

Technologiezentrum Hildesheim	contacts with the H.E.institutions in Süd-Ost-Niedersachsen
Zentrum für Klein- und Mittelbetriebe, Kassel	informal contacts with the university's industrial liaison unit
Technologie-Park Syke	cooperation with several H.E. institutions

(iii) GREECE

(a) Objectives of general cooperation and transfer of technology

A clear picture is impossible because of limited responses to the questionnaire. Three institutions indicate a published policy on general collaboration with Industry.

(b) Policies and Procedures for general cooperation and technology transfer

All respondents indicated they have a policy concerning consultancy and intellectual property. However, they did not include in their replies any published policy statements of their institution. Reference was also made to the laws that govern contracts with third parties.

(c) Structures for cooperation and technology transfer

Here, "Research Committees" of universities are mentioned. These committees should consist of at least three people, comprising the vice-president and one member of the different faculties. The Technological and Educational Institute of

Kozani has indicated that the members of its committee are selected by the Ministry and usually have 6 years of experience.

(iv) ITALY

(a) Objectives of general collaboration and transfer of technology

Most respondents do not appear to possess a published policy outlining the objectives concerning cooperation with Industry. No respondent makes reference to any audit of the institutions' resources for potential transfer of technology. The University of Udine mentioned that it is planning a data bank for cooperation with Industry.

(b) Policies and procedures for general collaboration and transfer of technology

By and large, respondent universities have said they do have a policy on consultancy, but none mentioned a policy on intellectual property. As regards consultancy they refer to legal provisions (see Part II A.5.) and their implementation in university statutes.

(c) Structures for cooperation and technology transfer

The university's administrative council was mentioned as the main structure in Italian H.E. institutions for liaising with Industry. The Council authorises and administers contracts with third parties. Two universities (out of 8 responding) mentioned the existence of an industrial liaison bureau or centre.

No reference was made to any spin-off companies or similar structures for technology transfer.

There exist, however, several science parks, eg. Tecnopolis Novus Ortus (T.N.O.) near Bari, Tecnocity in Turin. T.N.O., which owes its existence mainly to the ideas and initiative of Professors A. Romano, deputy rector of Bari's university, who has been something of a pioneer in this field in Italy.

The University of Milan possesssses a specific committee for liaising with Industry (Comitato Universita-Mondo del lavoro). This committee handles matters liks traineeships in Industry but not specifically transfer of technology.

(v) LUXEMBOURG

(a) Objectives of cooperation and transfer of technology

The institutions have not yet defined their policy objectives based on detailed analysis of their transfer potential. The Centre Universitaire de Luxembourg has, however, a published policy on collaboration with Industry. The general situation may well change, moreover, as institutions react to the law adopted early 1987 (see Part II A.5.) seeking to encourage technology transfer and innovation.

(b) Policies and procedures for cooperation and transfer of technology

The Centre Universitaire de Luxembourg includes, in its policy on general cooperation with Industry the following:

* participation of enterprises in the institution's administrative council
* secondment from Industry for teaching purposes
* traineeships of students in enterprises
* continuing education
* studies and projects carried out for enterprises
* research contracts.

No reference was made concerning the specific procedures for developing these modes of cooperation.

The Centre has also adopted an intellectual property policy, although no reference is made to revenues accruing from the exercise of its rights.

(c) Structures for cooperation and technology transfer

No special structures apparently have have been created for cooperation with Industry or technology transfer.

(vi) THE NETHERLANDS

(a) Objectives of cooperation and transfer of technology

Almost all responses to the questionnaire indicated that the institution had a published policy stating its objectives concerning cooperation with Industry. This high level of response is in part explained by the widespread auditing of internal resources which has given institutions a firmer basis on which to formulate clear objectives.

For example, in Leiden, the University together with a committee set up by the Chamber of Commerce conducted an an internal audit of the university's transfer capacity.

A similarly detailed audit was carried out at Twente in the Technische Hogeschool. The aim was to provide individual members of the teaching staff with a standardised procedure for identifying commercially viable research results.

To support this analysis of internal resources, the audit in many cases appears to extend its efforts to identify the resources' market potential. At the Rijksuniversiteit Groningen, attempts have been made to identify barriers hindering cooperation between Industry and the university. These revealed weaknesses in the university's profile with business as a result of which the university conducted an audit in order to clarify its objectives for cooperation and, further, to develop policies and procedures defining the role of structures such as transfer points in the process of technology transfer.

(b) **Policies and procedures for cooperation and transfer of technology**

Most institutions indicated that they do have a policy on consultancy, whereas only three of them mentioned a policy on intellectual property. Information on returns from intellectual property rights was only provided by one institution.

Consultancy and research contracts contain mainly the following procedures: arrangements for revenues earned from outside work are usually decided by the "Universiteitsraad", whereas the negotiations and signature of major contracts are usually in the hands of the "College van Bestuur". The university's scientific departments tend to have a broad scope for taking initial decision on contracts. They provide advice on the costing of contracts. Institutions usually use model contracts for commercial arrangements with third parties.

On intellectual property, policies can vary from university to university. Whereas Leiden insists that inventions are university property, the "Technische Hogeschool" of Delft may opt to register patents but does not seek to be involved in their exploitation - this being left to the industrial partner. In order to find a partner in industry, outside consultants are used, eg. the foundation for exploitation of knowledge "Stichting Kennis Exploitatie (SKE)" in Twente.

The university of Utrecht has stipulated that the industrial partner should indicate within a certain period of time its intention to use the result of research commercially, in which case the university would negotiate the price of transferring the rights.

(c) <u>Structures for cooperation and technology transfer</u>

Based on the analysis of the answers to the questionnaire sent to Dutch HE institutions, 6 out of the 9 responding institutions have said they possess a body for liaison with Industry, an industrial liaison bureau or centre. Only one science park (bio-technology) was mentioned and in one case spin-off companies were indicated. But there exist several structures for transfer of technology, as outlined in the following list.

Transfer points

The transfer point structure began to take hold in the 1970's. Now most H.E. institutions possess one. Transfer points tend to seek cooperation with SME's in particular. Their tasks usually include:

- providing Industry with information about the university and bringing potential partners together;
- links with SMEs: active marketing of university ideas;
- sorting of companies' enquiries before passing them on to the appropriate department in the university;
- advice and assistance to SMEs (on demand) in developing projects involving cooperation with the university;
- advice to the university on the costing of university contracts with third parties;
- help and advice for business start-ups.

Nevertheless, the OECD report "Industry and the University - New forms of co-operation and communication" in 1984 (3), recognised that "the vitality of these links is to a large extent a function of the vitality of the personalities in, and organisation of, the transfer point."

"Coordinatiecommissie Kennisoverdracht" (Mixed transfer structure)

Twente Technische Hogeschool has indicated a commission, the Coordinatiecommissie Kennisoverdracht (coordinating commission for transfer of know-how), that has the task to coordinate all activities of technology and know-how transfer. It is composed of members of the Administrative council, the departments, the transfer point and some outside members.

"Bedrijfscenter" (Business centres)

The role of these centres, located outside the university structure, is mainly to help start-ups, in a way similar to incubation centers. It is usually a municipal initiative often with the support of banks. They provide offices with infrastructure, management and financial advice. Sometimes they concentrate on links with one university. Examples

- the Bedrijfstechnologische Centrum in Twente
- a pilot project in Delft
- the Bedrijfscentrum in Amsterdam created by a private company
- ABC (Leiden): the Academisch Bedrijfen Centrum, Leiden, was initiated by the university together with the municipality and the chamber of commerce. It is especially geared towards the development of high-tech products.

Mixed structures for technology transfer - the "Technologisch Centrum Utrecht"

This foundation was created by the chamber of commerce, the municipal authorities, enterprises together with the Gemeentelijke Hogere Technische School Utrecht, and other local institutions. The task of the foundation is to conclude and administer contracts on research and advisory services between public authorities, companies and the institutions.

Spin-off comapnies and part-time jobs

This structure for technology transfer is quite widespread in the Netherlands. Most transfer points give advice on the creation of new companies, in particular spin-offs.

In 1981, the Twente University of Technology commissioned a survey on the number of spin-off companies created by its graduates or members of staff. This survey indicated that some 43 companies had been created. The figure is now guesstimated to have risen as high as 350. The analysis showed that most spin-off operations were either technically-oriented production entities or service companies.

The most difficult phase for spin-off companies appeared, according to this analysis, to be during the initial phase. This has led to publicly-assisted support for part-time jobs for the creators of these companies in the institution's laboratories. Young enterpreneurs can thus work part time in the laboratories of the institution for 1/2 to 1 year and participate in a departmental project. This gives them the opportunity to have some basic revenue during their company's start-up.

Science parks

Science parks with direct links to the institution have not been mentioned often by respondents as examples of technology transfer. The exceptions are Leiden (Bio-Science Park), where the initiative came from the municipality, and Groningen ("Stichting Science Park"), which was described by the transfer point in Groningen as a "para-university institution". The Groningen Park was created with the support of the government, Groningen's teaching hospital, and three provincial authorities. In a report by the Rijksuniversiteit Groningen it was mentioned that the transfer point of the university and the science park should present a coordinated profile to the outside. It was expected that the transfer point would channel projects towards the science park. Cooperation was foreseen in the areas of databanks, infrastructure, commercialisation of university ideas and inventions.

Transnational transfer of technology: "the joint Galway - Groningen project"

In 1985 this Irish-Dutch cooperation project started with the intention of enlarging university-industry links from the local/regional to the international level. The industrial liaison departments of the University College Galway and Groningen University started this project in October 1985 with the appointment of regional project officers. The personnel appointed in the two institutions concerned were entrusted with identifying the transfer potential from the standpoint of SMEs requirements in their regions. Companies could thus benefit from the know-how and other resources in the H.E. institution in the other country. This project benefitted from EC financial support.

National network of "Transfer Points"

The transfer points have been combined in a national network, (OTRA), whose members meet once a year. Furthermore, substructures have been developed on a regional basis.

(vii) PORTUGAL

(a) Objectives of cooperation and transfer of technology

Only one university responding (Coimbra) had considered a clear and structured approach concerning its objectives. None appears to have a published policy on general cooperation.

(b) Policies and procedures for coopration and transfer of technology

None of the respondents indicated having a published policy or procedures for general cooperation, consultancy or intellectual property.

(c) Structures for cooperation and technology transfer

No special structures for technology transfer appear yet to have been developed.

(viii) <u>SPAIN</u>

(a) <u>Objectives of cooperation and transfer of technology</u>

5 out of 8 respondents have a published policy on collaboration with Industry. However, no university has indicated that it has organised an audit of its transfer capacity.

(b) <u>Policies and procedures for cooperation and transfer of technology</u>

Although many universitities have a published policy on general collaboration with industry, only four respondents have a published policy on consultancy and only two have a policy on intellectual property. None has indicated revenues from intellectual property rights.

(c) <u>Structures for cooperation and technology transfer</u>

Out of the 8 responding institutions, 4 have said they possess a staff/body for liaising with industry (ILO or ILC). Only in one university were links with a science park mentioned, although there exist several science parks in Spain. A representative of the Basque country, who is concerned with the creation of a science park, has explained that this type of link with the universities is not always favoured by companies who, by and large, appear to consider the level of much H.E. research to be inappropriate for their purposes.

University-Industry-Foundations

This is the most common form in Spain for structured contacts with Industry. It appears to have been chosen for reasons of flexibility and independence. It gives universities the possibility of using funds obtained from contracts with the minimum of bureaucracy. Furthermore, the Foundations' mixed university-industry boards guarantee a balanced input from Industry and the H.E. Sector in the definition of research contracts.

The most common tasks of the Foundations are to:

- administer contracts;
- improve the mutual understanding between university and Industry;
- initiate common research programmes;
- contribute to improving training for business;
- assist with measures for regional development;
- promote the creation and sponsorship of special chairs by companies.

* * *

B. SURVEY OF THE QUALIFICATIONS, EXPERTISE, EXPERIENCE AND CRITERIA FOR APPOINTMENT OF THE STAFF WORKING IN THE ABOVE STRUCTURES, PARTICULARLY WITH REGARD TO TECHNOLOGY TRANSFER

1. Survey of the four selected Community countries based on a series of interviews and a questionnaire

(a) IRELAND

The appointments in Ireland appear to have been made on the basis of the academic and government service backgrounds of the I.L.O's, not their experience in Industry, nor their knowledge of intellectual property and technology transfer. Several of the officers have served in the IIRS during their careers, and the majority are from non-engineering academic backgrounds. The only recent appointment that has been made from Industry, by way of a secondment, did not meet the preconceived objectives of either party, and has been followed by an internal appointment.

"What are the qualifications of the executive persons liaising with Industry?"

technical	1
chemist	4
business studies	1
no indication	3

The majority of the I.L.O's possess excellent academic records culminating in Doctorates; for some reason a degree in chemistry is the common academic factor linking several of the ILOs. The academic standing of the majority also appears to have been accepted within their institutions.

"Do they have expertise in Industry, financing institutions or public service?"

Industry	5
government	1
none	1
no indication	2

Many of the ILO's have combined experience, both in Industry and government service, in their career patterns. It would appear however that in many cases the experience gained prior to taking up the post of I.L.O. has been of assistance to general cooperation only and does not prove the experience and expertise required for technology transfer.

"For how many years have they been exercising that job?"

more than 10 years	-
between 5 and 10 years	3
between 2 and five years	2
less than 2 years	4

Ireland is fortunate in having some experienced ILO's who have been in post for approximately five years or more. Their experience should prove most useful in bringing the benefits of cooperation to the notice of staff, students and industrialists. To-date however it does not appear that sufficient internal "missionary" work has been carried out in institutions.

"How were they appointed?"

internal appointment	4
advertisement	5

The Universities and NIHE's have looked outside for the majority of their staff, and the RTC have made internal appointments. This is probably due to the difficulty in getting qualified persons to work part time in some of the RTC's whose present activities would not a present warrant a full time appointment.

(b) UNITED KINGDOM

The majority of institutions in the UK have only one executive officer in charge of liaison. It is to be noted that an increasing number of officers are coming to their posts from Industry, on fixed term contracts. The information supplied indicates that the persons who are being appointed do not have the required expertise and experience in intellectual property and technology transfer.

"What are the qualifications of the executive persons liaising with Industry?"

	universities	polytechnics
engineers	11	5
chemists	3	1
solicitors	2	1
economists	1	-
marketing	4	-
accountancy	2	-
scientist	5	1
phycisist	1	1
product manager	1	-
educationalist	3	1
chartered secretary	1	-
bio-chemist	1	-

As in the US, the majority of the staff carrying out the functions of an I.L.O., are engineers from all three divisions of the profession. This emphasises the need for practical and analytical minds in this post. Many of the job descriptions have mentioned the need to appoint an officer with a knowledge of intellectual property; the lack of this expertise in those who are appointed points the need for the provision of the relevant training.

"Do they have expertise in Industry, financing institutions or public service?"

	universities	polytechnics
Industry	28	7
other	2	-
None	8	2

The appointment of staff in the universities has now moved from the majority being seconded from within the institution itself, which was prevelant in the 60's and 70's, to the appointment of persons who have worked in Industry. The industrial experience however does not appear, in many cases, to have been in management disciplines applicable to the basic duties of an I.L.O.

"For how many years have they been exercising that job?"

	universities	polytechnics
more than 10 years	7	2
between 5 and 10 years	4	-
between 2 and five years	8	-
less than 2 years	18	7

The number of ILO's who have held their posts for approximately two years clearly shows that there has been a considerable movement of staff recently. There are also several I.L.O's whose terms of service will expire over the next two years. This means a considerable loss of experienced I.L.O's to the institutions at a time when development of general cooperation and technology transfer are becoming of increasing importance to institutional forward planning.

"How were they appointed?"

	universities	polytechnics
internal appointment	15	7
advertisement	17	3
other:		
recommended	1	-
by invitation	2	-
Seconded	1	-
research contract	1	-

The increase in advertisements in the general, and specialist press for the post of ILO over the past eighteen months, and terms of the appointment clearly indicate that the duties are of an industrial/professional nature, not the internal appointment of an academic. As far as can be ascertained, only one institution has made an internal appointment from academic staff, without any industrial or professional experience, during this period.

(c) FRANCE

The information provided shows that most of the liaison bodies have only one executive officer, that very few are appointed for a fixed period of time and that most are doing the job on a part time basis.

"What are the qualifications of the executive persons liaising with Industry?"

economists	2
engineers	4
computer scientists	1
researchers/scientists	4
physicists	3
chemists/biochem.	2
biologists	1
geography	1
administrators	1
other professions	14

In several cases no reference was given concerning the qualifications of the personnel. Nevertheless, the general picture is quite different from the situation in Belgium, as shown below. There is no lawyer represented in these bodies, and much more importance is given to a scientific background. This may be due to the fact that the legal advice is provided in many cases by the CNRS.

"Do they have expertise in Industry, financing institutions or public service?"

Yes	15
No	8

8 H.E. institutions provided no information on this.

Although the majority of the persons responding indicated that they do have outside expertise, many institutions still rely on liaison bodies that are composed of scientific personnel which has only educational and research experience. This makes it sometimes difficult to be accepted by Industry. In fact, industry representatives frequently complain that the personnel dealing with Industry in the H.E. Sector does not always have the qualifications and personality which Industry would expect - and respect.

"For how many years have they been exercising that job?"

more than 10 years	1
between 5 and 10 years	3
between 2 and five years	6
less than 2 years	14

6 H.E. institutions did not provide the relevant information.

Most H.E. institutions have appointed the staff relatively recently. This reflects the changing legal situation explained in Part II. Most of the persons interviewed said that they are "learning on the job" and that only little assistance is provided on a national basis concerning training.

"How were they appointed?"

internal appointment	17
advertisement	3
seconded	3
other:	
personal relations	4
external recommendation	1

The fact that most of the staff was appointed via internal appointment appears to show that preference is given to knowledge of the institution over practice in industry. The advantage is probably that it is easier for the person so appointed to be accepted among the institution's staff. However, these qualifications may be sufficient if the task of the person is restricted to doing internal "missionary" work concerning collaboration with Industry.

(d) BELGIUM

In Belgium, one third of the institutions contacted possess a body staffed by only one executive officer, whereas two thirds have larger units. Often the composition is one full time officer assisted part time by teachers. In only one case did the person have a contract for a fixed period of time. Half of the persons dealing with Industry carry out their job on a full time basis. In Belgium much importance is given to outside experience. Experience in a political or financial administration is a special asset.

"What are the qualifications of the executive persons liaising with Industry?"

economists	4	
civil engineers	2	(one in combination with management)
engineers	1	
lawyers	3	
chemical engineers	1	
scientists	3	
applied science	1	
financing	2	
computer scientists	1	

The qualifications of the interface personnel are various. However, a general feature in Belgium is, if possible, to have a combination of different disciplines represented in the body, eg. a lawyer and a scientist. Knowledge of legal questions is considered to be important, because much of the advice that the industrial liaison units have to provide concerns contracts.

"Do they have expertise in Industry, financing institutions or public service?"

yes	12
no	9

Experience in the political sphere eg. in the "cabinets" of regional or national ministries, has been mentioned as very important in Belgium. This may be explained by the fact that a large proportion of the national funds have been regionalised and knowledge of the procedures for eg. research contracts on a regional and national level is important. Knowing the relevant authorities is furthermore an asset if the establishment of a science park is envisaged.

"For how many years have they been exercising that job?"

more than 10 years	1
between 5 and 10 years	3
between 2 and five years	4
less than 2 years	6
no indication	1

As these figures clearly show, few have been held their job for long. Most mention a lack of national and European structures that would permit an exchange of experience. For training they indicated "learning on the job" and participating in relevant conferences.

" How were they appointed?"

internal appointment	13	
advertisement	6	(+ 1 combined adv./internal)
other:		
seconded	1	
outside appointment	1	
personal contact	1	

The majority of the personnel has been appointed internally. Belgium as well as France stress the importance of an I.L.O. knowing the internal structures of the institution he/she is working for.

2. Survey in all other Community countries based on replies received from a questionnaire and other available information

(a) DENMARK

Only one of the responding institutions indicated it has a staff to execute the institution's policy on collaboration with Industry and provided the necessary information (see Appendix 3 b). However, mention should be made of the Danish Invention Centre (see Part II of the Study) which has a person dealing especially with transfer of technology. His profile looks as follows: Master in chemical sciences, with some 20 years of experience in industry (product development), including several years of administrative responsibility. These activities provided him with expertixe in patent and licensing matters.

(b) GERMANY

Based on the replies to the questionnaire, most of the industrial liaison units have only one executive person. Unlike many other EC countries, most are working full time; in several institutions the persons are employed for a fixed duration. The proportions between people having industrial and similar experience and the ones not having it appear roughly equal.

"What are the qualifications of the executive persons liaising with Industry?"

universities

economists	8 (1 with law)
marketing/P.R.	2
physicists	3
chemists	2
agric. engineers	1
mathematicians	1
sociologists	1
natural sciences	1
engineers	13
others	4
no indication	2 universities

Five persons have doctorates, which indicates a certain involvement in research. Two universities have not provided the relevant information.

"Fachhochschulen"

engineers	6 (1 with economics)
economists	2

German H.E. institutions that answered specified in many cases that the officer responsible for liaising with Industry has the title "Dipl. Ing." (without specifying the field), which might indicate a certain preference for the "applied sciences". Universities employ many economists and marketing specialists in comparison with eg. France.

"Do they have expertise in Industry, financing institutions or public service?"

	Universities	Fachhochschulen
yes	12	5
no	11	2
political expertise	1	-
no indication	7	1

"For how many years have they been exercising that job?"

more than 10 years	1	-
between 5 and 10 years	5	-
between 2 and five years	2	4
less than 2 years	17	2
no indication	3	2

Most persons have been exercising their job for less than two years. Training for these people appears already to have been recognised by the German government. The GHS Kassel has been entrusted with the organisation of a training programme (see Part II).

"How were they appointed?"

	Universities	Fachhochschulen
internal appointment	11	3
advertisement	12	3
other	4	2

According to the indications in the questionnaire, German H.E. institutions use advertisements for appointing their ILO-equivalent more frequently than other countries.

(c) GREECE

Information on structures and their composition was not provided in representative numbers (see Appendix 3 b).

(d) ITALY

As only two universities have provided information concerning liaison personnel, a general commentary is difficult. Nevertheless, indications show that the "administrative council" of the institutions appears to be in charge of contacts with Industry. Staffing and appointments thus tend to be internal.

(e) LUXEMBOURG

H.E. institutions in Luxembourg do not yet dispose of a relevant staff or body.

(f) THE NETHERLANDS

The Netherlands, with its special structure of transfer points, usually has bodies staffed by more than one person. Most are employed full time on a tenured basis. It is, however, difficult to make an assessment about the importance given to industrial experience, because not all the forms returned were filled in properly. 4 persons indicated that they had industrial experience, and 2 did not have this outside experience.

"What are the qualifications of the executive persons liaising with Industry?"

engineers (without any further specification)	3
doctorates (without any further specification)	7
agricultural economists	1
biologists	1

In addition, the Hogeschool Eindhoven has appointed one representative per faculty (in total 6). The indication that most of the persons have a doctor title indicates the importance given to the scientific knowledge and understanding - independent of the field of speciality of the personnel.

"Do they have expertise in Industry, financing institutions or public service?"

Industrial experience was mentioned in the case of 4 people, whereas 2 people do not have industrial expertise. For the remaining 11 respondents relevant information was not provided.

"For how many years have they been exercising that job?"

more than 10 years	2
between 5 and 10 years	3
between 2 and five years	1
less than 2 years	14
vacant	1

The Dutch situation concerning the experience on the job is similar to most other countries. Most people have been liaising the H.E. Sector with Industry for less than two years. They do, however, have a national "club" of these experts, which facilitates the exchange of information and experience.

" How were they appointed?"

internal appointment	13
advertisement	2
other:	
seconded	2

The proportion of internal appointments is very high. Much importance is given to the knowledge of internal structures of the HE institution, which is already reflected in the qualifications of the personnel (the high proportion of staff with a doctor title).

(g) PORTUGAL

No special personnel exists for technology transfer or general liaising with Industry, and thus no indications can be given on the personnel's qualifications.

(h) SPAIN

Spanish liaison is mainly organised via the University/ Industry Foundations (see Appendix 36). Clearly all these Foundations are extensively staffed with representatives half from Industry, half from the institutions. This specific structure explains also why responses to the questionnaire make it appear that half of the staff has industrial experience, whereas the other half has not got this experience. Very few persons are exercising these tasks on a full time basis and most only for a fixed period of time.

Only the university of Barcelona has indicated a personnel internal to the university (composed of an economist, an administrator and an equivalent to an MPhil).

* * *

C. SURVEY OF THE RELEVANT STRUCTURES IN SWEDEN AND THE U.S.

To provide a further comparative background, the relevant structures being utilised in Sweden and the U.S. are now considered. Specific consideration is also given to staff dealing with technology transfer in the U.S. The background to developments in cooperation in Sweden and the U.S. was given in Part II.

1. SWEDEN

The establishment in 1969 of one of the first formal structures for cooperation between the H.E. Sector and Industry, the Liaison Offices at Universities, was initiated by STU.

(a) Liaison Offices

These offices were funded by STU until the beginning of the 1980's when they became an integral part of their University under the responsibility of the National Board for Universities and Colleges (NBUC).

The objectives of these Offices _inter alia_ are:

* To further contacts with other universities, the local community, national and local government, Industry, trade unions and other organisations;

* To encourage the utilisation of university staff and facilities in the development by outside bodies of products, processes and services;

* The primary objective of the Liaison Office is to deal

with specific problems and assist in the development of projects;

* To give priority for assistance to small firms and inventors.

The work of the Offices is therefore targeted on assistance to and the development of SME's, assistance to local government and non-government bodies, and also to individual inventors and entrepreneurs.

Offices have now been established in all the nine major Universities; there are also Offices in some of the smaller institutions. The total staff of the Offices now number approximately 30.

Although the permanent staff of each Office may be minimal (1 executive and 1 secretary on average) they have a very important role in developing cooperation with Industry. The bulk of their work appears to be in generating industrial contacts and the brokerage of research contracts. They also undertake marketing of the University's resources and set up data bases to assist local industry.

The I.L.O. is closely associated with the Vice-Chancellor's office, and the post is part of the administration of the institution, financed through the ordinary budget. Financial assistance is also supplied by STU which supports some of the Offices. Special funds are also available for programmes developing and strengthening both general liaison and technology transfer.

All the ILO's hold academic qualifications but do not appear to have undergone formal or common training but they have meetings two or three times a year to discuss common policy matters and current problems.

The ILO's work within designated geographical areas and can seek assistance from any institution which can supply their technical needs. The work is of a facilitating nature, that of a "broker" rather than being deeply involved in individual projects.

Universities had also established information offices in the 1970's to ensure that their activities were well known to industry and the public. Coordination between the two offices is therefore essential, to ensure optimum use of valuable resources.

The Swedish Industrial Association, and regional Chambers of Commerce, have also set up offices of a similar nature in four or five areas to cooperate with the H.E. Sector.

(b) Liaison Researchers

Although the necessity for increasing links between the H.E. Sector and Industry had been stressed in several official documents at the beginning of this decade, the need to make academic cooperation more directly available to SME's and local government, had been particularly recognised.

This led to the Government Commission on Research Co-operation being asked to report on a scheme for the lending of the services of academic staff to Industry and the Public Sector. The Report was received in 1980 and the Commission was asked to implement a contact programme making these services available.

The salary of the post is paid jointly by the company and Government, normally on a 50% - 50% basis. All other expenses are paid by the company.

The initial programme was established by regional committees at four universities (Upsala, Lund, Gothenburg and Umea) with government funding of about SKR 8m. The programme provided the services of academic researchers and teachers to the bodies that required their assistance.

A review at the end of the first three years stated that 97 members of academic staff had been involved in 79 projects. 23 projects were in manufacturing industry, 18 with local government, while the remainder covered the service industry, trade unions etc.

Of the companies involved, 22 had less than 20 employees and 25 firms had less than 50. The review indicated that there had been general satisfaction with the implementation of the programme and the work of the academic staff. Most of the firms involved stated that they would wish to continue cooperation under the programme even though they had to bear part, or all of the costs.

The importance of the personality and expertise of the staff concerned, and the regional policy aspects of the programme, were also identified in the review as being the most important factors in its apparent success.

The programme has been continued on a partially subsidised basis and it will be interesting to ascertain if the initial transfer of academic technology and knowledge is still continuing.

(c) Coordinated Research Programmes

The STU initiates plans and coordinates specially identified research programmes. They also ensure that the relevant industrial companies are directly involved in these programmes.

The programmes are established to develop technical scientific knowledge combining the resources of institutions and industry.

As a result of these programmes major, concentrated, and targeted research projects are funded for a period of at least five years. Because of the applied nature of the projects a network of contacts, both national and international, has grown up which has given the programmes a considerable impact and "achieved great significance in terms of development of knowledge and powerful expertise in international terms. Activity under these programmes and international exchange of experience strengthens Sweden's ability to develop its own technology and to make the best use of foreign technology."

It has also been noted that these programmes have had a direct benefit on the teaching and research capabilities of the staff involved.

An example of a programme of this nature is a joint project in biotechnology, which commenced in 1982 at the University of Upsala, funded by that institution, the STU and a pharmaceutical company Fortia. The project was set up in the Department of Cellular Research but the staff concerned were employed by the Company on terms and conditions smilar to those of an academic researcher.

The objective of this project is "to increase the knowledge base in fairly broad areas of biotechnology <u>but</u> with a clear goal in mind : to make it possible to produce biological substances like nucleid acids, proteins and peptides. The company is also interested in raising the number of researchers in the field. Since the researchers employed by Fortia at the University are involved as teachers and advisors in the regular postgraduate education, the Company expects in due time to have access to a pool of talented Ph.D's who are from the start inclined to go into research directly relevant to the pharmaceutical products Fortia hopes to develop."

(d) Cooperative Research Institutes and Centres

Concern expressed about the slow rate of increase in productivity in Swedish Industry led to the introduction of a Bill in Parliament in 1982 establishing three centres, in Stockholm, Gothenburg and Linkoping, to assist in manufacturing development.

These centres act as links between, academic and research institutions, and Industry. They perform their own research and development and disseminate new technology, particularly in the fields of micro-electronics and computer aided design. The centres also act as a link between institutions and Industry.

These centres supplemented the 30 or so Cooperative Research Institutes which already existed in 1982, the largest being the Pulp and Paper Research Institute, from which a centre has also been created.

It has been noted that besides being vehicles for commercially applicable R&D the centres have been direct means of access for graduates into Industry.

(e) Education programme for scientists

The need to have academic scientific staff, engaged in research, trained to manage important research programmes, has also been identifed by the Swedish Government through a joint STU-NBUC Programme. This Programme has as its main goal "to convey to the project managing scientist the capacity to plan, organise and lead R&D projects of considerable magnitude and complexity".

The participants in the Programe have been scientists with previous major research management experience and the training puts special emphasis on the capacity to deal with industrial R&D projects.

(f) The Chalmers Technical University (CTH), Gothenburg

The strategy of this University, towards beneficial cooperation with Industry, has not been in the more traditional approach by the obtaining of research contracts, but in the establishing of personal links with Industry at all levels. These links had been mainly with large firms and they have led directly to the improving and up-dating of the content of the relevant undergraduate programmes.

Further consideration was also given towards developing links with SME's, and CTH has built up an international reputation for the establishment of companies developing technology generated in the University. These companies are referred to as "sprout" companies and are the Swedish equivalent to the American "spin-off" company.

As at M.I.T. and Stanford in the U.S. the "sprout" companies have been established by members of staff and students assisted by outside expertise. The main object is to transfer research results into production, and on to the market. CTH has helped this development by assisting in the obtaining of premises, supplying facilities, and in the joint purchase of specialised equipment.

In actively assisting these companies CTH is building one very important technical bridge with Industry.

Many established companies in Sweden, as in Community countries, have been very reluctant to take the risks involved in the development, of a "new idea" from academe. The cost of development and the identification of new markets are also seen as impediments to cooperation of this nature. These impediments, combined with the general conservative nature of SMEs had led to viable University Intellectual Property Rights (IPR) remaining undeveloped.

It was therefore decided to give staff the opportunity of transferring their own technology on to the market through Companies with outside partners providing any required expertise.

To assist in this technology transfer, CTH established its own Patents and Licencing Office dealing with the I.P.R's generated by staff. These rights are owned by CTH, and the Patents Office, on its behalf, carries out all the protection required and the negotiation of the transfer of the rights to the companies. The royalties or fees are shared between the relevant staff, the Department and CTH.

Members of staff concerned can be directors of a company but apparently not if they have a large equity participation in, or are giving a considerable amount of time to, the Company. In these circumstances they become members of the Company, but retain close links with CTH.

The first of these "sprout" companies commenced work in the early 70's and their number has been steadily increasing over the years.

In 1979 CTH opened an Innovation Centre. This was followed by the establishing of a Chair of Innovation in 1983. An Innovation Building, housing the Centre and its staff, was also opened in the same year.

During the past seventeen years over 98 "sprout" companies have been incorporated directly from work at CTH. Since CTH has been actively and directly concerned in this development, the number of spin-off companies has increased considerably. The present number exceeds 10 per year. Only one company has apparently failed over this period.

A recent element assisting the accelerating growth of spin-off companies has been finance from venture capital companies. Six companies have been established due to the availability of this financial facility.

Details of a number of "sprout" companies incorporated by 1984 are set out in the table below. Column A shows the Departments of origin. Column B shows the number of spin-off companies "fathered" by the Department. Column C shows the number of patent applications taken out up to 1982, as a result of the work of the Departments.

A	B	C
School of Technical Physics	9 Companies	14 Patent applications
School of Chemical Engineering	14 "	51 "
School of Electrical "	38 "	50 "
School of Mechanical "	20 "	36 "
School of Civil "	16 "	13 "
School of Architecture	1 "	0 "

About 30 of the companies manufacture products, the remainder do consultancy and computer work. About 30 companies are still occupying University premises.

CTH adopts a very liberal approach to the use of its premises. When a company reaches a certain size and has sufficient funds it is asked to pay for the premises it is occupying and the services it is receiving, normally at cost. When the company has grown even bigger it then leaves the institution's premises.

Realising that it could directly benefit from the continued presence of some of these companies, CTH provided facilities for them at the Innovation Centre. Three companies were established in the Centre at the beginning of 1985.

There are approximately 800 employees in all the spin-off companies and a 1985 report indicated that the employees of the companies should, at the present rate of growth, exceed those of the University (2200) by 1988. (1)

Founder members of the companies have come from graduates, academic staff, students, and technicians in that order.

The marketing of the work of the Innovation Centre is carried out through a yearly up-dated catalogue based on the work of the companies. Also a subscription publication in the form of a newsletter, setting out details of the new products and any new companies, is distributed four times a year.

<u>The introduction of a venture capital market in Sweden appears to stem from corporate tax changes in 1982</u>. It is a new element which has brought about an acceleration of the work of the Innovation Centre.

The Centre has therefore attempted to evaluate the commercial development of CTH research in a quantitative manner. The support received by one research group (Electron Physics 111) was quantified over a ten year period, interest free, at 17 million SEK. This included all unversity input, including teaching, and government funding.

During this time several inventions were registered, and several spin-off companies incorporated directly as a result of these inventions.

Venture capital support has now become available to these companies. In one company a venture capital firm purchased 10% of its equity for 1 million SEK, setting the value of the total equity at 10m SEK. Since then further venture capital investments have been made in a total of five relevant companies, bringing the aggregate value of these investments to 34 million SEK, double the estimated original input. (2)

This is obviously a very basic method of quantifying academic research and its subsequent transfer into the industrial world. However, it is one of the few examples, which are available, showing why some institutions in the Europe and the U.S. have become aware of the potential benefits from, and the essential need to protect and develop their intellectual property, through the utilisation of institutional assisted structures, such as companies.

* * *

The outstanding factor which arises, in considering the development of cooperation in Sweden, with other Western Countries, is that in many of these countries there appears to have been a "hands off", and changing approach by Governments to the need for innovation in academic science and technology.

This does not appear to be the case in Sweden where the Government planning, the coordination and implementation of the various programmes, aided by strong financial support, would indicate sincere and maintained backing for a defined policy on innovation. This approach has helped maintain Sweden's place on the international markets.

* * *

2. THE UNITED STATES

In view of the practical information which can be gained by careful consideration of established structures in other institutions or nations engaged in cooperative enterprises, a fairly detailed review has been carried out on relevant American structures and some of the staff dealing with these structures.

(a) Consultancy

Academic staff consultancy with Industry is recognised as a cornerstone upon which beneficial cooperation is established, to the benefit of both the institution, and the consultant "paid consultants tend to be more active in departmental and faculty affairs than non-consultants and tend to publish more as well".(1)

It has also been accepted in the US, that consultancy keeps academics in touch with their subject, and allows them, particularly in applied courses, to transmit to the student the relevance of the academic discipline.

A 1981 study at M.I.T. has also confirmed that ideas leading to technology transfer appear to come mainly from staff with a good consultancy record. Of those staff who consult, apparently "80% reported having commercial ideas, versus only 18% idea-havers among the non-consultants, a clearly significant relationship".(2)

Many institutions have established guidelines and reporting systems allowing, on average, one day per week for consultancy. Guidelines were inter alia deemed necessary in institutions to ensure that this privilege is not being abused and that the type of consultancy being undertaken was related to the professional interests and development of the consultant.

Reporting systems also allow the institutions to ascertain, and update, consultancy expertise which can be marketed as part of their cooperative policy.

The importance of consultancy to the eventual transfer of technology is confirmed in a British survey, on the U.S. scene, carried out in 1983, when it was considering the establishment of an environment, in which academic enterprise would flourish.

> "The most important factor here seems to be the attitude of the university towards the private involvement of staff in consultancy and other direct commercial interaction. Both M.I.T. and Stanford are distinguished from other universities by the positive encouragement which they give their staff to engage in outside consultancy and by their readiness to consider it as a factor in making appointments. As a result between 70% - 80% of their scientific staff engage in outside consultancies of some sort".(3)

A further British article also highlighted the practical result of the U.S. approach to consultancy "Three out of four research contracts given by industry to American universities evolve out of a consultancy relationship between a particular professor or researcher and a specified company. Consultancies arise far more easily in the U.S., where they are usually seen as a feather in the academic's cap". (4)

Special units to assist in obtaining consultancy work and marketing this expertise have also been set up in some institutions. A fee is normally charged for those services, as a surcharge on the consultancy fee.

(b) Policies on Intellectual Property

To establish the needed environment for beneficial cooperation and technology transfer, not only are equitable institutional policies on staff consultancy required, but also, equally as important, are the promulgation and acceptance of the policies dealing with Intellectual Property generated within the institution.

The basic policy adopted at M.I.T will be utilised to illustrate the approach adopted in many U.S. institutions.

Recognising the importance of the intellectual property which its research work generates, M.I.T. has established definite guidelines in the development of any relationships for technology transfer between itself and industry.

The fundamental issues which have been covered by these guidelines are:

* "Relevance of a proposed research program to the essential missions of the university and industry: how is a collaborative program designed which maintains a balance between the university's pursuit of research as an integral part of the educational process and industry's search for useful knowledge, to be applied in the development of products, processes and services.

* "Time-frames for research efforts: how is a program organised which provides an accommodation to the different time constants of industry and of the universities, where graduate students - and their theses, which at doctoral level may stretch over several years - are immediately involved with the research effort.

* "Proprietary rights to openness: how is the protection of proprietary information provided by industry assured while meeting the statutory and ethical requirements of the university - which demand that research serve a broad public good, that it be

conducted in an atmosphere of openess and free exchange, and that results be available for distribution on a non-confidential basis.

* "Patents and copyrights: how are methods of licensing determined that will promote the progress of science and technology: assure that discoveries and inventions are utilised in ways most likely to benefit the public: and provide both adequate recognition to inventors and appropriate financial support to the unversities." (5)

These guidelines attempt to balance the encouragement of academic publication with the need to ensure that premature publication does not harm institutional ownership of intellectual property.

In dealing with industrial-sponsored research, specific care is also taken to protect the confidentiality of client information.

It is institutional policy to claim ownership of intellectual property arising from sponsored research, as well as ownership arising from its own research activities. Normally non-exclusive royalty bearing licences are given to industrial sponsors on negotiated terms. However the grant of an exclusive licence can be made if it is in the public interest to encourage the marketing and eventual public use of the invention.

Since July 1981, under the Federal Patent Policy Act 1980, the ownership of intellectual property funded through Government agencies is in effect vested in the institution carrying out the project, subject to Government's right to use the invention, on a non-exclusive basis, free of royalty payments, and other safeguards.

Exclusive licences of Government-funded intellectual property can be granted, if this would be of direct benefit to college technology transfer. However, Government policy is to encourage the widespread use of their funded inventions for the public benefit. Normally therefore, non-exclusive licences are granted to all qualified applicants.

A very important object of M.I.T.'s patent policy is to ensure that there is full recognition, both financially and in academic standing, of the inventors, together with obtaining appropriate revenues for the institution.

The patent licensing activities of M.I.T. are now generating income in excess of $ 2,000,000.

The terms of the 1980 Act mentioned above has been recognised as having had a direct increase in the amount of technology coming to the market place from institutions and businesses who have received federal funds for R&D activities.

(c) <u>Industry Funded Contract Research</u>

The funding of a specific research project with individual members of staff has been the most common form of research collaboration in the US amounting to approximately 50% of all industrially sponsored funding.

Concern has been expressed however, that significant funds from industry for major research programmes have diminished. Companies with limited funds apparently now tend to give grants for graduate and post-doctoral research, normally funding salaries for specific periods.

(d) Government Funded College/Industry Cooperative Research

The main Government funding bodies are the Departments of Defence, Agriculture, Commerce and Energy, also the National Science Foundation. In view of complaints about lack of innovation in the U.S. economy, there has been an increase in funding for their programmes.

Government Departments act as the brokers bringing colleges and industry together and supplying necessary funding to make one party the prime contractor, and the other the subcontractor, to undertake government research and development projects, e.g. the Space Programmes.

One programme which has received wide acceptance is the N.S.F./Industry/University Cooperative Research Grant Programme (IUCR) which was initiated in 1973.

The object of this programme is to strengthen the linkages between the two sectors and also to strengthen fundamental research in science and engineering thereby improving future opportunities for industrial technology. Projects are submitted jointly by the two sectors and allows academic access to valuable industrial facilities and information.

The first four years of the programme resulted in the award of 231 competitive research grants totalling nearly $ 30m to fund 39 institutions in the carrying out of cooperative research projects with 88 compaies.

(e) Group or Consortial Arrangements Fostering Cooperative College/Industry Research

The multi-company approach to college research appears to be developing faster than most other forms of cooperative research. This could be due to the present national economic situation, the growing cost of "in-house" research, and, increasing multi-disciplinary research problems.

The two mains types of arrangements in this category are first, Focussed Industrial Liason Programmes (which differ from general purpose programmes "to the extent that these programmes involve a degree of technical focus on cooperation by the parties involved" e.g. electromagnetics propagation and geosignal processing).

The other arrangement is the Research Consortia which are "specific mission programmes organised to ensure that generic or mission oriented research will be carried out". The establishment of the Council for Chemical Research which has received funding of over $2,000,000 to support institutional research, is an example of this form of cooperative research.

(f) Institutional Facilities

This category covers college facilities offering special centres to deal with industrial problems and needs, including research projects. They are recognised in the U.S. institutions as being one of the most effective ways of furthering interaction with Industry, providing a flexible and multi-disciplinary approach which institutional Departments perhaps could not provide.

Some centres have been specifically set up to meet the needs of industry and include the Centres for Integrated Circuits, and Biotechnology at Stanford and, the Laboratory for Laser Energetics at Rochester.

From perusal of the relevant U.S. literature one of the main advantages of this structure appears to have been the administrative activity of the centres to find industrial partners and pass on institutional innovations.

It must be noted however that, side by side with their centres, the successful institutions are also able to maintain a number of "commercial units" such as Development Offices, Legal departments, Research Contract offices and Patent and Technology Transfer offices, on a scale which has not to date been established in Europe.

The basic infrastructure of such a "unit", is set out in Appendix No.14. This shows how many U.S. institutions identify the essential need for an unencumbered professional administrative facility in an institution to allow it to deal pragmatically with industry.

One of the categories of centre which is becoming more popular is the Cooperative Research Centre (CRC).

Since the early 1970's CRC's have been developed through the NSF within its Division of Industrial Science and Technological Innovation. A CRC is defined as "a University-based, typically interdisciplinary, program of research supported jointly by a number of companies".

(g) Industrial Liaison Programmes

For some years many U.S. institutions have been developing close links with industry through their Industrial Liaison Programmes of various types. This allows a Company direct access to information and expertise within an institution.

Probably the most internationally known programme is that carried out at M.I.T. since 1948. It still presents a good example of a well established Liaison Programme whose policies and practices can be considered and adapted for Community use.

The M.I.T. Programme is carried out by approximately 15 Liaison Officers who are experts in their own technical fields. Usually an Officer will have a degree from M.I.T. and/or research experience at the Institute. They are experts on M.I.T.'s infrastructure and Faculty.

Several years' experience in industrial or other relevant backgrounds are required of these Officers, and their technical backgrounds range from all branches of engineering, through chemistry, physics, to psychology and management.

An Officer is attached to several relevant industrial organisations and is responsible for ensuring that his "clients" obtain the optimum benefit from the programme.

Liaison Officers spend about 20% of their time away from M.I.T. obtaining a comprehensive understanding of their clients problems and interests.

The Liaison Officer is responsible for ensuring that the services offered by the Programme are utilised for the optimum benefit of the client. In his work, not only is he backed up by other Liaison Officers, but each member company has the services of a "back up" Officer.

The Liaison Programme publishes an annual directory of Current Research which contains a comprehensive summary of all M.I.T. research programmes. In addition a monthly "M.I.T. Report" is distributed containing 80-100 titles of reports with relevant abstracts. Copies of the reports listed can be obtained by returning a response card.

The M.I.T. Industrial Liaison Programme, therefore, offers its members:

* Direct access to research results without having to invest in the research.

* Direct access to the consultancy expertise of M.I.T. staff.

* Creation of close ties with M.I.T.

* The facility to efficiently monitor the progress of technologies which are of direct interest to the member.

(h) Technology Transfer Programmes

Some of the programmes categorised under the heading have been in existence for some years but many have arisen out of the Federal Government's concern, at the end of the 1970's, about lagging U.S. innovation in the international market place.

It has been recognised that beneficial transfer of institutional technology to industry, was a major element in developing innovation in the US, but that its actual transfer had many problems, including lack of industrial support, and non-Government funding.

Several Government-sponsored programmes to develop innovation have not been regarded as successful todate, but the essential need for transfer of institutional technology is still accepted. Institutions have now therefore taken the lead themselves, by establishing their own vehicles for the commercial development of their research, with the help of government and other interested parties.

The format of some of these vehicles has already been adopted or adapted in Europe.

* Innovation Centres

In June 1973, the NSF established three Innovation Centres at M.I.T., Carnegie Mellon University, and the University of Oregon. These centres were designed to assist innovators and entrepreneurs to develop their skills to a point when they could be launched on the market place. By the end of the NSF funding in 1985 there were eight Centres, the Centre at the University of Oregon having closed in 1980.

The main object of the programme was - "a limited duration federal cost-sharing with universities, to develop a centre which could educate potential technological entrepreneurs and innovators".

The first three centres initially utilised their Schools of Business and Engineering to provide the necessary input to develop the innovative and entrepreneurial spirit. They were designed to:

* Evaluate technology and R&D results;
* Develop new products and services;
* Provide assistance to independent inventors;
* Establish new business ventures.

The NSF claims that the centres had, by 1982 returned to the U.S. economy $9.70 for every $1 invested in them.

One of the most important lessons learned from the development of the U.S. centres, was that they should be incorporated separately from the host institution (6).

At the end of the NSF funding of Centres in 1985, a study on their viability was carried out. This study identified three issues which directly related to the survival of a Centre. These were, Centre-University relationships, the roles of the Centre Director and his staff, and Financial support sources (7).

Apparently the major reason for placing the Centres at Universities, i.e. to take advantage of the available expertise, was rarely realised to the degree anticipated. Either the expertise was not actually available, or the lack of recognition of commercial work for academic standing and promotion, together with policies on publishing, inhibited intensive academic participation. Much of the required expertise was therefore obtained from outside the parent institution.

The most successful Centres, in particular, developed intensive assistance to a limited number of new start-up businesses, especially in business and marketing providing important assistance which lead to accelerated development of their clients. This basic structure appears directly applicable to the need for education on, and the development of, innovation and entrepreneurship, within the Community.

* <u>Industrial Parks</u>

It is interesting to note that the conclusion of a NSF Study on this structure is (with some exceptions, i.e. Stanford University Industrial Park) that "most industrial parks are generally not significant stimuli to technology transfer".(8)

However, continuing interest in the utilisation of this form of interface with industry, indicates that some institutions have found them, at least, an aid in creating the correct climate.

The outstanding Industrial Park in the U.S. has been the Stanford Industrial Park, subsequently changed to Stanford Research Park, to reflect the status of the majority of its tenants.

The main development of the Park, and subsequently Silicon Valley, commenced in 1954 when Hewlett Packard built their Headquarters on a Park site. This Company acted as one of the main marketing "tools" for the Park's development, extolling to prospective tenants the benefits of being situated on the campus. By 1955, 7 companies were tenants, and by 1970 there were 70. By 1984, all the available sites were taken up by 90 tenants, employing approximately 25,000 workers.

The rental income from the Park has been a major factor in Stanford's development as a research institution. Prepaid leases are said to have brought in $16,000,000 and the annual rentals about the same amount. The utilisation of these sums has been unrestricted.

The previously mentioned NSF Study identified some of the reasons for institutions participating in parks, including:

* An investment which will generate new funds for the university.

* Providing incubator space for spin-off companies emerging from university research.

* A mechanism for preventing "brain drain" and underemployment by providing jobs which will require skills appropriate to a university graduate.

* A mechanism by which the university can maintain the "campus environment" in the surrounding area.

* A mechanism for fostering joint university/industry cooperative research programs. (9)

* <u>Spin-Off Companies</u>

One of the categories of tenant that can be expected on an Industrial Park are companies which have been incorporated directly as a result of products, processes or services arising within the host institution. Several institutions are encouraging this form of interface by arranging for the provision of "incubator" units on Industrial Parks, to help the companies in the nascent stage of their development.

A large number of U.S. institutions can now refer to at least one company to which it has "given birth" and several can claim the credit for one hundred or over. This development has already been noted in the reviews of Route 128, and Silicon Valley in Part II.

The establishment of these companies has indicated tangible success in the transfer of institutional technology, but it has also raised the question of how beneficial this mode of transfer has now become to an institution.

For some years, the normal financial return to an institution, for the transfer of technology, has been a royalty payment under a licence agreement. If the association has been really beneficial to the licencee, gifts of equipment and research grants might follow.

The majority of spin-off companies appear to have developed from a research association with an institution, where its facilities and staff were directly involved. The nascent stages of a company's development also tended to depend on institutional "back-up" for varying periods of time.

As the company advances into the market place however, it also moves further away from the institution. New factors, normally outside finance and professional management, join the relationship and the company's ties with the institution become more and more tenuous. In few cases, in recent years, where companies have been very successful, have institutions apparently benefitted by expected or significant research funding and gifts of equipment.

Institutions have therefore been considering how to maximise the return from the transfer of their intellectual property to spin-off companies.

As they have the distinct advantage of being able to assess the potential of their intellectual property, prior to the start of the venture, some institutions are now taking an equity participation in these companies. Several institutions, including Stanford, have also decided not to take an investment of this nature, as it was felts, inter alia, that it might indicate a preference for some staff over others.

* Soft Companies

Many spin-off companies have evolved from what has probably been one of the most effective vehicles to-date in transferring college technology on to the market - the so-called soft company.

This is the description utilised when referring to companies which have been established by academic staff, normally on the campus, with the knowledge and consent of the institution. This has been particularly true at M.I.T. and Stanford where this type of development has been encouraged.

These companies have usually commenced through the consultancy services of members of staff being recognised by companies in the relevant industrial sector, and in some cases has resulted in the soft company becoming manufacturers of standardised products, and thereafter becoming spin-off companies.

This change from soft to spin-off company is referred to as the "hardening process".

(i) <u>Technology Brokering and Licensing Activities</u>

As Federal funds for research have declined, U.S. institutions have also reviewed their internal policies and procedures dealing with their intellectual property and licencing, to obtain the optimum benefits therefrom.

Federal funded research now allows the institutions the right to retain the ownership of the intellectual property arising from their research except in the following circumstances :

* use of government owned facilities
* security reasons
* special circumstances in individual grants, decided by the Federal agency concerned.

With this ownership now having been made available to them, there is increasing institutional interest in this very important factor for the transfer of technology. Ensuring acceptable rewards to staff, and the introduction of the most suitable guidelines for transfer being two of the main concerns.

A detailed review of M.I.T.'s policy is set out in sub-section (b) above from which apparently its annual return from Intellectual Property was in the region of $ 2,000,000.

Before 1980 no data was available to show the amount received directly from royalty payments, but information for that year and 1981, from only 25 institutions, showed an increase of 25%:

1980 - $7,316,915 1981 - $9,178,276

Individual figures for 1983 which have also been received show that Stanford earned $ 2m from royalties in respect of 400 patent licenses, the University of California $ 2.3m from 109 licenses and Georgia Institute of Technology in 1986 had generated $ 6.4m over the previous five year period.

Some institutions have entered into arrangements with external brokering organisations e.g. The Research Corporation. An NSF Study however notes that "these were generally viewed with dissatisfaction by many university administrators and scientists. It was often stated that these organisations are not sufficiently aggressive in seeking out patent or licensing opportunities. Several administrators also stated that they did not believe these organisations were receptive to their needs" (10).

The same type of criticism was made against the National

Research and Development Corporation (NRDC) in the U.K. This Corporation has, from November 1985, lost its right of first refusal on all intellectual property arising from Government funded research in institutions. Similar criticisms have also been made in France, in respect of ANVAR, the equivalent to NRDC.

Despite the extra costs involved in staffing, an increasing number of institutions are developing internal facilities to directly manage their intellectual property.

The increase of in-house expertise to deal with institutional intellectual property can be gauged by the fact that in 1974 there were only about 12 patent administrators in relevant US institutions. By 1980 their number had increased to 100, and by 1984 this number had apparently doubled.

The Research Administration Office normally handles most of the work on intellectual property generated by institutions and in 1984 about 70% of the relevant staff in these Offices had received training in the patent/licensing area. This training fell in to two distinct groups. The majority had a professional legal training, and the rest had attended seminars and short courses which had been sponsored by such bodies as the Society of Research Administrators, the Society of University Patent Administrators and the Licensing Executives Society.

A recent survey by the US Department of Commerce indicates that the main institutions with active patent programmes maintain a small staff of personnel - "with specialised technical backgrounds and experience in producing and/or marketing products are common to all groups. In every office either full or part-time staff members skilled in negotiating agreements and with a first-hand or working knowledge of the patent system supplement the technically trained personnel. Most professional staff members, whether having technical or patent law background, engage in both evaluating and licensing activities. Outside patent attorneys and legal counsel are used to prepare and prosecute patent applications and to handle all legal problems associated with protecting patent rights and enforcing them against infringers" (11).

(j) Independant Foundations

There has also been a growth in the number of independent foundations established to assist in patenting and licencing on behalf of institutions. The foundations manage the income generated from the intellectual property and return an agreed percentage of their total income to the institution primarily for the benefit of new research projects.

A long established and probably the best known foundation, is the Wisconsin Alumni Research Foundation (WARF), incorporated in 1925.

The specific reason for the formation of the Foundation was that the University of Wisconsin did not have the legal capacity to own or defend a valuable patent which was offered to it by a member of staff.

A review of the first fifty years of the Foundation's work provides some of the most detailed figures available on the benefits academic technology transfer can bring to its owner, and this information is therefore set out in full -

> "During this fifty year period, out of a total of 62 inventions licensed to about 650 licensees, about 400 being under the Steenbock patents, (the original patent) 43 inventions have produced some royalty income. Of these

43 income producing inventions, 14 have produced between $10,000 and $100,000 each, 9 have produced between $100,000 and $1,000,000 each, and 4 have produced in excess of $1,000,000.

The 43 income-producing inventions resulted from the evaluation of 1,702 inventions disclosures. A total of 415 U.S. patent applications were filed and about 270 U.S. patents were issued, representing about 195 licensable areas of technology. One out of about every 40 invention disclosures, considered for patenting and administration, thus ultimately produced income.

It is interesting to consider the effect that the licensing of these 43 income-producing inventions has had on the country's economy. By estimating the sales which the various licensees would have had to have made to generate the royalty income received, it is estimated that four of the inventions, collectively, account for about $1,500 million in sales; nine inventions, collectively, account for about $80 million in sales; nineteen, collectively, account for about $20 million in sales; and eight, collectively, account for about $1,5 million in sales.

These sales include substantial royalties from foreign sources thus favourably affecting the foreign trade balances. In fact, a number of WARF inventions have produced income from foreign sources far exceeding that obtained in the U.S.". (12)

(k) <u>Staff directly involved in cooperation with Industry</u>

Having dealt with the relevant structures, the backgrounds of some of the staff directly involved in cooperation will now be considered.

As has been previously noted the majority of institutions actively cooperating with Industry have established administrative offices specialising in the various aspects of their industrial interface.

An example of a typical grouping of the relevant offices has already been referred to and is set out in Appendix No.14.

A body, whose members work in these offices, and who carry out several of the duties similar to those undertaken by I.L.Os in Europe, is the Society for Research Administrators. The members of this Society have now established themselves as a professional body and appear to have a recognised career structure. The Society produces a regular publication which contains some of the most informative articles on cooperation presently available.

The work carried out by these employees in the H.E. Sector has been described in the following terms: -

> "Research administration denotes activities which enable the advance of knowledge whether in a context of theory, practice or service. Such activities are usually peripheral to the direct pursuit of knowledge; they are a service to that pursuit. Whether working in a University, a medical centre, an industrial lab or a government agency, the research administrator focuses attention on issues ranging from the correctness of a proposal budget, or acceptability of contractual clauses, to institutional arrangements for the nurture of research projects and programmes. The research administrator is someone like an intellectual midwife, assisting the birth of new knowledge." (13)

In a study carried out in 1979 to ascertain their areas of expertise and interests the following were the main areas in declining order of importance:

* Contract and grant management
* Proposal preparation and review
* Budgeting
* Research and project planning
* Corporation/University management
* Information systems
* Accounting
* Personnel
* Teaching research management
* Patents/copyright.(14)

It has been noted that this order reflects the availability in the US of internal assistance in certain institutions i.e. legal and patent offices, development offices etc.

Like I.L.Os the Research Admnistrator in the US "work in a diverse field encompassing a variety of organisations, structures and environments. Research administrators are equally heterogeneous with differing academic backgrounds, experiences and levels of responsibility."

The role of the Research Administrator therefore requires unique personality traits which were also considered in a further survey. The Cattell personality assessment was utilised, in this survey, and produced the following results from a random sampling of administrators:

* Critical and cautious emotional characteristics

* Insight, good judgement, greater intellectual interests and high morale

* Emotional maturity, able to cope with difficulties.

A composite personality profile is characterised as - "reserved but friendly, self-directed individual able to confidentialy exercise good judgement in a democratic manner. An analytical approach to tasks and problems resulting in imaginative processes and solutions would be expected of our composite university research administrator."

The median age of the respondents was 45 of whom approximately three quarters were male. (15)

The structured and professional approach to cooperation adopted in many institutions apparently results in training being carried out by the relevant professional body, and, in larger institutions within the unit itself.

Instructional materials are prepared in some institutions for each responsibility identified from the relevant job description. These materials are changed and updated as a normal procedure.

In one institution the instructional materials are produced in logical order to allow the trainees to build up their knowledge on previously considered materials.

An example of this training includes:

	Topics for Instructional Units	Contents
General introduction	Research administration-general	readings
	Orientation to Office	meeting with Director
	The infrastructure of the institutions	readings
Overview of Office	Office procedures	meeting with Secretary
	Office activities-general	readings
	Office relationship to other units	meeting with Director
Specific Office activities	Sponsor information directories	readings
	Manual search using directories	activity
	Introduction to Terminals	videotape
	Introduction to IRIS computer searches	readings/ activity"

(16)

* * *

D. THE IDENTIFICATION OF THE FACTORS WHICH APPEAR NECESSARY TO ESTABLISH BENEFICIAL COOPERATION

From the information obtained in Parts II and III, certain factors have been identified as providing the base upon which beneficial cooperation between the H.E. Sector and Industry can be established, develop, and grow. These factors, in particular the establishment of structures such as liaison units, need to be in place if the I.L.O. is to be able most efficiently to carry out his job of liaison with Industry.

These factors are created by both direct and indirect measures. Direct measures include the establishment of the required structures, and Government Schemes.

Indirect measures consist of providing the favourable environment, without which cooperation will never succeed. The favourable environment would include the establishment of equitable institutional policies on consultancy and intellectual property rights, also the behaviourial attitudes within an institution, and between academe and Industry.

Indirect measures are ultimately the most effective way of ensuring beneficial cooperation. Direct measures are usually an inadequate substitute for a favourable environment. You can provide and fund the best possible structures, but without the wholehearted acceptance and backing of the relevant staff cooperative projects will not prove effective.

The basic requirements establishing the needed environment have to be generated by three separate sources, the Institution, Industry and Government.

1 INSTITUTIONAL REQUIREMENTS

(a) Clear and active support for cooperation from the institutional hierarchy

One of the most striking differences between institutions visited during the compilation of this Study was the receptive atmosphere in the institutions where the relevant authorities understood the benefits which could be brought to teaching and research from cooperation, compared to those who apparently felt that cooperation was being forced upon them, mainly for financial reasons.

Institutions and other relevant bodies that refuse to establish equitable policies and procedures on staff consultancy and intellectual property rights, and who continue to ignore all forms of cooperative work as factors for academic standing and promotion, may never establish an environment on which they can build strong, lasting, and beneficial links with Industry.

(b) Systematic identification of institutional resources suitable for cooperation with Industry

The majority of institutions have apparently not approached their cooperation with Industry in a pragmatic and systematic manner. Little attempt has been made to identify the present and future resources which would be applicable to a cooperative programme. Only after these resources have been ascertained can the relevant objectives for their development be established. Only after these objectives have been identified can the needed structures for their development be agreed and introduced. Only then can a trained I.L.O. operate effectively.

(c) Agreed and published policy and objectives for cooperation with Industry

Some governments in the Community have to-date developed a "hands off" approach to cooperation between their H.E. Sectors and Industry. General expressions of approval, and facilitating legislation are issued but few policy guidelines or strategic objectives have been promulgated. In the absence of such directives, it is essential that all the staff are fully aware of the institution's official, published, policy and objectives so that they are left in no doubt as to what is expected of them and how they are to deal with cooperative ventures.

In some institutions where official policies have been published, there does not appear to have been sufficient consultation with relevant staff or proper consideration of their views and the obtaining of practical advice. To ensure that the necessary backing is secured and the needed environment established the widest possible consultation is required before policies and procedures are officially adopted.

(d) Establishment of appropriate structures for cooperation

Because in many cases resources have not been properly ascertained and the resulting objectives established, structures appear to have been introduced without the necessary preparations.

The institutional structure is highly concerned with questions of academic freedom and accountability, and may not be geared to the basic needs required for cooperation with Industry, namely prompt decisions and flexible policies. The introduction of any structure for cooperation therefore requires that it be constituted in a manner which would allow its activities to be unimpeded or hindered by unnecessary constraints.

During the course of this Study it was noted that one structure which would appear to require consideration was the specific link between the institution and SME's. This appeared to be absent in several institutions where it might have proved to have been beneficial to both parties.

(e) <u>Representation of Industry, Commerce and the Professions on relevant institutional structures</u>

The beneficial input of up-to-date expertise and advice from non-academic members of governing institutional bodies, and also those internal bodies dealing directly with cooperation, has been noticeable in those institutions where it has occurred.

Bodies responsible for an institution's policy on cooperation and technology transfer need the range of "outside" expertise. This has been encouraged in some countries eg. in France by the "Savary Law".

(f) <u>Adequate funding for structures implementing cooperation with Industry</u>

The most successful structures that have been established are those with clear financial objectives and support from the nascent stages of their development onwards. Several successful programmes producing early profits have apparently failed directly due to the inability of academic administrators to accept that such structures require proper re-investment if they are to survive and grow.

Institutions must decide, when establishing their objectives, whether the policy on cooperation is primarily to facilitate its interface with the outside world, or whether it is commercially oriented with profit-making objectives. There can of course be several separate policies within an institution embracing both these objectives.

An institution should therefore consider two basic policies. The first, establishing a non-profit making, facilitating role, wherein the institution makes its relevant resources available, as a service to the community, and receives in return the benefits that the interface brings to teaching research and the standing of the institution.

The second policy deals with the beneficial transfer of its technology, and relevant services on to the market place. This could be approached as a profit-making venture, which, however, requires the necessary funding over the period required to establish the programme on an income producing, profit oriented, basis.

(g) The relevant structures need qualified and experienced staff

From the work now being required of I.L.O's throughout the Community, in particular the increasingly more sophisticated activities involved in technology transfer, proper qualifications and experience are needed.

A basic requirement appears to be some direct knowledge and experience of the industrial and commercial world. The calibre and credibility of the I.L.O. has been clearly identified as one of the most important factors in a successful cooperation programme, both in Europe and the U.S.

However, without the expertise, credibility cannot be generated, and appropriate expertise is sometimes difficult to define.

Job specifications of advertised ILO's posts over the past year, also disclose the problems faced with in identifying the correct staff, when resources have not been identified, and objectives clearly agreed, to provide proper definition of the job specifications.

There is a definite shortage of persons with the required experience, knowledge, and entrepreneurial spirit to manage hi-tech firms in the Community. A similar calibre of person is required to act as an I.L.O., with the added problem that the I.L.O. also has to work in a unique background involving both academic and commercial disciplines. The training of the required staff for both Sectors is therefore essential if the Community is to develop the innovation infrastructure to compete with Japan and the U.S. on international markets.

(h) Staff and structures for cooperation need status and support for internal and external credibility

Until the last few years, the status of I.L.O's in many institutions, and the place of their structures in the academic hierarchy, have been such that neither staff, nor industrialists could accept that general cooperation, and technology transfer, had more than a very minor role to play in the institution's future plans.

There has however been a growing awareness, in the more farsighted institutions, that the utilisation of their relevant resources could not only be directly beneficial to research and teaching, and but also be a key factor in national economic growth. This has led to the increasing appointment of staff at more senior levels with direct responsibility for the implementation of the institution's cooperative policy.

Staff are now being appointed at Deputy Vice-Chancellor, Deputy President, or Pro-Rector status to undertake the implementation of programmes of cooperation. The expert staff who are being appointed to managerial posts, such as managing directors or directors to run the required structures are being offered terms and conditions of appointment, which place them, as near as possible, on similar levels as the management with whom they will regularly be dealing in Industry.

The increasing introduction of the required internal structures, and the incorporation of institutional companies, are establishing the new basic job specifications of I.L.O's.

The calibre of the I.L.O. is paramount to the implementation of a successful programme, but although many are extremely enthusiastic, and enterprising, the lack of a recogniseable career structure is one definite impediment to the introducing of the most suitable personnel available.

(i) <u>Agreed and equitable policies for staff participation in consultancy and the sharing of monies received from technology transfer</u>

As has already been noted in considering successful developments in Europe and the U.S., the establishment of the correct environment is possibly the most important factor providing beneficial and lasting cooperation, in particular technology transfer. It has also been noted that two of the most important elements in the generation of this environment are the establishment and implementation of equitable policies and procedures dealing with consultancy fees, and payments arising from technology transfer.

The payment of money for "outside work" however, may not be the major reason for staff participating in cooperation, therefore these policies must be coupled with the already identified policies which will recognise outstanding cooperative work as an element in academic recognition and promotion.

Before introducing their policies and procedures, institutions should carefully study, and, review any information on the development of successful policies in other institutions with similar backgrounds.

(j) <u>The institution must have the facility to identify and evaluate commercially applicable research, or expertise, at the earliest possible opportunity</u>

To ensure that commercially viable products and processes are not lost to the market, every assistance must be given to the inventor in the identification and protection of his "idea". This necessitates not only the relevant policies and procedures but the availability of expert advice.

In the U.S. the development of the role of the "Research Administrator" not only to facilitate research funding but also to maintain an active awareness and understanding of research programmes, and a close supportive contact with potential inventors, has played a decisive part in the transfer of academic technology.

The widespread knowledge, in the U.S., of the benefits which can be derived from Intellectual Property, has also been a definite factor in introducing science and technology on to the market place.

In Europe there has not been the same scale of introduction of staff specifically trained to directly assist, and facilitate the work of the researcher. The assistance provided to-date has been mainly in the areas of costings and contractual advice, the latter being supplied, in many cases, by administrative staff who have little or no experience of negotiating, and concluding, what are becoming more and more sophisticated, technical agreements.

The established procedures in many U.S. institutions which will allow for early identification and evaluation of worthwhile "ideas" are also lacking in many European institutions, as are the procedures and knowledge, both professional and financial, which will ensure the development of the idea to an innovation, ready for the market.

(k) Institutions must have the facility to participate in multi-disciplinary, inter-institutional and multinational research, and other projects

The European Community's policy for developing transnational R&D, implies the requirement for the facilities and staff to carry out projects of this nature.

"Financial pressure combined with declining industries may well lead to the necessary collaboration within the EEC. Innovative developments require market sizes which are larger than those provided by national ones a fact that is well illustrated by the U.S. market size. Technology transfer does not recognise national boundaries and for major rewards it will be essential for innovations to be introduced on an international scale". (1)

The requirement for training at a Community level to provide the relevant expertise will be identified in Part V.

(1) All the facilities available to place technology directly on the market place if this is required

Over the past two years both the French and U.K. Governments have by statute, and other means, introduced or reconfirmed the means whereby institutions, or their staff, may establish legal entities to assist in their technology transfer.

It must be remembered, however, that established companies are often unwilling to embark on the manufacture, and marketing of new products in unknown markets. Industry is also reluctant to embark upon technical development programmes. The future economy of the Community could be severely depleted by a blockage in the transfer process due to Industry not wanting to manufacture and market new products, and institutions not being able to develop the product to the required level.

Besides the ability to set up the needed basic structures therefore, the institutions, and their staff may also need to have access to pre-development and development funding which would prepare the product or process for direct manufacture and sale.

2. INDUSTRIAL REQUIREMENTS

(a) Bridging the H.E./Industry behavioural gap

This requirement applies both to the H.E. Sector and Industry but it is suggested that there should be a concerted effort by Industry to bridge this continuing gap. To-date academe appears to have attempted to deal with this problem to a greater extent than Industry. Continued references to "ivory towers", and a supposed lack of appreciation of time scales by academics, emanating from Industry, without a real attempt to understand the academic problems, only tend to widen the existing divide.

There are varying degrees of lack of understanding, both national and sectorial, between the two sectors but overall this still constitutes a barrier to beneficial cooperation. Since the 1970's several studies on cooperation have repeatedly pointed out that the traditional split between academic and industrial values must be understood and to be understood they must be tackled in a systematic way. To-date this approach does not appear to have been undertaken in Europe.

(b) <u>Creation of formal and informal links with institutions enabling Industry's needs to be recognised</u>

Although large international corporations have maintained close, beneficial, links with certain institutions for many years, many firms are still unaware of how their technological needs can be identified and overcome through the assistance of institutions.

"On the industry side, clear articulation of needs is essential for constructive relations with the world of science and technology. In many cases (notably on the part of the most sophisticated industries) this does not raise problems. In many instances, however - small and medium-size firms, large traditional industries - the formulation of an articulate industrial demand is, in itself, a concern". (2)

The involvement of academic expertise at an early stage in problem-solving has often been of great innovative benefit to many firms.

The identification of Industry's needs also requires the existence, not only of short term objectives, but a published long term strategic plan in a company. Also a company policy which positively welcomes outside advice, particularly academic advice. The "not invented here" syndrome must be obviated, and the final decisions on the utilisation of academic technology should be in the hands of persons who are properly qualified to make such decisions.

(c) Encouragement for executives to take up positions in institutions

The introduction of "Integrated Chairs" (eg. in the University of Salford) where industrial staff continue to hold senior managerial roles in their own companies, but also undertake responsible academic roles is an excellent example of this requirement.

The increasing participation of industrial staff in relevant institutional structures should be assisted in every way, particularly those directly concerned with cooperation. There should be the maximum pcssible representation of qualified industrialists in these structures.

(d) Development of practical formats allowing the regular interchange of institutional and industrial staff

The objects of Strand B of the COMETT Programme are directly relevant to this requirement.

The benefits from the interchange of staff have been recognised for many years in the U.S. "The emerging interest in facilitating personnel exchange is indicated by its incorporation into several new University/Industry/Research Programmes. Personnel exchange is an increasingly popular element of many University/Industry cooperative research centres." (3)

The benefit which can accrue from such exchanges has been recognised by the Commission and I.L.O's should be utilised to assist in carrying out exchanges which would bring the optimum benefit to both parties.

(e) **Equitable terms for funding research and other contracts with institutions**

For many years academic researchers have been subjected to the "research assistant syndrome". This describes the dilemma they faced when seeking funding for research projects from Industry. The terms and conditions they were presented with normally provided salaries for needed research staff, for fixed periods, but in return they had to abandon all rights to Intellectual Property, arising out of the project, to the funding company. Recently, the introduction of expert staff in some institutions, has seen the negotiation of more equitable terms, recognising the input of the work of the institution to the generation of the relevant intellectual property.

3. GOVERNMENTAL REQUIREMENTS

(a) **Besides providing the facilities for forging strong links with Industry, Governments should also ensure that all the necessary direct, and indirect, measures are established and implemented.**

Although traditionally adopting a "hands off" approach to cooperation several Governments have now published legislation which has facilitated technology transfer. They should also, to the extent possible, encourage an internal environment favourable to cooperation in institutions. The introduction of equitable policies on staff consultancy, and Intellectual Property Rights, coupled with the recognition of suitable commercial work as an element for academic recognition and promotion should, to the extent that it is in the purview of Government, also be encouraged.

There does appear to be a growing Governmental realisation that the beneficial development of cooperation cannot be left to the uncoordinated and unsupervised efforts of academe and Industry. Otherwise, for example, growing and unwelcome inbalances could well occur between fundamental research and applied research.

(b) **Review and co-ordinate the public funding available to institutions, for the establishment of relevant structures and the training of their staff**

The majority of Community States have made public declarations, from time to time, about their backing for institutional/Industry cooperation. However, the actual funding of the necessary structures to implement this desire has not apparently been given adequate recognition in national budgets.

Some countries, such as Ireland, have assisted development by funding part, if not all of the salaries of I.L.O's. This is important since staff in Liaison Units cannot carry out their duties effectively if they are subject to fluctuations in funding policy. The majority of countries have also introduced financial assistance to, and for the establishment of, SMEs, some funded on the same lines as the successful U.S. Small Business Innovation Research Programme assisting new innovative businesses. This form of funding has obviously been available to academic spin-off companies, and several institutions and staff have made use of this source of finance.

The basic requirement for an institutional audit of its resources leading to the establishment of the needed structures, and employment of staff, should be undertaken on the instructions of Government to ensure that this essential factor is properly and professionally carried out.

This undertaking should not be left to an internal peer review, nor should it be carried out on sole instructions of senior members of institutional staff. It is not unknown for interested clients to influence the outcome of commissioned studies. The identification of resources and establishment of structures requires an unbiased assessment to ensure that there is the optimum return from valuable, publically funded technology and services.

The funding of structures will also be senseless unless they are staffed with trained personnel to carry out their administration and management. A shortage of personnel trained and experienced in the area of technology transfer has clearly been identified during the compilation of this Study. The funding of the training of the staff required for the identification and beneficial transfer of academic technology is a definite priority in several member states.

(c) <u>Review national policy on the ownership of intellectual property arising from public funding of institutions</u>

Accountability for public funding, and the benefit which the national economy derives from academic technology transfer, as opposed to its private utilisation by members of academic staff, are matters which appear to require consideration by several Community countries.

There has been substantial evidence that the introduction of the U.S. Federal Patent Policy Act in 1980 which removed differing Departmental approaches, and, with one or two provisos, gives the ownership of intellectual property generated from publically funded projects, to the institutions, has been directly responsible for the increased generation of technology transfer and additional income for institutions.

The U.K. has recently removed a statutory right of first refusal on patents arising from publically funded research projects, given to a quasi-governmental body, to allow institutions to deal directly with their intellectual property. Some other Community countries allow institutions to retain ownership of intellectual property generated from public funds, others do not. The position in some other countries appears to be unclear.

Examination of the present national laws dealing with the ownership of Intellectual Property Rights, generated in the H.E. Sector, and their amendment, it this is felt necessary, should be considered to ascertain if the national economy is obtaining the optimum return from the public funds initially involved.

(d) <u>The introduction of tax reliefs to parties involved in cooperation, particularly technology transfer to stimulate development</u>

Fiscal policy could be used in at least two ways. First, tax reliefs might be used to encourage Industrial R&D, particularly within institutions, including relief which would facilitate endorsements and gifts to institutions.

Secondly tax relief might be used to encourage inventiveness (eg. Section 34 of the Irish Finance Act 1973, which gives the owner of an invention exemption from tax on income arising from a patent).

The stimulation which tax reliefs could have brought to the transfer of academic technology within the Community, and in other parts of the world, should be examined and any relevant conclusions dealt with.

(f) **The funding of training programmes for persons managing small hi-tech companies**

The shortage of persons, with the required expertise and experience involved in the management of technology transfer in Industry has been recognised throughout the Community.

Various schemes have been introduced in the Community to assist in the training of managerial staff in SMEs including a recent long distance-learning system, both through importing skills and combining counselling with problem-solving in study groups. To-date however it appears that very little attention has been paid to dealing with the specific problems of managing academic spin-off hi-tech firms or the start up of other hi-tech firms. However, a call for proposals on a study to deal with this problem was made by the Commission in April 1987. Consideration of this problem is also set out in Part V (F) of this Study.

The gap between the two Sectors could be considerably reduced if the representatives of both sides had the same or similar expertise and spoke the same "language".

(g) **Identify the present impediments to cooperation, particularly technology transfer, and deal with them**

Very few authoritative Studies would appear to have been carried out by Governments in Member Countries, on the general problems faced in developing cooperation. In the U.K., with the exception of the previously mentioned ACARD Report, such studies have been left to non-governmental bodies.

Despite the unanimous desire to see the development of beneficial cooperation between Higher Education and Industry, expressed by all the Community States, it appears that only the Republic of Ireland has to-date commissioned a Report specifically on the barriers to cooperation and research with recommendations on their removal.

The U.S. National Science Foundation, the National Science Board, and the Department of Commerce, amongst other government bodies, have from time to time carried out or commissioned studies on various aspects of cooperation, particularly technology transfer. These Studies have provided very useful information, including case studies, which have directly benefitted the work of institutions and the staff involved in cooperation.

It is suggested that a Community wide study of impediments to cooperation, within the H.E. Sector, should be undertaken by the Commission and recommendations as to their removal be produced.

(h) <u>Ensure that the required funding of technology transfer is provided</u>

Selectivity of research projects, the need to increase publicaly funded civil R&D projects, and also Industry's investment in R&D, are matters which are receiving attention throughout the Community.

To develop the beneficial transfer of academic technology specific attention should be paid to the funding of the following:

(i) Pre-development costs, of inventions in institutions, leading to the manufacture of new products and processes.

(ii) Extra funding to already existing popular schemes where there are proposals of merit which cannot be considered due to budget restrictions.

(iii) The need to establish a fund to assist development of institutional services, as well as research, to Industry.

There are other non-research areas which also require direct consideration, if the development of cooperation is not to be impeded for lack of adequate funding.

(i) Joint funding of studies, on proposals from institutions who wish to carry out an audit of their resources available for cooperation with Industry, and thereafter be advised on the objectives and structures to be adopted.

(ii) Joint funding of fees to be paid by institutions to professional advisors on matters directly concerned with the protection of Intellectual Property, and subsequent technology transfer.

* * *

PART FOUR

THE FUTURE BASIC REQUIREMENTS OF THE H.E. SECTOR FOR BENEFICIAL COOPERATION WITH INDUSTRY

The technological imperative has become a commonplace for describing perhaps the major competitive challenge facing the Community's industrial and economic development over the medium and long term. Europe-wide cooperation has become the priority method recommended by the EC for moving towards a European Technological Community.

Cooperation, in programmes like ESPRIT, is growing between producers and users of technology - including between companies and research laboratories, among them those of the H.E. Sector. Improving Europe's innovation capacity, and the spread and transfer of its technology, are by now uncontested objectives of Community R&D and innovation policies.

In these circumstances, the need for effective cooperation between the H.E. Sector and Industry speaks for itself. Yet, judging by the findings of this Study as set out in Parts II and III above, the structures for ensuring an optimal and beneficial link between the two Sectors - respectively a major repository of know-how and its chief commercial agent - are far from complete, despite recent signs that some Member States are recognising the need to improve this situation. Moreover, without structures aimed at exploiting to the full its cooperation potential, it is difficult to see how the H.E. Sector can effectively play its essential role in transferring technology to Commerce and Industry.

Even so, the structures in themselves are not enough to guarantee successful cooperation and technology transfer. The personnel who staff them are ultimately the sufficient condition for the success of the business/university link. And there is widespread evidence - provided in Part III - about the great variety of tasks for which industrial liaison officers are gradually becoming responsible : tasks which are new in themselves and unique in combination.

In this Part of the Study, two objectives are sought. The first is to identify the structures which may be necessary for development of cooperation with Industry (Section A). The second is to profile the future requirements for staff working in these structures, in particular as regards the basic qualifications, expertise and experience needed to carry out cooperation and the transfer of technology (Section B).

A. THE IDENTIFICATION OF THE BASIC POLICIES, PROCEDURES AND STRUCTURES REQUIRED FOR COOPERATION WITH INDUSTRY WITH WHICH THE I.L.O. MAY WORK

The final decision on the structures to be established will be directly dictated by the resources identified, and the objectives agreed, by individual institutions.

Each Member State has its own H.E. Sector infrastructure and policies, its own legal and fiscal systems, and its own particular industrial background. All these factors will also have a direct relevance to the structures selected.

However, the facts presently available indicate that consideration should be given to the introduction of the structures, outlined below, in their relevant context. This general recommendation cannot of course be conclusive, since there may obviously be variations and amalgamations of some of the structures. However they have all proved their usefulness, as noted in Part III of this Study, both in Europe and in the

U.S.

The approach adopted, in this part of the Study, has been to establish the environment in which an I.L.O. will have to work, and to identify some of the specific expertise which will be required to provide the necessary advice and assistance to the management and the administration of the various institutional structures. "Structures" here has been used in its widest sense as it includes the utilisation of staff and students in the development of links with Industry.

Some of the problems which can arise in dealing with external structures utilised for academic technology transfer, eg. spin-off companies, have been considered, again to focus on the expertise which will be required to deal with these problems.

1. Utilisation of Students, Graduates and Academic Staff

It appears to have been overlooked, in many institutions, that each member of staff, and its students are potential "salesmen" of the institution's commercially applicable resources. The majority of cooperative ventures still commence through ad hoc, sporadic face to face encounters between representatives of academe and Industry. There has still not been the establishment of the environment in many institutions which encourages this type of contact.

* Students

The utilisation of student "ideas" has already led to the establishment of spin-off companies in several Community countries, and the establishment of Innovation Centres has helped to develop this welcome trend.

Many institutions however do not have programmes for staff and students introducing and explaining the benefits which arise from the cooperative work which it is carrying out. The reply which was received to a questionnaire sent to UDILS states: "It is sad that the majority of graduates and postgraduates leave University unaware of the services to Industry provided by their own institution. Academic staff and Industrial Liaison Officers would be helping their own cause if industry became populated with scientists, engineers, accountants and other professionals who are basically aware of what is available and how it can be harnassed."

<u>Through the I.L.O., regular, well-presented programmes should be made available to students (and staff) introducing the benefits to funding, teaching, and research, that can be obtained through cooperation with Industry</u>. Also the benefits which can be derived from the protection and development of intellectual property not only to the originator but to the institution, the Department and the national economy.

These programmes could include, not only written and video material, but also topical and specially prepared talks given by persons who have been directly concerned with the development of cooperation, both from the academic and industrial sectors. These speakers should come from throughout the Community, so that the maximum interest is stimulated by cross-national comparisons. The provision of expert speakers in the Community should be considered by the Commission.

Institutions have already produced their own promotional programmes, on film, or video, some of the national programmes are of an excellent standard. Consideration should therefore also be given by the Commission for the funding of a Community video combining relevant excerpts from institutional programmes, to provide a record of present developments throughout the Community. This could be shown in conjunction with a speaker, or if sufficient footage is available as a separate item on institutional programmes.

This should not prove a costly matter as the institutions with whom this idea was discussed have all expressed a wish to povide the material free of charge provided proper recognition was given of their work.

The Commission might consider the introduction of a Community-wide competition for the most promising student venture in the field of cooperation with Industry. Competitions of this nature have already been held in several Community countries.

Several unflattering comparisons have been made recently between the entrepreneurial spirit of students in the U.S., who are apparently prepared to take risks in their ventures, and in Europe, where it is said that they are reluctant to venture into the commercial world with high risk projects, fearing the stigma of failure. We can not agree with this broad statement as the compiling of this Study has shown that the entrepreneurial spirit amongst European students certainly exists. However, there still appears to be a reluctance in some institutions to accept and emphasize the vital part that Industry plays in the national economy.

Any lack of entrepreneurial spirit must obviously be dealt with basically in the academic curricula, but this should be supplemented by the availability of facilities for students who wish to find out about Industry at first hand. Several schemes assisting students in this area have been established and they should be encouraged and expanded to cover all the relevant institutions.

The University of Cambridge in 1977 introduced the first industrial society for students in the U.K. and others have followed. The objects of these societies are to make students more aware of the role of business and Industry in the economy. Some of these societies have already planned "innovation for business" competitions for the best student entrepreneurial idea of the year.

It is claimed that industrial societies in the U.K. Universities are one of the fastest growing student organisations in the country and their example should be considered in the building of a Community wide network of societies to act as a further factor in the development both of the entrepreneurial spirit and institutional links with Industry.

In France the Junior Entreprises Scheme also intends to make students more aware of the role of Industry. This is done by students setting up their own enterprises enabling them to undertake consultancy work. This seems an excellent way of providing practical "on the job" training for business. Special programmes have also been established through, eg. the introduction of "Chairs for the creation of Companies". The knock-on effect of this is to provide students with knowledge which can only be beneficial to forming future links with Industry.

* Graduates

Once students leave the institution, up-dated information might usefully be kept on their progress, and selected information about the institution's cooperation with Industry sent to them from time to time. If there are established graduate associations or programmes they should be fully utilised as one of the links to industry. This is often practiced by the "grandes écoles" in France, but less regularly by other institutions.

The utilisation of associations of this nature in the U.S., has been directly beneficial to the establishment of links with Industry. This can be seen in the assistance given by the M.I.T. Alumni Association which provides direct help to the introduction of new projects through the establishment of the M.I.T. Enterprise Forum which meets monthly to discuss new ideas and make new personal contacts. This format has been widely used in France, where it is considered to play a key role in consolidating cooperation with Industry.

* Academic Staff

As has already been mentioned, the cornerstone of cooperation with Industry is the establishment of good and lasting personal contacts between academic and industrial staff. The creation of a congenial social ambiance should therefore not be overlooked but fostered in any practical way.

This has already been done in several institutions. The University of Compiègne considers that its dining facilities are a definite factor in establishing its successful cooperation. The Petit Déjeuner Technopolys in Lyon provides a monthly breakfast meeting where academics and industrialists meet to discuss a defined topic. The Cardiff Technology Club established by UMIST is a regular quarterly social gathering of academics and industrialists at which a lecture is given followed by dinner. In Scotland, local government has taken the lead when the Glenrothes New Town Authority established GUID (Glenrothes University Industry Dining Club) regularly bringing together senior academics and industrialists.

A lot of social gatherings of this nature, however, have not proved beneficial and have petered out due to continued lack of interest. The I.L.O. has a role to play in maintaining meaningful dialogue and cooperation between the parties, in social and other frameworks.

The I.L.O. must also be involved in ascertaining which of the staff are able, authorised, qualified, and willing, to sit on Company Boards, the relevant Committees of Professional bodies, Industrial and Commercial bodies both local and national. In a 1983 U.K. Study on cooperation it was noted that "A few companies in the Country have academics on their Boards. The academic, able to think constructively, can offer alternative solutions, ask lateral questions, point to necessary help (particularly from his own institution) and generally act as a catalyst and bridge-builder without necessarily being an expert in the particular industry or activity of the firm." (1)

The I.L.O. should keep up-to-date records of the staff who would be willing to provide this link with Industry.

We now turn to the consideration of some specific structures with whom the I.L.O. will be directly concerned or have to work with on behalf of the institution.

2. A proposed internal structure in H.E. institutions for technology transfer

There is a need for a flexible internal infrastructure which can pragmatically deal with the development of academic ideas from the Department to the market place. This structure might be independent although in close cooperation with the ones for continuing education or traineeships.

The large number of offices utilised in some U.S.

institutions as set out in Appendix No.14 appears to be too overpowering and bureaucratic for European utilisation. There is also the problem of the shortage of trained staff in the Community.

The majority of institutions, however, already have in place Research Committees (RCs) or their equivalent dealing with research proposals and projects, and units like Industrial Liaison Centres (ILCs).

In many cases there are RCs and ILCs which have been set up directly by the Governing Body of the institution with specific tasks and reporting directly to that Body. It is suggested that any institution which does not already have in place bodies of this nature should consider their introduction as soon as possible, making sure that the reporting systems provide direct access to the Governing Body.

Normally an RC would have Departmental representation or reporting systems providing direct links with all aspects of research or proposed research. The I.L.C's should have as members, representatives of Industry who should be aware of the basic problems and needs of their Sector.

To provide a direct and coordinating link between the work of both bodies, providing one channel through which the "idea" can be eventually placed in the markets, a small executive Committee might be set up with joint representation of the RC and the ILC to deal specifically with facilitating the development of any intellectual property or service which could be commercially viable. This committee - possibly called a Commercial Innovation Committee (CIC) - would require minimal representation, possibly two of the best qualified persons from each and should be chaired at senior level.

Such a body would also be ideally structured, at least in countries whose institutions can lay claim to intellectual property rights, to deal with:

- adjudication of disputes as to ownership of intellectual property, share of royalties or other sums which may be due to inventors

- recommendations to the relevant institutional authorities for academic recognition and reward for staff inventors

- prizes for staff and students recognizing their inventiveness

- sponsoring competitions for both academic and non-academic inventors and entrepreneurs in their Region

- stimulating not only inventiveness but also entrepreneurship

- preparing an annual report for the Governing Body on the state of the institutions intellectual property, together with any recommendations thereon.

The CIC could ensure that all sources of funding, both traditional, and from the public and private Sectors, would be considered in planning the future development of the intellectual property or other services. The pre-development gap, which appears to be one of the main funding problems throughout the Community, could be identified and tackled with at the earliest possible time.

The RC would be responsible for the procedures governing relevant matters such as laboratory procedures identifying the ownership of intellectual property. The "research" policies and procedures should be checked and coordinated with policies and procedures on intellectual property, and with the work of the ILC in transferring technology. The CIC would delegate the individual responsibilities for such transfer through their parent bodies.

The CIC could also be utilised to facilitate the increasing demand for relevant interdisciplinary and multidisciplinary research projects. Interdisciplinary research is a unique form of team research in which staff from different disciplines are brought together to deal with a common problem and their efforts are "integrated in to a cohesive whole". Multidisciplinary research again involves representatives of different areas of expertise but the problems do not require integration, each person working on problems relevant to their own discipline.

The beneficial development of both types of research projects requires the removal of Departmental boundaries and the provision of experienced common management and administrative services.

To allow principal investigators to spend as much time as possible on actual research management problems - organising the work, establishing lines of communications and personality pojection, the I.L.O. could be utilised to facilitate pure administrative problems.

The CIC could also be the body which would assist, advise and coordinate inter-institutional research projects and also deal with the need to establish any Research Centres, or other similar structures which may be identified.

The utilisation of a structure of this nature appears to provide the optimum assistance whilst utilising minimum valuable resources.

The I.L.O's role in this structure would again be central to its beneficial development. He could, for example, be appointed Secretary to the Committee and should be able to advise on basic research and development management problems and on the law and documentation relating to all aspects of intellectual property.

3. Research Centres

As mentioned in the previous proposal for an internal technology transfer structure (the Commercial Innovation Committee), the increasing need for institutional models for structuring collaboration through inter-disciplinary and multi-disciplinary research can lead to the establishment of permanent adaptive Centres, established within the institution but with a great deal of autonomy.

Often traditional Departmental structures have not been able to react with sufficient flexibility to the needs of research and teaching in subjects which require a highly specialised or an inter-disciplinary approach.

Adaptive Research Centres are those which are still undergoing the process of redifining their goals and subsequently are employing and releasing staff according to the development of their research projects. Normally they are built up around the personality and research expertise of their Director and utilise only a small nucleus of research staff who are still directly tied to the parent institution.

A Research Centre establishes stable objectives and provides the resources required to develop a managerial hierarchy and a permanent staff of researchers. It has the facilities to invest in the equipment required for its objects and to justify the allocation by the institution of the required permanent accommodation.

In the U.S., since 1973 the N.S.F. has been experimenting with various approaches to Centres through its University/Industry Cooperative Research Centre Programme to stimulate industrial support to inter-disciplinary research programmes to meet Industry's research needs. All centres are expected to increase industrial support and become self supporting over a period of five years. The Programme normally commences with a planning grant "to study possible alternatives to both structure and content of research and draw up a management plan to be pursued and to evaluate the industry's interest in supporting a potential Centre".

There are now 30 Centres dealing with such subjects as Polymers, Interactive Computer graphics, Welding Research, Robotics, Analytical Chemistry, Ceramics Research, Steel Processing, Engineering Tribology and Monoclonal Lymphocyte Technology. Institutions in the U.S. have accepted the need for the utilisation of Centres providing specialist teaching and research to meet specific needs. The ratio of Centres to Departments at M.I.T., for example is 3 to 1.

Although many Community countries have their own government Research Laboratories and Establishments and Industrial Research Associations there has been increasing utilisation of Centres in institutions to fulfil industrial research needs.

Examples from the four selected EC countries include: the National Microelectronics Research Centre at Cork (Ireland); the Centre for Robotics at Imperial College, London, and the Leicester Biocentre (U.K.); the Centre d'Etudes et de

Recherches en Hautes Technologies and the Polytechnic Faculty in Mons (Belgium); the Groupe de Recherches CREDI (informatics) at the Ecole Centrale in Paris; and, on an inter-institutional basis, the different "groupements" and "pôles de recherche" to be found in France.

In Ireland, U.K., France and some other EC countries, Research Centres and their institution's Industrial Liaison arm actively collaborate in developing research projects. One direct input which the I.L.O. could provide would be to assist in drawing up guidelines for the Centres' work and their development. Among the items which might be treated in these guidelines could be:

(a) Establishing the objectives and autonomy of the Research Centre within the institution;

(b) Establishing the lines of communication and reporting between the Centre and all relevant posts of the institution;

(c) Establishing the managerial and administrative infrastructure of the Centre;

(d) Establishing a Policy Body in the Centre, introducing the input of the industrial clientèle. The I.L.O. should attend the meetings of this Body and, for the purposes of continuity and coodination of technology transfer, could act as the Secretary;

(e) Establishing the needed methods of project monitoring and evaluation;

(f) Establishing acceptable methods for the dissemination of research results. Publication and the identification and protection of Intellectual Property generated in the Centre. The drafting of publication and patent agreements;

(g) Establishing the markets and marketing of research results.

Industrial Liaison Units, as mentioned before, should also be prepared to assist in the coordination required for establishing inter-institutional Research Centres.

4. Industrial Liaison Programmes or Clubs - Affiliation Programmes

Several European institutions have followed the success of the programmes established at M.I.T, Stanford and other U.S. institutions and this has led to this structure, or its equivalent, becoming a very useful use tool for technology transfer.

Programmes of this nature, utilised by institutions with the required focussed research and consultancy expertise, have proved to be an effective way of providing direct links between the institution and Industry. Links which are of particular benefit to teaching and research through the regular contact with, and monitoring of the practical progress of new technologies.

The development of these Programmes also provides avenues of transnational cooperation which may not be available through normal liaison structures.

The administration of a programme requires administrative skills in the coordination of multi-disciplinary resources, and the international marketing of these resources.

Again it would be essential that a proper audit of resources be carried out by an institution embarking on the establishment of such a programme. Many Programmes have been unsuccessful as they have been "too broad and general so that they do not attract attention and commitment".

Institutions with major and diversified research programmes appear to be the only ones who can produce the formula for success namely, the provision of "in-depth, broad spectrum overviews in a sufficient number of areas to make it worthwhile for the companies to pay high membership fees.

The I.L.O's who are to deal directly with the members of the Programme must be active and energetic, able to communicate, to ascertain and completely understand the problems and needs of the member. The I.L.O. also needs to have the necessary expertise to be able to alert the member to research developments, intellectual property and educational opportunities, to arrange for short courses, symposia and seminars.

The I.L.O. should have relevant industrial experience, with a good academic background in a discipline which relates to core interests of the membership group, for which he or she is responsible.

5. Industrial Liaison Bureau

This heading is utilised to describe the facilitating structure which is still the principal vehicle utilised to carry out liaison with Industry and other "outside" bodies.

In view of the disparate and dispersed nature of the normal academic institution, the need for "one door", through which all enquiries can be routed, and out of which relevant information could be dispensed, has resulted in the establishment of internal offices to carry out these functions.

Although the basic function of a Bureau is still one of a facilitating nature, the advisory marketing and communications roles of the staff have increased considerably over the past ten years. The present basic job specifications of staff in many European countries reflect the increasing role that cooperation with Industry is playing in institutional development, and the increasing complexity of the varied aspects of cooperation.

Even in the old-established institutions, where a more informal and social approach to cooperation had previously been the norm, a professional and commercial style has now been adopted to ensure that the institutions meet and can deal with Industry in the appropriate manner.

These Bureaus provide the backbone of the whole liaison system, and it is suggested that every institution with resources which can be utilised to develop beneficial cooperation, should establish an office of this nature. The staffing of Bureaus can be part time or full time, depending on resources, but even in busy full time Bureau the staff do not normally consist of more than a Director and two or three Secretarial staff.

The establishment, objects, and situation of the Bureau should be widely publicised both internally and externally. A useful example has been provided by the German directory of I.L.U's, providing plans of the institutions and indicating the locaton of the I.L.U. The situation of the Bureau should be as accessible to the public as possible, with clear directions available. Many Bureaus appear to be tucked away in a labyrinth of identical corridors or situated at the most inaccessible end of the Campus. This sort of obstacle can cause businessmen to abandon their quest for cooperation.

The availability, or non-availability, of Bureau staff through the institute's telephone exchange has also been the subject of severe criticism in several Reports. Each Bureau should therefore have its own direct line which would be manned continuously during normal working hours. Modern communications equipment should ease contacts with the industrial partners.

The expertise and experience which is now required from the executive staff of a Bureau cover the following:

* To identify all the resources available for cooperation in the institutions

* To act as a broker introducing the resources of the institution to Industry

* To promote and market the resources of the institution, including the consultancy expertise of its staff

* To establish and maintain data bases and any other relevant information sources. To produce and publish all relevant information

* To provide advice on the costing of contracts, including staff consultancy contracts, their legal terms, and be able to negotiate these terms

* To advise on basic aspects of intellectual property and the development of technology transfer

* To identify sources of additional income which may be available to the institution, including funding sources

such as the EEC and venture capital.

It will be noted that an I.L.O. in an Industrial Liaison Bureau is not employed principally for scientific and technical expertise and experience, but to provide marketing and public relations expertise, combined with negotiating skills and a basic knowledge of costs, contracts and intellectual property law.

6. Industrial Liaison Centres

These Centres would normally contain all the functions of an Industrial Liaison Bureau but would have the added objective of carrying out "missionary work" in going out in to various sectors of Industry, Commerce and Public service to ascertain their needs on the spot and arrange for the assistance required.

In particular the I.L.O. would be concerned with improving industrial efficiency and the technological strength of local Industry, particularly SME's. The improvement of technological strength would directly relate to technology transfer from the I.L.O's institution or from any other available source.

The I.L.O. should also be able to explain and identify the required specialist advice and funding which is available to Industry from both national and international sources to allow for the introduction of new methods and techniques to raise productivity.

There is also a brokerage role in encouraging the SME's to make full, beneficial use of the institution or other available sources of expertise or available facilities.

The I.L.O. will therefore need to have the same basic expertise and experience as executive staff in a Bureau but with added expertise in relevant manufacturing industry and with academic qualifications to deal with hi-tech companies.

The growth of regional "innovation services" over the past years will require the optimum co-ordination of all available resources of this nature. The I.L.O's expertise and experience should therefore be directly related to the research and service expertise of his or her institution and should also be targeted on the relevant sectors of regional development plans.

The training and utilisation of suitable retired members of staff and graduates, to directly assist the I.L.O. in advice to SME's should also be considered.

Of course the work carried out by a Bureau and a Centre often overlaps in practice. A decision might then be useful on the priority to be given to the basic functions of the structure. Ideally in this situation one would have two I.L.O's one dealing with general cooperation and one with technology transfer. This situation has already arisen in institutions with well established and beneficial links with Industry.

I.L.O.s working in a Bureau or a Centre are often absent from their offices on business for considerable periods of time. It is essential therefore that the secretarial staff be trained to deal directly with any enquiries in a competent manner during their superiors' absences.

7. Incubation Centres

The difference between this structure and an Innovation Centre should be again noted. The latter is to provide the innovative background for the identification and development of technology and services. The structure now considered provides the physical needs for the gestation period required to bring innovative technology fully on to the market place. An excellent example of this structure is the Innovation and Incubation Centre (BIC) opened at the Technical University of Berlin in November 1983.

This structure should provide not only the actual space needed but also core administrative and other technical facilities.

If institutional space is to be provided within the Campus specific guidelines should be set down. Fairly strict accounting systems should be established between the parties. The terms of the lease should include specific time limits during which the lease must complete the development and move on.

The I.L.O's job would be to liaise with the "Buildings" Officer to provide space for student or staff inventors and/or entrepreneurs and to facilitate the development of their "ideas" as far as possible within the Centre.

The I.L.O. in dealing with Incubation Centres would have to have a knowledge of the management of innovation as well as coming from a scientific/technical background.

8. Innovation Centres

An innovation centre provides the innovative background for the identification and development of ideas, without per se putting actual space and laboratory facilities at the participants' disposal.

Several programmes have been initiated in France, which fulfil the role of an innovation centre, eg. the Programme d'Appui à la Création d'Entreprises innovantes of the Ecole Supérieure de Commerce de Lyon and its Programme "Création d'Entreprise" together with the Ecole Centrale de Lyon. Innovation Centres appear to be a very important starting point for spin-off companies.

The Centre should provide regular assistance during a certain period of time for individuals/groups who want to develop technology and services and perhaps set up their own company.

These programmes should be carried out in close collaboration with laboratories and the teaching staff of the institution, assisted by advice on eg. financing and patents, and by experts from Industry and brokers. A close link with venture capital "specialists" is important.

A study of the U.S. NSF programme has disclosed that these centres had been of more value to non-academic participants. This phenomena was also noted in Ireland. It would appear as a general rule that an essential criteria to a successful centre is the establishment of relevant "centres of excellence" in the hos institution.

The I.L.O. should be involved in the overall definition and coordination of the centre without being involved in its management.

However, careful selection of the candidates is a prerequisite for its success. The I.L.O. in collaboration with the Centre's manager should participate in the selection committee. Contracts concerning the use of university equipment may need to be prepared by the I.L.O.

The I.L.O's task would involve identifying within the institution potential candidates and ideas for transferring to the innovation centre, as well as providing assistance with subsequent transfer to an incubation centre where appropriate.

The I.L.O. would need expertise in evaluation of innovative projects and business plans.

9. <u>Institutional Companies, either wholly owned or with a majority share holding</u>

The statutory changes introduced by several Community countries over recent years have allowed the utilisation of the company structure by institutions to develop the transfer of their technology.

The expanding utilisation of the limited liability company structure has seen the incorporation of companies normally for the following main objects, alone or in combination:

* To carry out all areas of the institution's cooperation with Industry, particularly technology transfer and to incorporate subsidiary companies for this purpose

* To develop prototypes, produce and sell a product, process or service

* To carry out contract R&D for industrial clients.

The basic qualifications for the Chief Executive of all three types of Company will be the same as those required firstly for the management of innovation. This covers a wide spread of management skills, but would include the expertise and experience needed to introduce a proper and flexible system of management control and strategic planning; understanding and overcoming the differences between the business and university environment; to enhance the use of the institution's resources; to analyse and define market areas; to identify, protect and develop "ideas"; to advise on, and introduce "spin-offs" and joint ventures and to have a good and working knowledge of financial resources for development.

The executive staff for manufacturing companies would inter alia have to be able to introduce detailed specifications for the product, identify key technical problems and provide a solution; produce plans for design and development identifying regular reviews of progress; evaluate the risk involved in not achieving planned targets in performance and time; analyse defined market areas for needs, and product benefits, and relate these to current and future products; produce well defined manufacturing and control systems; derive a form of product which conforms to international and national standards, or which will require the minimum of modification, etc.

R&D management has its own special skills which would have to be added to the general skills and expertise required.

Staff for carrying out cooperation and technology transfer would typically come from the business world but possess a good initial degree in a relevant discipline. This could be a non-technical or scientific discipline, possibly law or commerce.

For production, industrial experience and for R&D work, research work, in public or private bodies, would be the needed requirements, together with managerial experience.

The insufficiency of effective management of innovation has been accepted as one of the main reasons for failures in small businesses dealing with academic technology. This shortage dictates the need for training of relevant executive staff both in the H.E. Sector and Industry.

10. Spin-off Companies

Spin-off or spin-out companies are those that have been incorporated by present or past students or staff to utilise intellectual property which has been generated in an institution. A considerable amount, if not all of the R&D has been completed in the institution allowing the new company to carry out early production of a specific product, process or service ready for the market place. The company has often started its life in a laboratory and after a certain development moved outside the campus and has been one of the main tenants of science parks.

The company is normally established jointly by three different categories of promoters, those bringing in research expertise and the intellectual property; those supplying experienced management and production; and those providing the funds.

The basic relationship between the institution and the company arises from the ownership of the intellectual property and/or the institutions' equipment which the company is being allowed to utilise, through a licence or other legal agreement.

The establishment of this structure for the specific purpose of completing the transfer of the institution's technology or services raises questions of institutional policy to be adopted with regard to the links with the company, including participation of staff in the company's business.

The institution must firstly satisfy itself, even more strictly than when dealing with an established "outside" company, that the company's development has been properly planned and fully funded before finalising any licence agreement. A thorough examination of the complete background of the company must be carried out to be absolutely certain that it has the ability to carry out the proposed venture.

Often the fact that some of the promoters are members of academic staff results in a proper examination and assessment of the proposals being overlooked, resulting in failure of the project.

The terms of the licence or other legal agreement should be such that the institution receives an equitable return for the use of its property, but if the product or process is in a new field, and is looked upon as a high risk project then the terms should be such that the main financial return to the institution may be withheld for a specific period until the company had been able to establish itself on the market.

Terms must also be included which will allow the institution to cancel the agreement if agreed progress is not made within a specified period.

The institution should have "inside knowledge" of the technical worth of the product or process and once the required market research has been carried out in the company's business plan it would be in a position to consider an equity investment in the company. An equity share in a successful company could bring the institution a better financial return than royalties or licence fees. This has been practiced several times by institutions, eg. in Belgium and has been adopted by several U.K. institutions. A prudent investment of this nature indicates, to outside investors and the public, that the institution was prepared to stand behind its technology.

Once the institution has satisfied itself that all the necessary criteria have been met it can then finalise its negotiations, remembering always that this is the time to ensure the optimum return for its technology. At this stage the parties concerned with the incorporation of the company will be fully aware of the actual input of the institution. This appreciation diminishes as the company develops and new partners join the venture.

Most spin-off companies require what can be described as "general back-up" from the institution during the nascent stages of its development in-put which is hard to quantify at the time of incorporation. This should be estimated, however, and specifically dealt with in the Subscription Agreement or other document between the parties establishing the company.

The specific consultancy input of members of staff should also be clearly identified and agreed at this stage and approved consultancy agreements executed. These establish useful precedents for further staff participation. The question of confidentiality terms in consultancy agreements must also be dealt with.

Direct representation of the institution on the board of the company should also be covered at this time. This establishes a useful link which can provide direct knowledge of new developments, beneficial to teaching and research, and often lead to funding of further institutional research. Care must therefore be taken to ensure that the institution's representatives are the persons who would be able to properly deal with these opportunities.

One problem involving spin-off companies which has been clearly identified is the desire of the staff inventor to take executive control of the company. It is natural for academic inventors to believe that they are the only persons who can caringly nurse their "brainchild" through to proud maturity. Unfortunately it has been proved that only in very exceptional cases do academic staff have the managerial and entrepreneurial knowledge and skills which are essential in establishing a sound company.

A recent article considering a Report undertaken for the U.K. Committee of Vice Chancellors and Principals noted: "The research conducted for this study found that the track record of companies with a significant university involvement was considerably poorer than for those without that involvement". The main obstacles to success in these companies appeared to be inadequate funding and a poor knowledge of marketing, manufacturing and management. The Report goes on to say: "Often the industrial liaison officer or university company managing director was selected from a short list of fairly tired and tried executives who were made available following an ICI purge on overmanning". (2)

This Study is not able to confirm the specific criticism on staff set out above, but what has been identified is that some institutions have lost valuable assets, or received poor financial returns, because they were not capable of correctly assessing the technical, financial and managerial capabilities of the company to whom they had licensed their technology. The establishment of an innovation centre on the campus could solve some of these problems.

One further problem must also be identified in companies in which staff inventors have obtained executive positions. The continuous "tinkering" with a product by an inventor to make sure that it is the best on the market, has been directly responsible for the demise of more than one spin-off company. Once a production line has been established it should be left alone and a new technical input incorporated in "Mark II". This is often not appreciated by academics who have always worked in a research laboratory environment.

Academic staff should therefore not normally have an executive position in the company, which some national legal provisions forbid in any case. If they insist then they should be asked to opt for either their academic employment or employment in the company. This should be clearly decided before the company commences business. It should be possible to arrange for some direct continuing relationship between the institution and its former staff.

A further useful arrangement, if the company is to maintain close links with the institution, is the appointment of the I.L.O. as the official Liaison Officer with the company, attending Board meetings by invitation. This has proved to be a very effective method of dealing promptly with matters of mutual concern, such as, the intellectual property of the institution and the company, academic publication and consultancy fees.

Very strict guidelines must be established between the institution and the company to ensure that there is no "intermixing" of their intellectual property.

The spin-off company structure has been identified in the U.S. as probably the most useful vehicle for the generation of research and academic technology transfer. As stated in an N.S.F Study: "There is certainly an untapped potential in providing mechanisms which would facilitate the collaboration between the research programmes of these new companies and university research programmes. Several universities are currently looking into a variety of possibilities, including programmes of technical assistance, providing "incubation space" for the new companies and mechanisms by which a

University can integrate its research into programmes of economic development". (3)

Several established problems arising out of relationships between the institution and a company of this nature have therefore been looked at in some detail to establish the expertise and experience which will have to be available to the institution, in order to optimise the benefits due to it.

11. Science Parks

The establishment of a Park by an institution requires the following basic prerequisites:

(a) The presence of research colleges with centres of excellence.

(b) The presence a critical mass of inventors, entrepreneurs, trained technical staff, and all the required professional expertise.

(c) Government funding of research and innovation.

(d) Access to corporate, bank and venture capital funding.

(e) The establishment of both formal and informal information exchange systems for technical know-how.

(f) Access to all the necessary facilities and resources within a defined geographical area.

(g) Access to all the commercial, social and cultural needs of a technical society.

If these prerequisites have been fulfilled, the development of the Park would obviously require to be undertaken by professional staff. The institution would interface with all company tenants on the Park in the same way as it would in dealing with a spin-off company. If the managment of the Park was to be directly undertaken by the I.L.U. special training should be given to the relevant personnel if they do not already possess it.

Availability of a course in respect of the management of a Science Park by the Commission has been set out in Part V. It is considered that this training should be undertaken on this basis to provide a Community perspective in view of present Park developments in many Community countries.

* * *

B. IDENTIFICATION OF REQUIREMENTS CONCERNING STAFF

1. THE DUTIES OF STAFF

In defining the duties of an I.L.O. for the purposes of this Study, it must be remembered that no two institutions, throughout the Community, are exactly alike nor have the same facilities. The national laws also affect institutions in differing ways. As previously pointed out, many institutions have also not properly defined their objectives for general cooperation and/or technology transfer. This makes a specific definition of all the duties actually required somewhat problematic.

It is also to be noted that although may ILU's contain only one ILO, with the present increase of their duties many ILU's had more than one ILO sharing some of the duties set out below.

What this Study has attempted to do, therefore, is to take an amalgam of duties from the information received and meld the various duties presently being undertaken, or which should be undertaken, together under two basic headings, (a) Duties covering general cooperation; (b) Duties covering technology transfer.

Particular attention should be given to the alteration or addition of any of the job specifications of ILO's. These should be fully discussed, understood and agreed upon before being implemented. It would appear that some ILO's have undertaken additional duties without fully understanding the expertise which was required to carry them out.

The main purpose of this exercise is to idenify the basic duties which are being carried out, or which should be carried out by I.L.Os in these categories to be able to define the training needs which are thereafter dealt with in Part V. The consultants wish to acknowledge the assistance which they received for this task from the well prepared documents and advice which provided by UDILS as set out in appendix No. 9.

The identified duties will also be utilised to consider the basic qualifications, expertise and experience which are required by the staff to carry out their work efficiently in the next Section of this Study. In dealing with General Cooperation the duties have been placed in basic groupings. These duties reflect the basic duties applicable to staff working in all types of Industrial Liaison Units.

(a) Duties covering general cooperation

Administrative duties

(a) To organise the Industrial Liaison Unit (ILU), or its equivalent, to carry out the objectives and policies of the institution relating to general cooperation, ensuring the Unit is properly staffed.

(b) To advise on, and carry out, an audit of institutional resources applicable to general cooperation, including services which could be provided and equipment which could be utilised. To ascertain the strengths and weaknesses of the institution.

(c) To advise on, and draw up policies, procedures and documentation needed for general cooperation, including those relating to staff consultancy.

(d) To establish the relevent data base which will supply the information required for the efficient undertaking of the functions of the ILU.

(e) To carry out the administrative procedures involved with commercial contracts, including the invoicing of clients and disbursement of income according to agreed procedures.

(f) To advise on the structures which may be required in the institution for cooperation, and the establishment, management and administration of these structures.

(g) To devise and carry out the planning and strategy required for the implementation of the institutes policies.

General Duties

(a) To receive requests for assistance from outside the institution and to ensure that these requests are properly and efficiently dealt with, maintaining good customer relations.

(b) To make personal contacts/visits with outside undertakings in order to inform them about the resources and facilities of the institution, to ascertain the needs of the potential client, and ascertain how the institution can be of service.

(c) To discuss requests for assistance with the relevant Departments and staff of the institute, introduce the client to the correct expertise or facility, and then ensure that any subsequent work is carried out, expeditiously according to the contractual terms, and to the client's satisfaction.

(d) To safeguard the institution's interests and reputation by ensuring that client's work is placed with the right Department and members of staff and that client confidentiality is honoured. To seek to protect the institution and its staff against possible claims for unprofessional conduct, product liability or any other legal liability.

(e) To be alert to new developments, initiatives, commercial opportunities and sources of funding which can benefit the institution. Also to seek new commercial initiatives and opportunities.

(f) To create an institutional corporate image of industrial liaison consistent with institutional policy.

Specific Duties:

(a) To advise on, and draw up basic contractual documents, including staff consultancy agreements.

(b) To negotiate on, evaluate, and finalise the terms of agreements between the institute, staff, and other parties.

(c) To cost contracts and prepare quotations and estimates thereon.

(d) To advise and assist with publicity materials, exhibitions, conferences and meetings related to cooperation with Industry.

(e) To market the facilities and services of the institution.

(f) To establish practical and useful channels of communication, both internally and externally, including membership of relevant local and national bodies.

(g) To have basic accounting knowledge, including the preparation of accounts and budgets, also the interpretation of a balance sheet.

(h) To have a knowledge of the sources of funding available to the institution and staff.

(i) To advise staff on the structures which could be utilised for technology transfer.

(j) To advise on taxation and other fiscal policies relevant to cooperation.

If the institution wishes to utilise a company to carry out its cooperative ventures, then the following extra duties could be involved:

<u>Specific duties involved in the incorporation and management of a company</u>

(a) To prepare a business plan.

(b) To have a basic knowledge of company law and company incorporation.

(c) To be able to assist the preparation of company accounts, budgets and have a basic knowledge of company taxation.

(d) To advise on company management.

(e) To advise on company funding.

If the duties of the ILO are going to involve the transfer of the institution's technology then the following duties could be added to the above duties.

(b) **<u>Technology Transfer</u>**

(a) To advise on, and implement, institutional policies involving the identification of intellectual property, its protection and its development, including the preparation, or assisting in the preparation, of documentation.

(b) To facilitate the development of inter-disciplinary, inter-institutional and transnational research projects.

(c) To negotiate intellectual property and technology transfer agreements.

(d) To advise the institution and staff on the scale of royalties, licence fees and other like matters relating to technology transfer.

(e) To advise on funds specially available for the development and protection of intellectual property and technology transfer.

The above duties are obviously not exhaustive but it will be noted that they include expertise on the following different subjects:

- administration, contract/law; publicity/marketing; communications; negotiations; accounting/funding; intellectual property and technology transfer.

2. BASIC QUALIFICATIONS, EXPERTISE AND EXPERIENCE REQUIRED BY STAFF

Before looking at the basic qualifications, expertise and experience, of the relevant staff, it has been emphasized throughout this investigation that their personality and credibility are essential elements for carrying out their duties effectively.

Important components in the desired personality profile appear to be maturity, diplomacy, leadership qualities and an entrepreneurial attitude. Apart from the personality of the I.L.O., credibitily seems to derive above all from possession of the appropriate qualifications, expertise and experience.

The desired qualifications are clearly directly linked to the duties to be undertaken. Consideration of qualifications has therefore been divided into the same categories as those dealing with duties.

(a) General Cooperation

As institutions adopt a more businesslike approach to cooperation, to be able to deal on the same level with Industry, so the main qualifications required by an ILO are becoming more professionally-oriented.

The need for a sound academic background with a first degree in an applied scientific discipline could still be a basic qualification, but this must be supplemented by several years experience in industry, the professions or commerce, involving management-level responsibilities. These responsibilities should include, if possible, an entrepreneurial/marketing background.

During this Study it was also noted that several I.L.O's admitted that their basic qualifications and industrial experience did not provide them with the expertise to effectively deal with some of the following aspects of their present duties:

(i) The interpretation and drafting of basic research and other contracts. This would require legal expertise and drafting experience.

(ii) Negotiation of agreements. This requires the attaining of specific skills which many I.L.Os did not acquire in Industry.

(iii) A knowledge of intellectual property, its protection and its transfer on to the market. This requires knowledge which is only obtained in very specialised sectors of Industry.

(iv) Accounting and funding. These were subjects that most I.L.O's had no experience of prior to their appointment.

If a company structure was to be utilised as the vehicle for cooperation, then besides a good basic degree in an applied scientific discipline, a working knowledge of company law, accounting and procedures would be required.

(b) Technology transfer

For the technology transfer function, the applied scientific discipline again would be of importance, but the academic or research experience of an I.L.O. is probably of less significance than the expertise which is required to take an academic "idea" to an invention and then to an innovation, bringing it on to the market place for the benefit of inventors, institution and national economy.

The expertise required of an I.L.O. for effective technology transfer is in very scarce supply. To the extent that it exists, it would normally be found in successful professionals in their mid-carrier path. However, the terms and conditions being offered to I.L.O's together with the complete absence of any career structure, might not be attractive to this kind of person. This being so, the problem could *inter alia* be overcome by systematic training of less experienced personnel.

This makes the undertaking of specially prepared courses of training by I.L.O's an essential part of any Community policy on the transfer of academic technology.

3. THE RANK AND STATUS OF STAFF

The terms and conditions under which ILO's are presently employed vary from institution to institution, and from state to state, but there is one common factor which, until it is removed, will always present a direct impediment to the employment of the needed expertise in the H.E. Sector: the lack of a career structure. To date there appears to have been no attempt, within the Community, to emulate the development of a professional standing for academic staff engaged in cooperation with Industry as seen in the U.S. through the work of such bodies as the Society of Research Administrators.

Until the beginning of this decade the post of ILO was mainly filled by internal secondments of staff, normally holding the equivalent rank of a Senior Lecturer, who continued to enjoy their academic terms and conditions providing tenure and academic pensions. Many of these appointees appeared to have lacked the basic expertise and attributes now required by an ILO.

The post of ILO at the beginning of the 1980's, in many institutions, also appears to have been accepted on sufferance as an evil of doubtful necessity. Attempts by ILOs to introduce a more "commercial" approach to cooperation were often defeated or deflected by academic and administrative concerns that the terms of personal consultancies, in the light of traditional practices, might be viewed critically. The academic ambience is known for its reaction to unpalatable intrusions.

The lack in many ILO's of the expertise and experience needed for beneficial cooperation, in particular technology transfer, also led to the post being viewed with cynicism by many members of staff, experts in their own fields.

Unfortunately some of the factors just identified still linger on within certain academic establishments, and they present ILOs coming from Industry with unexpected and unknown problems.

Emerging awareness of expertise needed in ILO appointments

Over the past five years, in many cases because of the need to generate new sources of funding, a change of attitude can be noted to the criteria adopted for the appointment of an ILO in many institutions.

It has been realised that if cooperation with Industry is essential, then staff will have to be employed who have an intimate knowledge of the workings of commerce, not academe. The further realisation that academic resources have also to be protected, developed and marketed, has led to an ever increasing and widening list of duties for ILOs. The fact that many institutions have not even properly identified their resources has traditionally made the definition of these duties a matter of guesswork, not of actual requirements.

A "jack of all trades, master of none" approach to the duties of ILOs has made the establishment of the status and rank of the post even more problematic.

With the need for a more professional approach towards cooperative ventures there is a growing trend to appoint ILOs from Industry or the Professions, normally without the usual institutional terms and conditions of service. Many of these appointments are on short term contracts, often for an initial period of three years.

The practice can be seen in new structures, such as institutional companies, where "Managing Directors" are being appointed. The salary scales for these appointments are now within the Professorial range. Bonuses are being paid annually on performance with ceilings up to 50% of salary. A company car is some times provided, and a personal pension scheme in place of academic pension rights.

It is of interest to note, however, that many institutions appear reluctant to introduce these new appointments publicly in to the "pecking order" of the academic hierarchy, and, are not giving the post the rank and status which is essential if the staff are to be effective both in the Institution and Industry. This lack of recognition also affects the internal lines of communication and detracts from the effectiveness of the appointment particularly where there is no direct access to the Governing Body of the Institution.

At the same time, in some Institutions, internal appointments to the post of ILO are still being made, but the importance of the post is being recognised by an increasing number of appointments at the Professorial level. In these cases, institutional terms and conditions of service, including academic tenure, are retained on appointment. The criteria for these internal appointments vary considerably and the needed basic expertise and attributes now required by an effective ILO again appear to be lacking in many instances.

In the case of some staff with academic terms and conditions of service, one could also perhaps question whether these terms provide the required incentive to be performance-oriented in a commercial and competitive environment.

A third method of appointment of an ILO has also been noted, namely secondment from Industry for a specific period or for specific duties. The secondee normally retains his corporate salary and terms of service.

Some of these appointments have been most successful, particularly when the person concerned has been given the status which his expertise warrants, and the assistance the appointment actually requires. In other cases, unfortunately, lack of effective status and the differences in approach to basic "managerial" problems have led to the premature termination of the secondment.

The differing approaches to the terms of appointment, and the varying status given to ILOs have led either to a relatively quick turnover of staff, whose qualities appear to be more readily appreciated outside their Institution, or to a disinclination to accept the posts by the most suitable candidates.

There is a clear need for the rationalisation, on a national basis, of these terms and conditions of service, of the incentives and the rank and status of ILOs, if a suitable career structure is to be established. In addition, with the growth both of inter-institutional dvelopment of technology transfer and of transnational projects, the Community dimension of the structure must also be considered. The establishment of recognised qualifications based on training and experience, which could be tested and graded at various levels, should be introduced on a Community basis as soon as possible. If this is not done, obtaining staff of the required calibre will become a definite impediment to cooperation, in particular technology transfer.

The scientific knowledge which the ILO will be required to protect and develop is multiplying dramatically in diverse fields. This expansion also demands the continued updating of the ILO's skills to match developments in the process of innovation.

In several Community countries governments have recently provided Institutions with the legal requirements which will facilitate beneficial cooperation, in particular technology transfer. These steps are however, in themselves, not sufficient and could lead to frustration, and dissipation of scarce and valuable resources if the structures are not properly manned.

It is essential that the structures, to be effective, are provided with the services of dedicated staff having the legal and technical expertise needed to develop general cooperation, and able to identify, protect, develop, and market technology and services.

National governments should therefore give urgent consideration to the establishment of recognised and established posts, with the appropriate rank and status, within Institutions for staff cooperating with Industry, and ensure the provision of the required funding for these posts. As it may take some time to obtain the services of properly trained staff, funding should also be made available in the meantime to ensure proper levels of professional expertise and to assist Institutions in the identification of their resources and the protection and development of their technology.

The coordinating, and financing of the actual training requirements of the relevant staff might be approached on a Community basis, with support both from Community and national sources. This will be necessary if the optimum training input and updating is to be provided to deal <u>inter alia</u> with future transnational cooperative ventures on the scale required effectively to counteract Japanese and U.S. competition. The training requirements are dealt with in Part V, as are proposals for the establishment of a Community Association and for workshops to ascertain the training requirements of ILOs.

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PART FIVE

THE PROPOSED METHODS FOR THE FUTURE TRAINING TO PROVIDE THE REQUIRED SKILLS IN INDUSTRIAL LIAISON PERSONNEL

Introductory remarks

The identification of the structures and other factors needed for beneficial H.E./Industry cooperation (as set out in Part III. D and Part IV. A), combined with the definition of the core duties of I.L.O.s (Part IV. B), provide the starting point for the detailing of the training requirements for I.L.O.s set out in this Part.

The analysis of the four designated EC countries, and of other countries surveyed, shows that the functions carried out by I.L.O.s are varied and complex. Moreover, these tasks appear to have expanded in recent years, just as the performance requirements imposed on liaison personnel in carrying them out have intensified. In parallel with this, the demands on the expertise and qualifications of I.L.O.s have grown.

Pressures on liaison personnel, which can only be effectively met if staff have the appropriate qualifications, are principally two-fold : the emerging awareness in the H.E. Sector of the potential rewards from beneficial cooperation; and the demands from business for an ongoing flow of appropriate technology.

For all these pressures, however, few systematic study programmes or courses geared to providing specific vocational training for I.L.O.s have been ascertained during this Study. This does not mean that there is no demand for such training.

On the contrary, I.L.O.s do indeed follow courses but these are not, with a minimum of exceptions, courses which are designed with the I.L.O. in mind. In short, the need for training is recognised, but this is in no way matched by its supply.

The training lacuna is, moreover, becoming critical as more and more H.E. institutions, realising the need for effective cooperation, are appointing I.L.O.s. Since many have thus been appointed recently, they cannot by definition rely on on-the-job experience. "Muddling by" is, moreover, increasingly being recognised as an inappropriate response to a function of potentially great benefit to the H.E. Sector.

The scope of the training required is extensive, mirroring as it does the wide variety of skills required for effective cooperation and for the sharp end of such cooperation - technology transfer.

In addition, the scope of the training has to reflect the nature of modern technology - its transcendence of national frontiers. Thus a British or a German firm may be well placed to exploit a data-processing technology being developed in France, just as the opposite may be true. So, while training for I.L.O.s may be in large part carried out nationally, Community-wide inputs are not so much an optional extra but a central component of any national training schemes. Moreover, the case for a Community dimension is reinforced by the role that the EC could play, in the absence of limited national traditions and experience in this field, in identifying the core requirements for such training and assembling and disseminating relevant experience throughout the Community.

A. THE HOLDING OF REGULAR TRAINING COURSES AT BOTH NATIONAL AND COMMUNITY LEVEL, THE SUBJECTS, VENUES AND FORMAT TO BE ADOPTED

As far as can be ascertained in the four designated EC countries, no H.E. institution is providing courses which would cover all the basic training needs of I.L.O's. The course content and training may therefore have to be undertaken through structures and individuals not necessarily linked to existing H.E. institutions.

For this purpose, it has been proposed, later in this Section, that an Association of Industrial Liaison Executives organised on a Comunity-wide basis, be established. One of its main tasks would be to deal with the needed training on a Community basis.

This Association (see point 7 in this Section) might also assist training on a national basis where appropriate. The Commission's possible role in relation to this Association and its training task is also set out in this section.

The approach followed in this Section to training has been considered at two distinct levels: the national level, and Community level, including courses which could be undertaken with the assistance of the Commission.

Dealing firstly with the training which can be carried out on a national basis, this can be divided into two parts: training which can be carried out within H.E. institutions; and the subjects which should be dealt with nationally through the provision of centralised and regional courses.

1. Institutional Training for an ILO

The subjects required for training need to be approached methodically, and on a step-by-step basis, are set out in the following list.

	Subjects	Methodology
a)	The role of the I.L.O.	Readings, from the institutions, national and Community sources
b)	Office Administration including publicity materials	Readings, produced nationally and by national courses
c)	"Your institution", its legal constitution, and the internal interface between the ILO and other Departments	Readings, and briefing by relevant staff
d)	Data base of institutional resources	Courses on computer applications, and readings
e)	A knowledge of the local Industrial base and Regional Development Plans	Readings and visits to specific companies and such bodies as Chambers of Commerce, Regional Councils etc.
f)	Dissemination of knowledge about the benefits of general	Readings and other materials, eg. video, supplied nationally, supplemented by national courses

cooperation and
Intellectual Property

The training required to deal with the basic duties of an I.L.O. can therefore be essentially covered by manuals and other materials produced nationally, with input from the Community-level where required. Courses at national and regional level should supplement and up-date these manuals.

The above training should also be undertaken by secretarial staff who would be in charge of the office from time to time, in the absence of the I.L.O. The duties of an I.L.O. dictate that absences from the institution will often occur. Several complaints were received during this Study that during the I.L.O's absence no answers could be given to basic questions about cooperation. This could result in initial interest being lost.

2. <u>National Training for an I.L.O.</u>

This would cover some of the subjects identified above and other matters such as:

	Subjects	Methodology
a)	The carrying out of an institutional audit of applicable resources	Manuals and courses produced nationally and with Community input, supplemented by courses
b)	Policies and procedures concerning staff consultancy and intellectual projects	Manuals and courses produced nationally
c)	Report writing and	Manuals and courses produced

	preparation of general documentation	nationally
d)	The national Industrial base and Research interests, and how to utilise data bases on these subjects	Talks and literature provided nationally by the relevant Government Departments and Industrial Associations
e)	Intellectual Property and technology transfer	Manuals produced nationally and, with Community input
f)	The structures required for general cooperation and the development of Intellectual Property	Manuals produced nationally and with Community input, supplemented by courses
g)	Contract law and documentation	Manuals produced nationally, supplemented by courses
h)	Negotiation and costing of basic contracts	National courses supplying relevant literature
i)	The identification of a commercially viable "idea" and its development on to the market	Manuals produced nationally, supplemented by courses, supplying relevant literature
j)	Marketing the resources of the institution	Manuals produced nationally with Community input, supplemented by courses

k)	Interview techniques and effective communication in dealing with Industry	Readings, supplemented by courses
l)	The Funding of commercial research projects, and all other aspects of cooperation	Manuals, information produced nationally and with Community input, supplemented by courses on the preparation of applications
m)	Analysis of financial statements and budgetary control	Readings, supplemented by national courses
n)	To devise and carry out the planning and the strategy required for implementation of the institution's policies	Manuals, produced nationally, with Community input, and courses
o)	The running of, and appearance at exhibitions, fairs, etc	Readings, supplemented by courses

3. <u>National Training for the incorporation and management of a company utilised for general cooperation.</u>

To the previous training needs would be added:

	Subjects	Methodology
a)	Preparing a business	Readings, manuals supplemented by

	plan	courses
b)	Company law and company incorporation	Readings, manuals supplemented by courses
c)	Company accounts, taxation and budgets	Readings, manuals supplemented by courses
d)	Company management	Readings, manuals supplemented by courses
e)	Long term Planning and Strategy	Readings, supplemented by courses
f)	Company funding	Readings and information from relevant Public and Private sources

4. Technology Transfer

To the training required for the personnel of an ILU or an institutional company would be added the following training needs:

	Subjects	Methodology
a)	The protection and development of Intellectual Property including the preparation of documentation	National manual with Community input, supplemented by courses

b)	The negotiation of Intellectual Property Agreements, including royalty payments and licence fees	National manual with Community input supplemented by courses
c)	Marketing High Technology	National manuals with Community input, supplemented by courses
d)	Funding sources, including venture capital and equity financing (where relevant)	Readings, supplemented by courses

5. <u>The venues for the National Training Courses</u>

The National Courses might be held at regular intervals, say twice per year, during institutional holidays, on a broad Regional basis. Certain subjects may warrant a "national" course or workshops, but small classes would provide the optimum chance to disseminate the required knowledge and undertake practical exercises, including case studies.

The courses could typically last for approximately three days and consist of lectures, supplemented by videos, utilising manuals and other materials, also practical exercises.

The subjects and proposed venues would be discussed at the beginning of each year and agreed by the participants, details being forwarded to the organisers early each year.

As has already been identified earlier in this Study, there appears to be a shortage of persons who could have the expertise required to undertake some of the training needs. Most subjects could be undertaken by national specialists. However, it would appear that the Association proposed under point 7 below might assist in the identification of national trainers and also the establishment of small teams consisting of two or three persons with the required expertise to provide courses on subjects requiring Community-level input.

These teams could also form the core staff for Community courses. It is proposed that the courses be organised primarily by the Association, in conjunction with any established national body. If there are no existing national bodies, then this could be done by the Association's national representatives.

By holding the courses on a broad "Regional" basis and giving I.L.O's the option of two training meetings in each year, the optimum attendance could be anticipated.

The utilisation of a core training team could also be the most cost-effective method of carrying out the training. The continuity of a core staff visiting national regions would also allow the training team to visit institutions on a regular basis to ascertain if their training had been effective and if the needed subjects were being covered, required up-dating or whether new subjects were necessary.

They core team would also have the opportunity to discuss problems with H.E. institutions and advise them on such matters as an institutional audit, the establishment of a new structure and the implementation of a new policy and procedures.

6. Training on a Community Basis

There are certain training subjects which would appear to need a Community dimension to provide the optimum results. These could include:

	Subjects	Methodology
a)	The protection and promotion of Intellectual Property at a Community level, including utilisation of data bases	Manuals and courses
b)	The negotiation of trans-national agreements involving institutional Intellectual Property	Manuals and courses
c)	The management of Innovation, including strategic planning	Manuals and courses
d)	The management of trans-national research projects	Manuals and courses
e)	EEC funding sources applicable to institutions, and the methods of application	Documentation and lectures
f)	International agreements involving institutional Intellectual Property	Manuals and courses
g)	Identification of international market	Manuals and courses

opportunities

h)	The establishment and management of institutional structures for technology transfer, including Transnational Research Centres Incubation Centres Innovation Centres and Science Parks.	Manuals, courses and visits to relevant establishments

The Community courses would be held from time to time when it was known that there would be sufficient members who would wish to attend. The courses could be held on the most suitable dates at a central location. The time involved would be dictated by the subjects being dealt with.

The initial training of the core training staff and the updating of their programmes should be carried out by a body coordinating cooperative developments on a Community basis.

7. The establishment of a Community Association of Industrial Liaison Executives

In order to carry out most effectively the training required throughout the Community, the creation of a coordinating body should be considered. In the Community countries which are actively participating in cooperative programmes with Industry, Associations have already been established or informal group meetings of I.L.O's are being held.

HEDEL in Ireland, UDILS, SUILEX and AILO in the U.K., the regular meetings of I.L.O's in France, Germany and the Netherlands indicate that a trans-national flow of publications and other information and meetings between I.L.O's of all Community countries would be directly beneficial to national and Community linkages with Industry.

Not even the largest, and most technically advanced, Community countries are going to be independent in the research to be utilised for future industrial application.

If the optimum benefits are going to be obtained from commercially applicable academic research and expertise, "ideas" must be drawn in from all over the Community. This would enable transnational research projects to be identified, practical funding needs from non-regular sources, such as pre-development finance, to be identified and assistance provided.

This need could also be met in part by a Community-wide network of information as set out in Section C. The obvious provider of the initial information would be the I.L.O. and the Association would coordinate the input of institutions and arrange for the provision of any required advice and assistance.

Besides coordinating an information network the Association would be required to carry out the following functions:

(a) To maintain a Register of experts throughout the Community, who would be qualified to provide the necessary training and from whom the training core teams would be drawn, and to arrange for induction courses for all trainers.

(b) To arrange and coordinate the training programme throughout the Community. Consideration should be given to the certification of courses, after assessment, to form the basis of a professional career structure for I.L.O's throughout the Community. The establishment of a career structure, and a professional body, should be one of the main objects of the Association.

(c) To arrange for the supply of any required expertise to institutions to enable them to carry out any studies, or supply any advice, on all matters pertaining to general cooperation and technology transfer.

(d) To carry out needed Studies on a Community level on such matters as:

(i) Closing the gap between academe and Industry

(ii) The impediments to general cooperation and technology transfer within the Community's H.E. Sector

(iii) To ascertain if the present national laws in the Community, dealing with the ownership of Intellectual Property Rights, generated in the H.E. Sector, and their implementation, is directly benefitting the national economy, and providing the optimum return from the initial investment of public funds.

(iv) The establishment of a career structure for I.L.O's

(v) The teaching of Research and Development Management within the Community

(vi) The place of the ILU in Regional Development

(vii) The development of academic assistance to SME's throughout the Community

(viii) An international comparative study on the development of institution/industry relations

(ix) The stimulation to the transfer of academic technology, brought about by tax reliefs, both inside and outside the Community.

(e) To arrange for and assist in, the production of training materials such as the manuals, videos, and other training aids.

(f) To arrange for an up-date of all training materials.

(g) To collect international information on all relevant matters and provide a regular informative publication for distribution throughout the Community.

(h) To arrange for suitable visits and secondments between the staff of Community ILU's under the COMETT and other relevant EEC Programmes. Also for study visits of I.L.O's to public and private institutions and companies throughout the world.

(i) To arrange for an Annual Meeting and other meetings, and the provision of suitable speakers from outside and throughout the Community.

(j) To establish and maintain "round tables" for interactive dialogue between I.L.O's and industrialists throughout the Community.

(k) To represent, and present, the views of academic Industrial Liaison to relevant bodies throughout the Community, in particular the Rectors Conference.

The membership of the Association would be open to all institutions and persons in the Community's H.E. Sector who are cooperating with Industry. Also to Industry and other bodies established within the Community directly concerned with institutional/industry cooperation. The Association would be organised on a national basis with an elected representative from each country forming its executive council.

The constitution of UDIL as set out in Appendix 9 could be looked at as providing assistance in preparing the terms of the Association's Constitution.

The core staff of the Association would be in the region of 2 to 3 persons required to administer the objects of the Association but not including the maintaining of the information network if an off line service was to be established.

The Association's office should be situated at or adjacent to a centrally located institution which is active in cooperation and which would welcome assistance from the Association in the introduction or provision of courses directly related to cooperation with Industry including the training of I.L.O's and the management of Innovation.

*   *   *

B. THE COMPILATION AND PUBLICATION OF MANUALS

1. The production of manuals

These should be produced by the Association, with national assistance for national and Community training programmes. Unfortunately to-date the wealth of experienced knowledge collected by I.L.O's has not been propely collated and published in several countries. This knowledge should be presented for the benefit of all interested parties through this medium.

The manuals would be divided into two basic types, Reference Manuals and Training Manuals.

(a) Reference Manuals

These manuals would be prepared, in loose leaf form, to provide I.L.O's with text and precedents to deal with problems arising out of both their general duties and technology transfer. They would contain some of the following items:

(i) Written guidelines and policy statements from a variety of national institutions together with sample documents in respect of :

* An audit of institutional resources
* Staff consultancy
* Research contracts
* All aspects of Intellectual Property

(ii) The inclusion of the above material on a Community basis, where relevant. This would allow for comparative references on the relevant subjects and would be of assistance in dealing with transnational projects.

(iii) Details of Structures utilised for cooperation throughout the Community, including case histories of successful and unsuccessful structures, and guidelines on management and administration

(iv) Advice on national contract law applicable to the duties of an I.L.O. including personnel and insurance

(v) The production of business plans

(vi) Advice on national company law, including accounts and taxation

(vii) Advice on sources of funding available both from national and Community sources. This would also include guidelines on applications for funding

(viii) Advice on the facilitation of inter-disciplinary, inter-institutional and trans-national research projects

(ix) Advice on the marketing of institutional resources

(x) Advice on the relationships between the institution and spin-off companies

(xi) Advice on where to obtain outside expertise

(b) Training Manuals

These would also be in loose leaf format to cover the training needs identified in Section A above. This material would also be utilised to up date the Reference Manuals.

(c) Other Manuals

There would also be a need to produce manuals dealing with specialist subjects such as:

* Research Centres
* Incubation Centres
* Innovation Centres
* Science Parks.

In the case of several aspects of the I.L.O's duties, directly applicable materials are already available in such matters as business plans, negotiations and attendances at exhibitions. Where available these materials would be supplied for inclusion in the relevant manual and provided by way of a video programme.

2. A Community Directory of the cooperative services of institutions

As far as could be ascertained, only the U.K. and Germany provide directories on I.L.O's.

UDILS in the U.K. have published a Directory of the services offered by its members. This publication is now in its 10th edition and has been found to be a very practical guide which is regularly utilised by Industry.

It is understood that an international technical publisher might be prepared to publish a Community Directory of a similar format. This interest should be investigated and followed through if equitable terms can be agreed.

3. The utilisation of Video tapes and other similar programmes

Several institutions have already produced video programmes illustrating the cooperative work which is already taking place.

The Association should consider the utilisation of these Programmes in the preparation of a national video showing the benefits of cooperation. This presentation would assist in the carrying out of the missionary work required to bring home, both to academe and Industry, the benefits which can be derived from cooperation. If it is practical a combined Community Video could also be produced from available national material, supplemented by any new material which might be required to give this production a Community dimension. Several national bodies, such as the U.K. Patent Office, have already produced their own video programmes and materials on Intellectual Property which are available for general utilisation in training courses.

The ascertainment of the availability of any other suitable material which has been produced outwith the Community should also be carried out by the Association which should establish a library of these productions for use by its members and other interested parties.

* * *

C. THE ESTABLISHMENT OF A NETWORK OF INFORMATION AVAILABLE TO ALL RELEVANT STAFF WITHIN COMMUNITY

1. An Association Library

As previously noted the experienced knowledge of many

I.L.O's has not be documented and published.

Information on all aspects of cooperation, including the transfer of academic technology published in the Community is scarce, although increasing. In the U.S. a great deal of relevant literature has been published over the last fifteen years but its identification and retrieval is extremely laborious. It is proposed therefore that one of the first tasks of the Association would be to obtain copies of all relevant publications by donation or purchase and compile a Bibliography of this material to be utilised by members. Some Community countries such as Ireland have already produced publications of this nature which would facilitate this task, and other states have records of their own national publications. Community Governents should also be requested to supply copies of any of their relevant publications. For this task the Association could work in close cooperation with Eurydice.

2. <u>Data Base</u>

Besides providing a literature search facility the Association should also consider the establishment of an information network based broadly on relevant existing data bases in the Community (eg. the British Expertise in Science and Technology (BEST) database). Consideration of this format would however have to be qualified by language considerations.

The BEST proposals received the approval of Government and Industry, the CVCP and the Committee of the Directors of Polytechnics (CDP). A specially formed commercial company, Longman Catermill, was chosen to develop the proposals, and a code of practice was drawn up to govern and formalise the relationship with the contributing institutions. A Liaison Committee was established with representatives from the institutions which provides the mechanism for ensuring that the quality and comprehensiveness of the database is always improved. There is also an independent Advisory Committee which looks at the wide issues raised by the database and offers advice on the industrial and academic prospectuses.

BEST is offered primarily as an off-line service. Users describe their requirements by completing a Search Form, which is processed by the company. Charges for the service depend on the anticipated use.

A Large User Programme offers a high level of off-line use as well as an on-line service which allows companies access from their place of work using a computer terminal and a modem.

Other formats which could be considered would be the national and regional data bases to be found in Belgium and France, and any other relevant data bases in the Community.

The proposed Association should negotiate with interested publishers in the Community to enter into suitable arrangements for the introduction of a similar facility which would be available to institutions and other interested parties throughout the Community. Institutions should have the use of the database on equitable terms.

3. An Association Newsletter

As previously mentioned the Association would publish a topical regular Newsletter for distribution to its members containing reference also to practical matters of both Community and national interest.

* * *

D. THE UTILISATION OF CONFERENCES, SEMINARS, WORKSHOPS AND VISITS IN THE TRAINING PROCESS OF STAFF

One common criticism which was made during this Study focussed on the several large transnational conferences which had been held throughout the Community in the last few years dealing with subjects generally concerning the work of I.L.O's. It was felt that whilst these meetings were of some interest they did not help to properly address the practical problems faced in the day-to-day interface with Industry.

Details of successful or apparently successful cooperative programmes were given at these conferences, but the "ups and downs", which all these programmes experience, were not normally recorded or recorded in a form which would be of practical use to the participants at the conferences or persons reading the published conference materials.

It was strongly recommended that if there were to be any future conferences they should be arranged on a Community-wide basis to deal with subjects directly applicable to cooperation with Industry. Conferences which would provide a meeting place with representatives of Industry and at which a flow of interactive ideas could be ensured.

The one subject which repeatedly arose during the course of this Study, as a theme for a Community-level conference, was to consider the most practical methods of dealing with the attitudinal and other impediments to cooperation which still exist between Academe and Industry. It was thought that a Conference of this nature, involving all interested Sectors, could lay down the practical guidelines which would assist the carrying out of a Community-wide Study on this vital problem.

It is also suggested that any proposed Association could hold an Annual Meeting which would also include a Conference on a selected topic.

The setting up of Regional "Round Tables" or other suitable forums at which academics and industrialists could meet regularly to make contact and exchange ideas was also raised during the Study. This could take the form of eg. "project days" as practiced in Belgium, where university projects can be presented to Industry. A similar format is being followed in the U.K. The interaction of experience from both Sectors is one of the best methods of forging cooperative links. The practicalities of this suggestion could also be considered by the Association.

The primary requirement of I.L.O's appears to be the acquiring of practical advice on wide-ranging problems. This need would be answered in the main by the training programmes set out in Section A above, but it is felt that the holding of workshops on specific subjects throughout the Community would be more cost effective, and beneficial, than some of the large Conferences which have been held to-date.

It is also proposed that workshops be utilised to implement some of the proposal contained in this Study.

Workshops to implement proposals

To provide the optimum benefit from the proposals set out herein the following series of 5 workshops might be considered:

i) To examine and determine the exact training needs throughout the Community, it is proposed, that a one week residential workshop be held for selected participants representing the relevant expertise presently available in Community countries. These, together with the organisers and Commission representatives, would number approximately 25.

An offer of financial assistance and the production of lecturers for a workshop of this nature has already been made by an International Bank and an application for further financial assistance under the COMETT Programme is pending.

The basic format of the workshop would be:

For the first two days participants would attend lectures on selected subjects covering such matters as Grants and Grantsmanship; starting a Hi-Tech Company Planning Research and Development; marketing Hi-Technology; Intellectual Property Rights, Accounting Standards and Venture Capital and Equity financing.

These lectures form part of an already well established course on the management of small R&D firms given at Cambridge University by International Accounting Firms and a Bank. The format of the lectures would be the same as normally given on these courses and the participants would have to consider whether the commercial approach of these courses was suitable for I.L.O's and what alterations would require to be made to them.

This would target in on one of the practical problems which is often met when outside lecturers address I.L.O's, namely ensuring that the content and format of the lecture gives the optimum information and applicable advice to this particular audience. Many meetings are of interest, but of no direct help, because the content has been prepared "solely" for an industrial or commercial audience.

The remainder of the workshop would be taken up with considering the following subjects and making recommendations thereon, both on a national and Community basis.

(a) The basic training requirements of I.L.O's

(b) The specialist training requirements of I.L.O's

(c) The most practical format, venues and times for the carrying out of the said training requirements

(d) The establishment of a Community Association of Industrial Liaison Executives, the objects, format, and work to be undertaken by this proposed body.

The organisers of the workshop would report back to DG V on the recommendations of this meeting.

ii) It is proposed that for the second workshop participation be invited from I.L.O's, and other relevant persons, throughout the Community (again numbering approximately 25) to a residential workshop of about five days duration.

The participants would have been previously supplied with the relevant information and recommendations of the First Workshop.

This meeting would make recommendations on the following:

(a) The national and Community content of Reference Manuals
It is to be noted here that negative experiences due to badly documented operating principles and bad drafting, were mentioned, on more than one occasion, during the Study, as having reduced the interest of industrialists in cooperative ventures.

(b) The national and Community content of Training manuals

(c) The content of self-instructional packages

(d) The utilisation of video programmes and other relevant material to disseminate knowledge regarding the benefits of cooperation and intellectual property.

iii) If the proposal about the Community data base set out above was to proceed, then it is proposed that a workshop to consider the practical problems involved and to lay down guidelines should be called prior to negotiations with interested parties commending.

iv) In view of the paucity of the information obtained from the Questionnaire forwarded to institutions in Italy, Greece, Spain and Portugal, consideration should also be given to the holding of two workshops, one for the I.L.O's or other relevant persons from Italy and Greece and one for Spain and Portugal to <u>inter alia</u> consider, and make recommendations on the following:

(a) The need for academic cooperation and technology transfer in those countries

(b) The present impediments to academic cooperation and technology transfer in those countries

(c) The methods of developing beneficial cooperation and technology transfer.

(v) Specialist workshops

The differing operational requirements of such persons as managing directors of Institutional Companies, Directors of Research Centres, Incubation Centres, Innovation Centres and Science Parks, indicate the usefulness of the holding of workshops specifically to deal with their problems.

* * *

E. CONSIDERATION OF THE NEED FOR THE DISSEMINATION OF KNOWLEDGE ARISING OUT OF THESE PROPOSALS TO OTHER MEMBERS OF STAFF AND STUDENTS IN THE H.E. SECTOR

The terms of Parts II and III have identified various groups of persons in, or associated with, institutions to whom regular information should be given on the beneficial development of general cooperation and technology transfer. These groups are:

1. Senior Officers of institutions

As most of these persons are extremely busy it is suggested that the Association endeavour to provide well prepared and presented information on cooperation and technology transfer at the regular national meetings which the various categories of Officers attend. This would keep them up to-date on developments both on a Community and national level.

2. Non-Academic members of Industrial Liaison Committees or similar bodies

   Again one would normally be dealing with busy business and professional men, who will obviously be aware of what is going on in their own institution, but who would not normally be aware of other Community and national developments. The same materials prepared for the Senior Officers could also be supplied to these persons. These materials could be supplemented by talks given to Committees by the "outside" trainers who would be visiting the area from time to time.

   A more specialised information programme, including lectures, should also be prepared for the following categories.

3. Researchers who are involved in the management of inter disciplinary, inter-institutional and transnational Research Projects.

4. Faculty and Departmental "representatives". The continued autonomy of many Faculties and Departments in institutions results in some cooperative ventures being administered directly from the relevant Department. The persons who normally undertake this administration should also be assisted through the presentation of specially prepared materials and lectures.

5. During the course of the Study it was suggested that as many academics and industrialists were taking early retirement that some of these persons, whose experience and expertise were directly relevant to the work of the institution, could be utilised to assist an I.L.O. both inside or outside the institution.

If assistance of this nature was available the courses should also be prepared so that the persons concerned can be introduced to, and assisted in their work.

* * *

F. CONSIDERATION OF THE NEED FOR THE DISSEMINATION OF KNOWLEDGE ARISING OUT OF THE STUDY'S PROPOSALS TO STAFF IN INDUSTRY, PARTICULARLY SME's

Several reports have identified the gap between the H.E. Sector and Industry, in particular the SME's. Bridging this gap may start in the H.E. Sector, but it seems clear that it has to be a mutual effort by both parties. Sometimes representatives of the H.E. Sector during this Study pointed out that, although the institution and its staff were willing to establish links with Industry, several attempts failed because of lack of receptivity in business. Interviewees have attributed this to mainly three factors :

i) <u>Lack of knowledge in SME's about technology and resources available in H.E. institutions</u>

Regional and national governments and the EC should assist the I.L.O's and technology transfer brokers to make SME's more aware of the technological potential available in H.E. institutions. Special video tapes and other marketing material, focussing on different industrial sectors, could be developed. Advertisements publicising H.E. resources could be placed in relevant business publications perhaps with financial support and organised on a national or regional basis.

Several studies have identified the importance of intermediaries and technology transfer brokers (eg. chambers of commerce, banks, professional groupings, "guichets communautaires" etc.) for improving information flows to SME's. Special training and information programmes could be designed on a European and national level to make SME's aware of:

* the structures of cooperation and technology transfer that exist in he EC, and their own country and region in particular;

* the technological potential available, particularly in those sectors that are of particular interest for their field of action;

* the support systems that exist on an EC, national or regional level to foster technology transfer from institutions to Industry.

ii) <u>Lack of sufficient expertise in SME's to exploit H.E. know-how</u>

This is often the case in SME's which have little R&D activity. Several representatives of both Industry and the H.E. Sector suggested continuing education programmes as a remedy. These programmes could be a first step in a durable relationship between the Sectors.

Some institutions have set up special structures for transferring to SME's ideas arising in their institution. This is especially important for liaison with SME's who should be informed of these structures.

iii) <u>Mistrust of the H.E. institutions</u>

Institutions are still perceived as an "ivory tower" by some in Industry. These traditional perceptions which have developed over many years are difficult to change. Missionary work could be usefully undertaken by representatives from the institutions, eg. the I.L.O. who might establish regular contacts with SME's on a more informal basis eg. the "Petit déjeuner Technopolys" in Lyon (mentioned in Part IV).

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A LIST OF THE PUBLICATIONS AND ARTICLES REFERRED TO

PART II A

1. Ireland

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(2) Keith Sellar, F., National and College Structures for Technology Transfer from the Higher Education Sector (Report to the NBST, May 1986)

2. United Kingdom

(1) Small Firms (HMSO CMND 4811, November 1971)

(2) "A boom for boffins" (The Economist 2/5/1987)

3. France

(1) Ergas, H., Innovation, more or less (paper presented at the annual conference of the Centre for European Policy Studies, Brussels, 1984)

(2) Kahane, J.-P., "Le CNRS, ça nous interesse" (dans "La Pensée", no. 255, Jan./Feb. 1987)

(3) La Gazette du Crin, No. 38, 1986; Supplement.

4. Belgium

(1) Law of 30 Jan. 1947 "déterminant le statut de création et de fonctionnement des centres chargés de promouvoir et de coordonner l'avancement technique des différentes tâches de la vie industrielle du pays par la recherche scientifique".

(2) Arrêté royal of 2 April 1987 "tendant à valoriser la recherche scientifique fondamentale".

(3) Voorontwerp, "Koninklijk besluit nr... tot wijziging van de wet van 27 juli 1971 op de financiering en de controle van de unversitaire instellingen"; Avant-projet "Arrêté royal no.... modifiant la loi du 27 juillet 1971 relative au financement et au contrôle des institutions universitaires".

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5. Other Community Countries

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(2) Presidential decree no. 432 of 5 May 1981, esp. article 4.

(3) Gibb, G.M. (ed.), Science Parks and Innovation Centres: Their Economic and Social Impact (Proceedings of the conference held in Berlin 13 - 15 Feb. 1985, Commission of the European Communities, Luxembourg, 1985)

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n. 382 - prestazioni dei contratti e convenzioni con Enti pubblici e privati", of July 1980, esp. article 66.

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(8) Reviews of National Science and Technology Policy - Portugal (OECD, Paris, 1986, p. 45)

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(10) "Ley organica 11/1983 de reforma universitaria" (of 25 August 1983, especially article 11 ("Los departamentos y los Institutos Universitarios, y su profesorado a través de los mismos, podràn contratar con entidades publicas y privadas, o con personas fisicas, la realizacion de trabajos de caràcter cientifico, tecnico o artistico, asi como el desarollo de cursos de especializacion.").

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(2) Bruno, A.V., and Cooper A.C., Patterns of Development and Acquisitions for Silicon Valley Start-ups. (Technovation Vol.1 (1982), Pg. 275)

(3) Mc Cuen, P.A., The inter-relationship between Silicon Valley and Stanford University and its impact upon the development of a Region (Address to the IACHEI Conference, Ennis, Ireland, September 1985, Pg. 22)

PART III

1. Ireland

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(5) Keith Sellar, F., The development in Scotland of a University Company Group: the Aberdeen experience (European Journal of Education, 1985, Vol. 20, No.1, Pg. 47)

(6) Jones, A.D.A. and Dickson, K.E., Science Parks in Europe - the U.K. experience (The Technical Charge Centre, London, 1985, Pg. 1)

3. France

(1) Décret no. 80-900 of 17 November 1980.

(2) Décret no. 85-618 of 1985, and Arrêté of 13 June 1985.

(3) Décret no. 85-1022 of 24 Sep. 1985 and Arrêté of 8 Jan.

1986.

(4) "Des inventeurs pour l'industrie" (Le Monde Campus, 14 May 1987).

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4. Belgium

(1) Information provided by M. G. Declercq, Investco N.V., Brussels; president of IACHEI.

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(3) Industry and the University - New forms of co-operaton and communication (OECD/CERI, Paris, 1984).

PART III B

Nil.

PART III C

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(1) McQueen, D.H., and Wallmark, J.T., Support for new ventures at Chalmers University of Technology - Proceedings of a C.E.C. Conference on Science Parks and Innovation Centres, Berlin 13-15, February 1985 (Elsevier, Amsterdam, Pg. 155)

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(3) Bullock, M., Academic Enterprise, Industrial Innovation, and the development of High Technology financing in the United States (Brand Brothers & Co, London, 1983, Pg. 10)

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(6) Clarke, T.E., Industrial Innovation Centres, are they for you ? (The Business Journal, Spring 1982, Pg. 8)

(7) Scheirer, M.A. et al, Innovation and Enterprise, A Study of the National Science Foundation's Innovation Centres Programme (National Science Foundation, Washington D.C., December 1985)

(8) University-Industry Relationships: Selected Studies, National Science Board and National Science Foundation, Washington D.C., Pg. 107)

(9) Ibid 8, Pg. 110

(10) Ibid 8, Pg. 104

(11) Marcy, W., Comparative Survey of selected private sector technology transfer and patent management organisations (National Technical Information Service, Department of Commerce, Springfield VA, June 1986, Pg. 19)

(12) Bremmer, H.W., University Technology Transfer, Publish and Perish (American Chemical Society Conference on Patent Policy, 1978, Pg. 57)

(13) Seibert, C.H., The Humanities and the Research Administrator (SRA Journal, Spring 1985, Pg. 51)

(14) Rodman, J.A. and Dingerson, M.R., What is a University Research Administrator - Current and Future ? (SRA Journal, Fall 1979, Pg. 5)

(15) Teàgue, G.V. et al, Personality profile of Higher Education Research Administrators (SRA Journal, Winter 1982, Pg. 29)

(16) Lowry, P.S., On-the-job training for the new University Research Administrators (SRA Journal, Fall 1983, Pg. 21)

PART III D

(1) Desforges, D.C., Academic Invention and Business Innovation - USA and UK Experience (E.E.C. Conference, Lille, 1985, Pg. 244)

(2) Industry and University, New Forms of Co-operation and Communication (OECD, Paris, 1984, Pg. 56)

(3) University-Industry Research Relationships, Selected Studies (National Science Foundation and National Science Board, Washington D.C., October 1982, Pg. 86)

PART IV A

(1) The Scottish Council, Development and Industry - Profit through Partnership: Industry - Academic Collaboration in Scotland (SCDI, Edinburgh, August, 1983, Pg. 29)

(2) Fagan. M., Campus capitalists fail to make the grade (New Scientist, 15 January 1987, Pg. 17)

(3) University-Industry Research Relationships, Selected Studies (National Science Foundation and National Science Board, Washington D.C., October 1982, Pg. 107)

PART IV B

Nil.

PART V

Nil.

A LIST OF APPENDICES

1. A list of the institutions, organisations, and individuals, in the Community countries who gave:
   (a) Interviews, both personal and telephonic, and also supplied information
   (b) Supplied answers to a Questionnaire

2. A copy of the questionnaire forwarded to relevant institutions in the Community's H.E. Sector

3. (a) Summary of the responses received to the questionnaire
   (b) Details upon which the above summary is based

4. An "A-Z of University/Industry Linkage Mechanisms" in Ireland produced by the Higher Education Authority, Dublin

5. Standard job specification for I.L.Os appointed under the Industrial Liaison Programme by the National Board for Science and Technology (NBST), Ireland.

6. Extract from The Development of Higher Education in the 1990's (HMSO, Comm. 9524, May 1985)

7. Details of the University Spin-out and Interface Companies assisted by the Scottish Development Agency

8. Policy on Higher Education - Industry Interface (Higher Education Directors of External Liaison (HEDEL), Ireland)

9. The role and functions of UDIL and University Industrial Liaison Services (University Directors of Industrial Liaison Services, U.K.)

10. Information regarding "Cellules de Valorisation" issued by the Ministry of Education, France

11. Details on the policy and funding for the exploitation of research generated in the H.E. Sector in France, Ministry of Education, France

12a Details of the arrangements for the distribution of monies received by CNRS for the exploitation of inventions arising in the H.E. Sector

12b Example of a CNRS convention with an H.E. institution

13. Copy of a Memorandum, dated 1st July 1980, from the Bundesverband der Deutschen Industrie c.V. (BDI) to relevant institutions in West Germany setting out the basis of future cooperation

14. An outline of structures dealing with technology transfer based on U.S. practice

15. Training programme for "Transferbeauftragte" in Germany

16. Examples of Institutions' Research organisation

17. "Gruenderzentren" and similar structures in Germany (aus "Technologietransferinrichtingen in der Bundesrepublik Deutschland, Bochum 1986)

18. Science Parks and similar sstructures in Germany (source: J.M. Gibb (ed.), "Science Parks and Innovation Centres: their economic and social impact", Commission of the European Communities, Oxford, 1985).

APPENDIX No. 1

IRELAND

(a) Discussions were held with, and information received from members of the following : -

The Higher Education Authority
The National Board for Science and Technology
The City of Dublin Vocational Education Committee
The National University
  (a) University College, Dublin
  (b) University College, Cork
The University of Dublin, Trinity College
The National Institute for Higher Education, Dublin
The National Institute for Higher Education, Limerick
The Dublin Institute of Technology
  (a) Kevin Street
  (b) Bolton Street
The Regional Technical College, Cork
Higher Education Directors of External Liaison
Plant Biotechnology U.C.C. Ltd.
Dr. R. Johnson

(b) Information was received from the following :

Institute for Industrial Research and Standards
Industrial Development Authority of Ireland
Confederation of Irish Industry
Irish Management Institute.
Federated Union of Employers
The University College Galway
The Regional Technical College Athlone
The Regional Technical College Galway
The Regional Technical College Waterford

UNITED KINGDOM

(a) Discussions were held with, and information was received from, members of the following: -

The Department of Education and Science
The Department of Trade and Industry
The Manpower Services Commission
The Committee of Vice-Chancellors and Principals
The Committee of Directors of Polytechnics
The British Technology Group
The Patent Office
The Scottish Development Authority
The Scottish Council (Development and Industry)
Barclays Bank p.l.c.
Licensing Executives Society of Great-Britain and Ireland
University Directors of Industrial Liaison
Association of Indstrial Liaison Officers
The Confederation of British Industry
The Institute of Directors
Oxford Educational Resources Ltd
Target
Basic Medical Imaging Ltd.
The University of Cambridge
Imperial College of Science and Technology
The University of Oxford
The University of Salford
The University of Strathclyde
The University of Sussex
The University of Manchester Institute of Science and Technology (UMIST)
Brighton Polytechnic
Coventry (LANCHESTER) Polytechnic
North East London Polytechnic

Paisley College of Technology
Trent Polytechnic, Nottingham

(b) Information was received from the following: -
The Science and Engineering Research Council
The University Grants Committee
University of ASTON
University of BATH
Queen's University of BELFAST
University of BIRMINGHAM
University of BRADFORD
University of BRISTO
BRUNEL University UXBRIDGE
CITY University LONDON
University of DURHAM
University of EAST ANGLIA
University of ESSEX
University College CARDIFF
University of GLASGOW
Heriot-Watt University EDINBURGH
University of HULL
University of KEELE
University of KENT
University of LEICESTER
University of LIVERPOOL
King's College LONDON (University of LONDON)
University of Technology LOUGHBOROUGH
University NOTTINGHAM
Queen Mary College University of LONDON
University of MANCHESTER
University of NEWCASTLE UPON TYNE
University of ST.ANDREWS
University of SHEFFIELD
University of SOUTHAMPTON
University of SWANSEA

University of ULSTER
Napier College of Commerce and Technology EDINBURGH
University College of Wales, ABERYSTWYTH
University of YORK
BRISTOL Polytechnic
DUNDEE College of TECHNOLOGY
HATFIELD Polytechnic
HUDDERSFIELD Polytechnic
KINGSTON Polytechnic
LEICESTER Polytechnic
LIVERPOOL Polytechnic
Polytechnic of Central LONDON
MIDDLESEX Polytechnic
NEWCASTLE UPON TYNE Polytechnic
OXFORD Polytechnic
PLYMOUTH Polytechnic
PORTSMOUTH Polytechnic
Polytechnic of WALES
City of LONDON Polytechnic
SHEFFIELD City Polytechnic
TEESSIDE Polytechnic
THAMES Polytechnic
Polytechnic WOLVERHAMPTON
Engineering Industry Training Board
Courtalds Plc.
Grant Metropolitan Innovation Ltd.
Dr. David Hall
Mr. P. Brackley
Mr. R. Hood
Mr. G.A. Christie

FRANCE

(a) Discussions were held with, and information was received from, members of the following: -

Université de Technologie COMPIEGNE
Université Scientifique, Technologique et Medicale de GRENOBLE
Université des Sciences et Techniques de LILLE
Université de METZ
Université de PARIS Dauphine
Institut Universitaire de Technologie de CACHAN
Institut National Polytechnique de Lorraine NANCY
Institut National Polytechnique de GRENOBLE
Ecole Centrale de LYON
Ecole Centrale PARIS
Ecole supérieure de Commerce de LYON
Ecole Nationale d'Ingénieurs de METZ
HEC-ISA PARIS (Jouy-en-Josas)
ACTINOVE, Lyon:
    M. R. Fabre (Directeur)
ADERLY, Lyon:
    M. H. Debeuret (Chargé de Mission Recherches)
ANVAR, Lyon:
    M. Meyzenc
ARIST, Lyon:
    M. Nuaillat
BSN, Paris:
    M. P. Mainguy (Directeur scientifique)
CCI, Lyon:
    M. Debeuret
CNPF, Paris:
    M. de Montgolfier et
    M. J. Lafosse-Marin (Chef du Service Enseignement-Formation)

CNRS, Lille:

M. Alain Dorat et M. F. Wallart (Délégué régional à la Recherche et à la Technologie Antenne Nord/Pas-de-Calais)

Fondation Scientifique de Lyon et du Sud-Est, Lyon:

M. J.J. Périer (Vice-président délégué)

IBM, Paris:

M. de Savignac et

M. B. Leroy (Education technique et scientifique)

Ministère de l'Education Nationale (MEN), PARIS

M. Bedin

M. Korolitzki

M. Montel

M. Prokorof

PHILIPS, Paris:

M. Ducuing

Région de Lorraine, Metz:

M. M. Poinsignon (Secrétaire général adjoint, Mission Recherche)

Société Lyonnaise de Banque, LYON:

M. F. Juillet, (Responsable de la Délégation Régionale R.A.)

Société Nationale ELF AQUITAINE, Paris:

Mme. M.C. Gabillaud-Wolf (Chargé de Mission auprès du Directeur scientifique) et

M. Barbouteau

(b) Information was received from the following: -

Université de Droit et d'Economie et des Sciences AIX/MARSEILLE

Université de FRANCHE-COMTE/BESANCON

Université de BRETAGNE OCCIDENTALE

Université de CAEN

Université de BOURGOGNE/DIJON
Université Claude Bernard LYON
Université des Sciences et Techniques du Languedoc MONTPELLIER II
Université de NANCY I
Université de NANTES
Université d'ORLEANS
Université René Descartes - Académie de PARIS
Université de PAU et des pays de l'Adour
Institut Universitaire de Technologie d'AIX-EN-PROVENCE
Institut Universitaire de Technologie de BOURGES
Institut Universitaire de Technologie de NANTES
Institut Universitaire de Technologie d'ORLEANS
Institut Universitaire de Technologie de RENNES
Institut National Polytechnique de TOULOUSE
Ecole Nationale Supérieure des Mines de PARIS
ATTELOR (Association pour le Transfert de Technologie en Lorraine)
Société Nationale ELF AQUITAINE, Paris:
Mr. B. Michaux

BELGIUM

(a) Discussions were held with, and information was received from, members of the following: -

Université Libre de BRUXELLES
Vrij Universiteit BRUSSEL
Rijksuniversiteit GENT
K.U. LEUVEN
Université de LIEGE
Université Catholique de LOUVAIN
Flemish Science Council:
    Prof. T. Peeters (President)
Fondation Université-Industrie:
    M. G. Deurinck
    M. D. Symoens
Investco:
    M. G. Declercq (President of IACHE)
Ministère de la Région Wallonne:
    M. André
Ministerie van de Vlaamse Gemeenschap:
    M. F. Colson
Services du Premier Ministre:
    M. L. Bril (Secrétaire d'Etat à la Politique Scientifique)
Vlaamse Interuniversitaire Raad:
    M. J. Van der Perre

(b) Information was received from the following:-

Faculté Polytechnique de MONS
Université de l'Etat à MONS
Facultés Universitaires Notre-Dame de la Paix NAMUR
GOMOV, Regional Development Authority for East Flanders:
    M. P. Desiere

DENMARK

Information was received from the following: -

AALBORG Universitetscenter
AARHUS Universitet
ODENSE Universitet
Danmarks Ingeniorakademi and
Danmarks Tekniske Hojskole, LINGBY

Danish Employers' Confederation
Federation of Danish Industries
National Agency of Technology

GERMANY

Information was received from the following: -

Universität AUGSBURG
Technische Universität BERLIN
Universität BIELEFELD
Rheinische Friedrich-Wilhelms-Universität BONN
Ruhr-Universität BOCHUM
Technische Universität BRAUNSCHWEIG
Universität BREMEN
Technische Universität CLAUSTHAL
Universität DORTMUND
Universität DÜSSELDORF
Katholische Universität EICHSTÄTT
Universität-Gesamthochschule ESSEN
Universität ERLANGEN-NÜRNBERG
Albert-Ludwigs-Universität FREIBURG
Georg-August-Universität GÖTTINGEN
FernUniversität HAGEN
Universität HANNOVER
Ruprecht-Karls-Universität HEIDELBERG
Universität KAISERSLAUTERN
Universität KARLSRUHE
Universität des Landes Hessen KASSEL
Universität zu KÖLN
Philipps-Universität MARBURG
Technische Universität MÜNCHEN
Ludwig-Maximilians-Universität MÜNCHEN
Universität OLDENBURG
Universität-GH-PADERBORN
Universität-GH-SIEGEN
Universität ULM
Bayerische Julius-Maximilians-Universität WÜRZBURG

Fachhochschule AACHEN
Fachhochschule AUGSBURG
Technischen Hochschule DARMSTADT
Fachhochschule DARMSTADT
Fachhochschule DORTMUND
Fachhochschule GIESSEN-FRIEDBERG
Fachhochschule MÜNSTER
Fachhochschule NIEDERRHEIN
Fachhochschule WÜRZBURG-SCHWEINFURT

Bundesverband der Deutschen Industrie, KÖLN
Bundesvereinigung der Deutschen Arbeitgeberverbände, KÖLN
Ministerium für Wissenschaft und Kunst, BADEN-WÜRTTEMBERG:
Regierungsdirektor Retzlaff

GREECE

Information was received from the following: -

Technical University of CRETE
University of THRAKI

Technological and Educational Institute of KUZANI
Technological and Educational Institute of PATRAS

ITALY

(a) Discussions were held with, and information was received from:

FIAT:

M. S. ROSSETTI (suppléant au CES)

(b) Information was received from the following: -

Universita degli Studi di ANCONA
Universita degli Studi dell'Aquila degli ABRUZZI
Universita di BRESCIA
Universita di CATANIA
Universita Cattolica del Sacre Cuore MILANO
Universita degli Studi di PADOVA
Universita degli Studi di PALERMO
Universita degli Studi di PISA
Universita degli Studi di TORINO
Universita degli Studi di UDINE

<u>LUXEMBOURG</u>

Information was received from the following: -

Centre Universitaire de LUXEMBOURG

Fédération des Industriels Luxembourgeois, Luxembourg
Ministère de l'Education Nationale et de la Jeunesse, Luxembourg

THE NETHERLANDS

Information was received from the following: -

Universiteit van AMSTERDAM
Vrije Universiteit AMSTERDAM
Technische Universiteit DELFT
Rijksuniversiteit GRONINGEN
Riksuniversiteit LEIDEN
Rijksuniversiteit te UTRECHT

AMERSFOORTSE Laboratoriumschool
Hogeschool DRENTHE
Hogeschool EINDHOVEN
Technische Hogeschool TWENTE

Netherlands Universities - Foundation for International Cooperation (NUFFIC)
TNO Board of Management (Netherlands organisation for applied scientific research)

PORTUGAL

Information was received from the following: -

Universidade dos ACORES
Universidade de COIMBRA
Universidade do MINHO, engenharia:
Mr. Altamiro Barbosa Machado

Instituto Superior de Engenharia do PORTO

Confederaçào da industria Portuguesa

SPAIN

Information was received from the following: -

Universidad de EXTRAMADURA
Universidad Pontificia Comillas MADRID
Universidad de MALAGA
Universidad de SALAMANCA

Universidad Politecnica de LAS PALMAS

Fundacion "Bosch Gimpera" BARCELONA
Fundacion Universidad-Empresa de CASTILLA-LA MANCHA
Fundacion Empresa-Universidad de ZARAGOZA

EUROPE, OECD

Discussions were held with, and information was received from, members of the following: -

COMETT Technical Assistance Unit, Brussels:
Mr. E. Prosser

European Center for Strategic Management of Universities, Brussels:
Mr. G. Deurinck

European Industrial Research Association (EIRMA), Brussels:
Mr. Schultz

European Institute of Education and Social Policy, Brussels:
Mr. T. Arnold

IACHEI (International Association of Consultants in Higher Education Institutions), Brussels:
Mr. G. Declercq

OECD, Paris:
Mme. Solaneff

<u>OTHER COUNTRIES</u>

Information has also been received from the following: -

AUSTRALIA:
Swotech Ltd, Melbourne

CANADA:
Canadian Patents and Development Ltd, Ottawa

PEOPLES REPUBLIC OF CHINA:
Tsunghua University

FINLAND:
Technology Development Centre, Helsinki

HUNGARY:
State Office for Technical Development

JAPAN:
Research Development Corporation of Japan, Tokyo

SOUTH AFRICA:
South African Inventions Development Centre, Pretoria

SWEDEN:
Chalmers Institute of Technology, Gottenburg

U.S.A.
Research Corporation, Arizona

UNIVERSITY/BUSINESS COOPERATION : QUESTIONNAIRE FOR THE EEC'S HIGHER EDUCATION SECTOR

Please return the completed questionnaire at your early convenience and no later than 28 February 1987 to :
European Research Associates S.A.
Boulevard Clovis, 39
B - 1040 Brussels (Belgium)

Please indicate your answer where appropriate by placing a ✓ in the relevant box.

1. Does your Institution have an authorised and published policy on general collaboration with industry ? yes ☐ → no ☐ →

2. If the answer to 1. is "yes", please return publication/documents containing details of this policy, and annex it to this questionnaire marking it as annex "A".

3. Does your Institution have a body (ie a committee, board of directors) and staff who are authorised and responsible for the implementation of your general policy regarding cooperation with industry? yes ☐ → no ☐ →

4. If the answer to 3. is "yes", please send as annex "B":

   ° full details of this body, including its membership, objects and powers
   ° the following specific information concerning the responsible executive staff :

(a) names and addresses

(b) the title(s) of the post(s) held

(c) any academic rank held

(d) indication as to whether the post(s) is (are) tenured or for a fixed period

(e) full description of their duties

(f) is the post a full-time or part-time appointment ? Please give details of other duties undertaken

(g) academic and professional qualifications held

(h) academic, professional, industrial, government or other relevant experience

(i) the period that the post has been held.

5. Please also state in which way the post(s) was (were) filled (tick appropriate box) :

- by way of an advertisement, in the press or professional journals ? ☐

- by secondment from industry, commerce or government ? ☐

- by internal appointment ? ☐

- or any other mode of appointment ? Please give details. ☐

6. Please mark as **annex "C"** details of any training, relevant to the post, which the responsible executive staff have undertaken since their appointment. Also details of any publications read or other aids utilized to keep them up to date with their duties.

7. Does your Institution have an authorised and published policy and procedures governing members of staff undertaking industrial or commercial consultancies for financial reward ?

   yes ☐ → no ☐ →

8. If the answer to 7. is "yes", please give as **annex "D"** full details of the policy and procedures. Please also include details of the body or person responsible for their implementation, the annual number of authorised consultancies over the past five years and the Departments involved.

9. Does your Institution have authorised and published policies and procedures on any of the following: identification, ownership, and protection and commercial utilisation of intellectual property, know-how and services arising from work carried out by members of staff as part of their official duties ?

   yes ☐ → no ☐ →

10. If the answer to 9. is "yes", please give as **annex "E"** full details of the relevant policies and procedures. Please also include details both of the body responsible for their implementation,

and of its membership (ie committee, board of directors) together with details of the responsible executive staff (ie names and addresses, relevant professional qualifications, prior experience of dealing with intellectual property and technology transfer).

11. If your Institution has received any financial returns from intellectual property and know-how over the past five years, please give as **annex "F"** details of the total annual amounts received together with the sources of this income (ie royalties, license fees).

12. If your Institution owns, or has an interest in, an Innovation Centre, Technology Park, or similar entity, please give full details as **annex "G"**, together with full details of the body or persons representing the Institution's interests and the responsible executive staff.

13. If your Institution or staff has produced publications covering any of the above subjects (eg published articles or talks, books or brochures) over the past five years, please give details as **annex "H"** and state if copies are still available.

14. If there is any further information which is felt would also be relevant to this Study, please provide as **annex "I"**.

APPENDIX No.3 (a)

SUMMARY OF THE RESPONSES TO THE QUESTIONNAIRE

COUNTRY: IRELAND

INSTITUTIONS:

	Universities	Other H.E. Institutions
"Does the institution have a published policy on collaboration with industry?"		
yes:	1	1
no:	2	5
under consideration:	-	-
" Does the institution have a staff/ body to implement this policy?"		
yes:	2	6
no:	1	-
"How many members does the institutions' body consist of?"		
one:	2	6
more than one:	-	-
no indication:	-	-
"How many positions are for a fixed period of time?"		
fixed:	-	1
not fixed:	2	5
no indication	-	-
"Are the persons employed on a full or part time basis?"		
full time:	2	4
part time:	-	2
no indication:	-	-

"Do the persons have outside experience in the public (e.g. ministerial cabinets) or private sector?"		
yes:	2	6
no:	-	-
no indication:	-	-
"Does the institution have a policy on consultancy contracts with industry?"		
yes:	2	6
no:	-	-
no indication:	-	-
"Does the institution have a policy on intellectual property rights?"		
yes:	1	-
no:	1 (under consider.)	6 (2 under consider.)
no indication:	-	-
"Does the institution receive revenus from intellectual property rights?"		
yes:	1	-
no:	1	all
no indication:	-	-

COUNTRY: UNITED KINGDOM

INSTITUTIONS:	Universities	Other H.E. Institutions
"Does the institution have a published policy on collaboration with industry?"		
yes:		
no:		
under consideration:		
" Does the institution have a staff/ body to implement this policy?"		
yes:		
no:		
"How many members does the institutions' body consist of?"		
one:		
more than one:		
no indication:		
"How many positions are for a fixed period of time?"		
fixed:	22	5
not fixed:	10	7
no indication	-	-
"Are the persons employed on a full or part time basis?"		
full time:	31	10
part time:	8	11
no indication:	-	-

"Do the persons have outside experience in the public (e.g. ministerial cabinets) or private sector?"

yes:	30	7
no:	8	2
no indication:	-	-

"Does the institution have a policy on consultancy contracts with industry?"

yes:	29	10
no:	5	2
under consideration	-	-

"Does the institution have a policy on intellectual property rights?"

yes:	30	5
no:	3	8
under consideration:	2	1

"Does the institution receive revenus from intellectual property rights?"

yes:	19	4
no:	8	5
not applicable:	7	9

COUNTRY: BELGIUM

INSTITUTIONS:

	total	Universities 9
"Does the institution have a published policy on collaboration with industry?"		
yes:		4
no:		5
under consideration:		-
" Does the institution have a staff/ body to implement this policy?"		
yes:		9
no:		-
"How many members does the institutions' body consist of?"		
one:		3
more than one:		6
no indication:		-
"How many positions are for a fixed period of time?"		
fixed:		1
not fixed:		19
no indication		-
"Are the persons employed on a full or part time basis?"		
full time:		12
part time:		11
no indication:		-

"Do the persons have outside experience in the public (e.g. ministerial cabinetts) or private sector?"

yes:	12
no:	9
no indication:	-

"Does the institution have a policy on consultancy contracts with industry?"

yes:	5
no:	4
no indication:	-

"Does the institution have a policy on intellectual property rights?"

yes:	6
no:	3
no indication:	-

"Does the institution receive revenus from intellectual property rights?"

yes:	5
no:	1
no indication:	3

COUNTRY: FRANCE

INSTITUTIONS:

	Univ.	INP	IUT	Other
total	16	3	6	6
"Does the institution have a published policy on collaboration with industry?"				
yes:	14	3	5	6
no:	2	-	1	-
under consideration:	-	-	-	-
" Does the institution have a staff/ body to implement this policy?"				
yes:	13	3	4	5
no:	3	-	2	1
"How many members does the institutions' body consist of?"				
one:	7	3	2	4
more than one:	6	-	2	-
no indication:	-	-	-	1
"How many positions are for a fixed period of time?"				
fixed:	5	-	-	3
not fixed:	16	2	14	1
no indication	19	1	1	-
"Are the persons employed on a full or part time basis?"				
full time:	9	2	-	2
part time:	29	1	14	2
no indication:	2	-	1	1

"Do the persons have outside experience in the public (e.g. ministerial cabinets) or private sector?"				
yes:	7	-	1	4
no:	11	2	-	-
no indication:	2	1	14	1
"Does the institution have a policy on consultancy contracts with industry?"				
yes:	8	2	4	5
no:	7	1	2	-
no indication:	1	-	-	1
"Does the institution have a policy on intellectual property rights?"				
yes:	9	3	1	4
no:	7	-	5	2
no indication:	-	-	-	-
"Does the institution receive revenus from intellectual property rights?"				
yes:	7	1	-	1
no:	-	1	-	-
no indication:	9	1	all	5

COUNTRY: GERMANY

INSTITUTIONS:

	Universities	Fachhochschulen
total	30	9
"Does the institution have a published policy on collaboration with industry?"		
yes:	15	5
no:	15	4
under consideration:	-	-
" Does the institution have a staff/ body to implement this policy?"		
yes:	22	6
no:	7	3
planned:	1	-
"How many members does the institutions' body consist of?"		
one:	12	5
more than one:	9	1
no indication:	2	-
"How many positions are for a fixed period of time?"		
fixed:	13	1
not fixed:	11	8
no indication	14	-
"Are the persons employed on a full or part time basis?"		
full time:	26	8
part time:	3	1
no indication:	13	-

"Do the persons have outside experience in the public (e.g. ministerial cabinetts) or private sector?"

yes:	13	4
no:	11	5
no indication:	16	-

"Does the institution have a policy on consultancy contracts with industry?"

yes:	9	6
no:	20	3
no indication:	-	-

"Does the institution have a policy on intellectual property rights?"

yes:	7	1
no:	20	8
no indication:	2	-

"Does the institution receive revenus from intellectual property rights?"

yes:	-	-
no:	all	all
no indication:	-	-

COUNTRY: GREECE

INSTITUTIONS:

	total	Universities 3
"Does the institution have a published policy on collaboration with industry?"		
yes:		3
no:		-
under consideration:		-
"Does the institution have a staff/ body to implement this policy?"		
yes:		3
no:		-
"How many members does the institutions' body consist of?"		
one:		1
more than one:		2
no indication:		-
"How many positions are for a fixed period of time?"		
fixed:		-
not fixed:		all
no indication:		
"Are the persons employed on a full or part time basis?"		
full time:		8
part time:		-
no indication:		10

"Do the persons have outside experience in the public (e.g. ministerial cabinets) or private sector?"

yes:	8
no:	-
no indication:	10

"Does the institution have a policy on consultancy contracts with industry?"

yes:	3
no:	-
no indication:	-

"Does the institution have a policy on intellectual property rights?"

yes:	3
no:	-
no indication:	-

"Does the institution receive revenus from intellectual property rights?"

yes:	2
no:	-
no indication:	1

COUNTRY: ITALY

INSTITUTIONS:

	total	Universities 10
"Does the institution have a published policy on collaboration with industry?"		
yes:		5
no:		5
under consideration:		-
" Does the institution have a staff/ body to implement this policy?"		
yes:		3
no:		7
"How many members does the institutions' body consist of?"		
one:		-
more than one:		3
no indication:		-
"How many positions are for a fixed period of time?"		
fixed:		43
not fixed:		-
no indication		-
"Are the persons employed on a full or part time basis?"		
full time:		-
part time:		43
no indication:		-

"Do the persons have outside experience in the public (e.g. ministerial cabinetts) or private sector?"

yes:	-
no:	-
no indication:	43

"Does the institution have a policy on consultancy contracts with industry?"

yes:	9
no:	-
no indication:	1

"Does the institution have a policy on intellectual property rights?"

yes:	1
no:	9
no indication:	-

"Does the institution receive revenus from intellectual property rights?"

yes:	-
no:	all
no indication:	-

COUNTRY: LUXEMBOURG

INSTITUTIONS:

	total	Universities 1
"Does the institution have a published policy on collaboration with industry?"		
yes:		1
no:		-
under consideration:		-
" Does the institution have a staff/ body to implement this policy?"		
yes:		-
no:		1
"How many members does the institutions' body consist of?"		
one:		-
more than one:		-
no indication:		-
"How many positions are for a fixed period of time?"		
fixed:		-
not fixed:		-
no indication:		-
"Are the persons employed on a full or part time basis?"		
full time:		-
part time:		-
no indication:		-

"Do the persons have outside experience in the public (e.g. ministerial cabinets) or private sector?"

yes:	-
no:	-
no indication:	-

"Does the institution have a policy on consultancy contracts with industry?"

yes:	-
no:	1
no indication:	-

"Does the institution have a policy on intellectual property rights?"

yes:	1
no:	-
no indication:	-

"Does the institution receive revenus from intellectual property rights?"

yes:	-
no:	-
no indication:	1

COUNTRY: THE NETHERLANDS

INSTITUTIONS:

	total	Universities 10
"Does the institution have a published policy on collaboration with industry?"		
yes:		1 (?)
no:		6
under consideration:		3
" Does the institution have a staff/ body to implement this policy?"		
yes:		7
no:		3
"How many members does the institutions' body consist of?"		
one:		1
more than one:		5
no indication:		1
"How many positions are for a fixed period of time?"		
fixed:		4
not fixed:		16
no indication:		3
"Are the persons employed on a full or part time basis?"		
full time:		10
part time:		12
no indication:		1

"Do the persons have
outside experience in
the public (e.g. ministerial
cabinets) or private sector?"

yes:	4
no:	2
no indication:	16

"Does the institution have
a policy on consultancy
contracts with industry?"

yes:	5
no:	3
no indication:	1

"Does the institution have
a policy on intellectual
property rights?"

yes:	4
no:	6
no indication:	-

"Does the institution
receive revenus from
intellectual property rights?"

yes:	1
no:	-
no indication:	7

COUNTRY: PORTUGAL

INSTITUTIONS:

	total	Universities 4
"Does the institution have a published policy on collaboration with industry?"		
yes:		-
no:		3
under consideration:		1
" Does the institution have a staff/ body to implement this policy?"		
yes:		-
no:		-
"How many members does the institutions' body consist of?"		
one:		-
more than one:		-
no indication:		-
"How many positions are for a fixed period of time?"		
fixed:		-
not fixed:		-
no indication:		-
"Are the persons employed on a full or part time basis?"		
full time:		-
part time:		-
no indication:		-

"Do the persons have outside experience in the public (e.g. ministerial cabinets) or private sector?"

yes:	-
no:	-
no indication:	-

"Does the institution have a policy on consultancy contracts with industry?"

yes:	-
no:	3
no indication:	-

"Does the institution have a policy on intellectual property rights?"

yes:	-
no:	2
no indication:	1

"Does the institution receive revenus from intellectual property rights?"

yes:	-
no:	-
no indication:	all

COUNTRY: SPAIN

INSTITUTIONS:

	total	Universities 8
"Does the institution have a published policy on collaboration with industry?"		
yes:		-
no:		5
under consideration:		3
" Does the institution have a staff/ body to implement this policy?"		
yes:		4
no:		4
"How many members does the institutions' body consist of?"		
one:		-
more than one:		3
no indication:		1
"How many positions are for a fixed period of time?"		
fixed:		19
not fixed:		-
no indication:		1
"Are the persons employed on a full or part time basis?"		
full time:		3
part time:		16
no indication:		1

"Do the persons have outside experience in the public (e.g. ministerial cabinets) or private sector?"

yes:	11
no:	3
no indication:	1

"Does the institution have a policy on consultancy contracts with industry?"

yes:	4
no:	4
no indication:	-

"Does the institution have a policy on intellectual property rights?"

yes:	2
no:	6
no indication:	-

"Does the institution receive revenus from intellectual property rights?"

yes:	-
no:	-
no indication:	8

APPENDIX No. 3 (b)

Ireland *)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	no	no
Does the institution have a staff/body to implement this policy ?		yes	yes	yes	
Such a body includes how many executive positions ?	1	1	1	1 (planned)	
Are positions for a fixed period of time or not ? **)	ten.	ten.	not fixed		
Are the persons employed on a full or part time basis ?	full	full	full		
Do the persons have outside experience in the public or industrial sector ?	yes	?	yes		
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	no	no	no
Does the institution have a policy on intellectual property rights ?	yes	no	no	no	no
Does the institution receive revenus from intellectual property rights ?	yes/soon	/	/		
What are the qualifications of the executive persons liaising with industry ?	Chem.Tech.	MBA	Scientist		
Do they have expertise in industry, financing insti--tutions or public service ?	yes	?	yes		
For how many years have they been exercising that job ?	5 Y	3 months	9 Y		
How were they appointed ?	advert.	second. advert.	advert.	internal	

*) Some of the data from Ireland have arrived late and could not be included in the totals of Appendix No. 3 (a).

**) Some of the responses did not allow to make a distinction between "tenured" and "not for a fixed period of time".

Ireland (2)

Does the institution have a published policy on collaboration with industry ?	no	no	no	no
Does the institution have a staff/body to implement this policy ?	1	1	1 (ext.aff. dept.)	1
Such a body includes how many executive positions ?				
Are positions for a fixed period of time or not ?	fixed	ten.	ten.	ten.
Are the persons employed on a full or part time basis ?	full	full	full	full
Do the persons have outside experience in the public or industrial sector ?	yes	yes	yes	no
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	no	no	not yet	no
Does the institution receive revenus from intellectual property rights ?	no	no	no	no
What are the qualifications of the executive persons liaising with industry ?	?	chemist ?	chemist	chemist ?
Do they have expertise in industry, financing insti--tutions or public service ?	yes	yes	yes	no
For how many years have they been exercising that job ?	1 Y	5 Y	5 Y	5 Y
How were they appointed ?	advert.	advert.	advert.	internal

Ireland (3)

Does the institution have a published policy on collaboration with industry ?	yes	no
Does the institution have a staff/body to implement this policy ?	1	1
Such a body includes how many executive positions ?		
Are positions for a fixed period of time or not ?	ten.	ten.
Are the persons employed on a full or part time basis ?	part	part
Do the persons have outside experience in the public or industrial sector ?	yes	?
Does the institution have a policy on consultancy contracts with industry ?	yes	yes
Does the institution have a policy on intellectual property rights ?	no	no
Does the institution receive revenus from intellectual property rights ?	no	no
What are the qualifications of the executive persons liaising with industry ?	?	?
Do they have expertise in industry, financing insti--tutions or public service ?	yes	?
For how many years have they been exercising that job ?	2 Y	1 month
How were they appointed ?	internal	internal

United Kingdom *)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	no	yes
Does the institution have a staff/body to implement this policy ?	no (Sc. Park)	yes	yes (company +comittee)	yes	yes
Such a body includes how many executive positions ?	2	1	4	3	2
Are positions for a fixed period of time or not ?	/	?	fixed	ten	ten
Are the persons employed on a full or part time basis ?	/	?	full	1 full 2 part	full
Do the persons have outside experience in the public or industrial sector ?	yes	yes	yes	2 yes 1 no	no
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	yes	yes	consid.	yes
Does the institution receive revenus from intellectual property rights ?	no	35000 pds royalties + software	?	/	yes
What are the qualifications of the executive persons liaising with industry ?		chemist	2 engineer	sollicitor engineer scientist	engineer
Do they have expertise in industry, financing insti--tutions or public service ?		yes	yes	yes	yes
For how many years have they been exercising that job ?		25 Y	4,17 Y	2,1,1 Y	since '72
How were they appointed ?		recom.	advert.	2 internal 1 external	advert

*) Some of the data from the UK have arrived late and could not be included in the totals of Appendix No. 3 (a).

United Kingdom (2)

Does the institution have a published policy on collaboration with industry ?	yes	no	no	?	no
Does the institution have a staff/body to implement this policy ?	no	yes	yes	off. of commercial pub. aff.	yes
Such a body includes how many executive positions ?	1	?	(acad.+ adv.com. of 12 ind.	?	1
Are positions for a fixed period of time or not ?	ten	fixed	ten	?	fixed
Are the persons employed on a full or part time basis ?	full	full	full	?	full
Do the persons have outside experience in the public or industrial sector ?	yes	no	yes	?	yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	no	?	yes
Does the institution have a policy on intellectual property rights ?	yes	no	yes	yes	yes
Does the institution receive revenus from intellectual property rights ?	?	/	yes	?	yes
What are the qualifications of the executive persons liaising with industry ?	engineer	lawyer	engineer		Scientist BSC
Do they have expertise in industry, financing insti- -tutions or public service ?	yes	yes	yes		yes
For how many years have they been exercising that job ?	20 Y	16 months	20 Y		18 months
How were they appointed ?	advert.	advert.	invit.		advert.

United Kingdom (3)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	no	yes
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	yes	yes
Such a body includes how many executive positions ?	1	2	2	1	1
Are positions for a fixed period of time or not ?	?	1 ten 1 fixed	ten	second	fixed
Are the persons employed on a full or part time basis ?	?	1 full 1 part	full	full	part
Do the persons have outside experience in the public or industrial sector ?	?	yes	yes	yes (market.)	no
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	no	yes
Does the institution have a policy on intellectual property rights ?	yes	yes	yes	yes	yes
Does the institution receive revenus from intellectual property rights ?	yes	yes	?	yes	no
What are the qualifications of the executive persons liaising with industry ?	engineer chemical	economist chart. acc	none	marketing	Physic. Teacher
Do they have expertise in industry, financing insti--tutions or public service ?	yes	yes	yes	yes	no
For how many years have they been exercising that job ?	since '74	1 Y	5 Y	15 months	1.7 Y + ?
How were they appointed ?	?	internal	1 advert. 1 intern.	seconded	internal appoint.

United Kingdom (4)

Does the institution have a published policy on collaboration with industry ?	yes	no	no	no
Does the institution have a staff/body to implement this policy ?	yes	yes	no	yes (comitte + ILO)
Such a body includes how many executive positions ?	1	1		1
Are positions for a fixed period of time or not ?	ten	fixed		fixed
Are the persons employed on a full or part time basis ?	part	full		full
Do the persons have outside experience in the public or industrial sector ?	yes	yes		yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	no
Does the institution have a policy on intellectual property rights ?	yes	yes	yes	yes
Does the institution receive revenus from intellectual property rights ?	yes	no	yes	yes
What are the qualifications of the executive persons liaising with industry ?	chemist	marketing		Prod. Man.
Do they have expertise in industry, financing insti--tutions or public service ?	yes	?		yes
For how many years have they been exercising that job ?	6 Y	since '86		2.5 Y
How were they appointed ?	advert.	advert.		internal

United Kingdom (5)

Does the institution have a published policy on collaboration with industry ?	no	yes	no	no	yes
Does the institution have a staff/body to implement this policy ?	yes (comittee + ILO)	yes	yes	under consid.	yes
Such a body includes how many executive positions ?	?	3	1	1	1
Are positions for a fixed period of time or not ?	ten.	permanent	ten.	permanent	permanent
Are the persons employed on a full or part time basis ?	part	full	full	full	full
Do the persons have outside experience in the public or industrial sector ?	little	?	yes	yes	no
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	yes	no (under consid.)	yes	yes
Does the institution receive revenus from intellectual property rights ?	yes	yes	?	no	no
What are the qualifications of the executive persons liaising with industry ?	M.A. (carreers guidance)	3 graduate	Academic	Chartered Secret.	Chemist
Do they have expertise in industry, financing insti--tutions or public service ?	yes	yes	no	yes	yes
For how many years have they been exercising that job ?	7 Y	-	since '85	since '87	2 Y
How were they appointed ?	internal	1 advert. 1 internal 1 per.cont	internal	advert.	internal

United Kingdom (6)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	no	no
Does the institution have a staff/body to implement this policy ?	campus	yes	yes	yes (ILO)	yes
Such a body includes how many executive positions ?	?	1	4	1	2
Are positions for a fixed period of time or not ?	?	fixed	ten	fixed	job
Are the persons employed on a full or part time basis ?	(part)	full	part	full	full
Do the persons have outside experience in the public or industrial sector ?	(yes)	yes	no	yes	yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	yes	yes	no	yes
Does the institution receive revenus from intellectual property rights ?	?	yes	yes	no	yes
What are the qualifications of the executive persons liaising with industry ?	1 business 1 engineer 1 chemist	chemical engineer	aerodyn. engineer	scientist	engineer
Do they have expertise in industry, financing insti--tutions or public service ?	yes	yes	yes	yes	yes
For how many years have they been exercising that job ?	since '69	since '85	since '86	since '82	since '84
How were they appointed ?	internal	advert.	internal	advert.	advert.

United Kingdom (7)

Does the institution have a published policy on collaboration with industry ?	no	yes	no	no	no
Does the institution have a staff/body to implement this policy ?	yes (ILO)	yes	yes	yes	yes
Such a body includes how many executive positions ?	?	1	1	1	1
Are positions for a fixed period of time or not ?	fixed	permanent	?	?	ten
Are the persons employed on a full or part time basis ?	full	full	part	?	full
Do the persons have outside experience in the public or industrial sector ?	yes	no	yes	?	yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	no	?	yes
Does the institution have a policy on intellectual property rights ?	no	yes	no	?	yes
Does the institution receive revenus from intellectual property rights ?	no	yes	/	?	/
What are the qualifications of the executive persons liaising with industry ?	chartered account.	BS philo.	?	?	Business Administ.
Do they have expertise in industry, financing insti--tutions or public service ?	no	no	yes	?	yes
For how many years have they been exercising that job ?	4 Y	oct. 84	4 months	?	3 Y
How were they appointed ?	internal	internal	second.	internal	internal

United Kingdom (8)

Does the institution have a published policy on collaboration with industry ?	yes	no
Does the institution have a staff/body to implement this policy ?	yes	yes
Such a body includes how many executive positions ?	1	2
Are positions for a fixed period of time or not ?	ten.	fixed
Are the persons employed on a full or part time basis ?	full	part
Do the persons have outside experience in the public or industrial sector ?	yes	no
Does the institution have a policy on consultancy contracts with industry ?	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	yes
Does the institution receive revenus from intellectual property rights ?	yes	/
What are the qualifications of the executive persons liaising with industry ?	Scientist	chem. eng. teacher
Do they have expertise in industry, financing insti- -tutions or public service ?	yes	no
For how many years have they been exercising that job ?	6 months	4,2 Y
How were they appointed ?	invit.	internal

United Kingdom (9)

Does the institution have a published policy on collaboration with industry ?	no	yes	no	no	yes
Does the institution have a staff/body to implement this policy ?		yes	no	no	yes
Such a body includes how many executive positions ?	2				1
Are positions for a fixed period of time or not ?	ten	ten			ten.
Are the persons employed on a full or part time basis ?	full	full			full
Do the persons have outside experience in the public or industrial sector ?		no			little
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes		yes
Does the institution have a policy on intellectual property rights ?	yes	yes	no		yes
Does the institution receive revenus from intellectual property rights ?		no			
What are the qualifications of the executive persons liaising with industry ?	elec. eng.	physicist			scientist
Do they have expertise in industry, financing insti--tutions or public service ?	yes	no			yes
For how many years have they been exercising that job ?	-	1 Y			20 Y
How were they appointed ?	internal	internal			advert.

United Kingdom (10)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	no	no
Does the institution have a staff/body to implement this policy ?	yes	no	yes	no	yes
Such a body includes how many executive positions ?	10		2		1
Are positions for a fixed period of time or not ?	ten		fixed		fixed
Are the persons employed on a full or part time basis ?	part		full		full
Do the persons have outside experience in the public or industrial sector ?	?		?		yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	no	yes	yes
Does the institution have a policy on intellectual property rights ?	no	no	yes		no
Does the institution receive revenus from intellectual property rights ?	no		/	yes	
What are the qualifications of the executive persons liaising with industry ?	engineer		?		outside academic
Do they have expertise in industry, financing insti- -tutions or public service ?	yes		?		
For how many years have they been exercising that job ?	2 Y		?		
How were they appointed ?	internal		internal		advert.

United Kingdom (11)

Does the institution have a published policy on collaboration with industry ?	no	no	no	no	yes
Does the institution have a staff/body to implement this policy ?	no	no	no	no	no
Such a body includes how many executive positions ?				2	
Are positions for a fixed period of time or not ?				1 fixed 1 ten	
Are the persons employed on a full or part time basis ?				full	
Do the persons have outside experience in the public or industrial sector ?				1 yes 1 no	
Does the institution have a policy on consultancy contracts with industry ?	yes	no	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	no	yes	yes	yes
Does the institution receive revenus from intellectual property rights ?					yes
What are the qualifications of the executive persons liaising with industry ?					
Do they have expertise in industry, financing insti--tutions or public service ?					
For how many years have they been exercising that job ?					
How were they appointed ?					

United Kingdom (12)

Does the institution have a published policy on collaboration with industry ?	no	yes	no	no
Does the institution have a staff/body to implement this policy ?	yes	yes	no	yes
Such a body includes how many executive positions ?	1	1	1	1
Are positions for a fixed period of time or not ?	second.	fixed	ten	ten
Are the persons employed on a full or part time basis ?	full	part	full	full
Do the persons have outside experience in the public or industrial sector ?	no	yes	yes	yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	no	no	yes	no
Does the institution receive revenus from intellectual property rights ?	no	no	no	yes
What are the qualifications of the executive persons liaising with industry ?	engineer	chemist professor	chemist	prod. engineer
Do they have expertise in industry, financing insti- -tutions or public service ?	yes	no	yes	yes
For how many years have they been exercising that job ?	1 Y	2 Y	18 Y	since '86
How were they appointed ?	internal	internal	advert.	internal

United Kingdom (13)

Does the institution have a published policy on collaboration with industry ?	no	no	yes	no	yes
Does the institution have a staff/body to implement this policy ?	no	under consid.	yes	no	yes
Such a body includes how many executive positions ?			4		2
Are positions for a fixed period of time or not ?			3 ten 1 fixed		ten
Are the persons employed on a full or part time basis ?			4 full		full
Do the persons have outside experience in the public or industrial sector ?			?		yes
Does the institution have a policy on consultancy contracts with industry ?	yes		?	no	yes
Does the institution have a policy on intellectual property rights ?	no			no	no
Does the institution receive revenus from intellectual property rights ?					
What are the qualifications of the executive persons liaising with industry ?			2 bus.adm. 1 chem.eng 1 scient.		1 scient. 1 ?
Do they have expertise in industry, financing insti--tutions or public service ?					yes
For how many years have they been exercising that job ?			17,8,4 2.5 Y		1,? Y
How were they appointed ?			?		1 advert. 1 internal

France

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	yes	yes
Does the institution have a staff/body to implement this policy ?	yes	yes	no	yes	yes
Such a body includes how many executive positions ?	1 (+1 plan.)	1		1	1
Are positions for a fixed period of time or not ?	fixed	fixed		fixed	ten.
Are the persons employed on a full or part time basis ?	full	part		part	full
Do the persons have outside experience in the public or industrial sector ?	yes	yes		yes	yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	planned	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	no	no	yes	yes
Does the institution receive revenus from intellectual property rights ?	yes	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	chemic.	Dr. Ing. Metal.		Management	Ingen.
Do they have expertise in industry, financing insti--tutions or public service ?	yes	yes		yes	yes
For how many years have they been exercising that job ?	1.5 Y	6 Y		?	1 Y
How were they appointed ?	1 second.	other recommend.		internal	avert.

France (2)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	yes	yes
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	yes	no
Such a body includes how many executive positions ?	?	1	1	1	
Are positions for a fixed period of time or not ?	?	unlimited	?	unlimited	
Are the persons employed on a full or part time basis ?	?	part	full	full	
Do the persons have outside experience in the public or industrial sector ?	?	yes	?	yes	
Does the institution have a policy on consultancy contracts with industry ?	yes	no	yes	yes	no
Does the institution have a policy on intellectual property rights ?	yes	yes	yes	yes	no
Does the institution receive revenus from intellectual property rights ?	/	no	yes	?	
What are the qualifications of the executive persons liaising with industry ?	?	chemist + physic.	Scientist	Ing. (micro inform.)	
Do they have expertise in industry, financing insti--tutions or public service ?	?	yes	?		
For how many years have they been exercising that job ?	?	13 Y	?		
How were they appointed ?	?	seconded	second.		

France (3)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	yes	no
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	yes	no
Such a body includes how many executive positions ?	18	1	3	2	
Are positions for a fixed period of time or not ?	?	fixed	ten.	fixed	
Are the persons employed on a full or part time basis ?	part	?	2 part 1 full	1 part 1 full	
Do the persons have outside experience in the public or industrial sector ?	yes (some)	?	no	no	
Does the institution have a policy on consultancy contracts with industry ?	no	no	yes	no	no
Does the institution have a policy on intellectual property rights ?	yes	yes (CNRS)	yes (CNRS)	no	no
Does the institution receive revenus from intellectual property rights ?	?	yes	yes	/	/
What are the qualifications of the executive persons liaising with industry ?	Prof + ANVAR + CNRS	Chercheur CNRS	?	1 Physic. 1 Admin.	
Do they have expertise in industry, financing insti--tutions or public service ?	?	?	no	no	
For how many years have they been exercising that job ?	?	recent	3x5 Y	18,9months	
How were they appointed ?	internal +second.	?	1 advert. 2 internal		

France (4)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	yes	no
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	yes	no
Such a body includes how many executive positions ?	5	1	1	1	
Are positions for a fixed period of time or not ?	2 fixed 3 ten.	?	ten.	ten	
Are the persons employed on a full or part time basis ?	2 part 3 full	?	full	full	
Do the persons have outside experience in the public or industrial sector ?	2 yes 3 no	?	no	yes	
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	no	no
Does the institution have a policy on intellectual property rights ?	yes	yes	no	yes	no
Does the institution receive revenus from intellectual property rights ?	yes	yes	?	yes	
What are the qualifications of the executive persons liaising with industry ?	Econ.Phys. Bioch.Geo. Biology	?	ing.	sciences	
Do they have expertise in industry, financing insti--tutions or public service ?	2 yes 3 no	?	no	yes	
For how many years have they been exercising that job ?	2 months 1,6,1,3 Y	recent	8 Y	1 Y	
How were they appointed ?	2 intern. 3pers.rel.	internal	internal	internal	

France (5)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	yes	yes
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	yes	yes
Such a body includes how many executive positions ?	3	1	2	1	7
Are positions for a fixed period of time or not ?	ten	ten	ten	ten	ten
Are the persons employed on a full or part time basis ?	part	part	1 full 1 part	part	part
Do the persons have outside experience in the public or industrial sector ?	yes	yes	?	no	?
Does the institution have a policy on consultancy contracts with industry ?	under consid.	no	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	no	yes	yes	no
Does the institution receive revenus from intellectual property rights ?	?	?	yes	?	/
What are the qualifications of the executive persons liaising with industry ?	3 profs	Econom.	?	Research.	6 Profs 1 Resp.
Do they have expertise in industry, financing insti--tutions or public service ?	yes	yes	yes	no	?
For how many years have they been exercising that job ?	2 Y	4 Y	?	2 Y	?
How were they appointed ?	internal	external	1 ? 1 internal	internal	internal

France (6)

Does the institution have a published policy on collaboration with industry ?	yes	yes	yes	no	no
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	no	no
Such a body includes how many executive positions ?	1	1	6		
Are positions for a fixed period of time or not ?	?	ten	ten		
Are the persons employed on a full or part time basis ?	?	part	part		
Do the persons have outside experience in the public or industrial sector ?	?	yes	?		
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	no	yes
Does the institution have a policy on intellectual property rights ?	no	no	yes	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	?	/	
What are the qualifications of the executive persons liaising with industry ?	1 Resp. Admin.		5 profs +1 cons.		
Do they have expertise in industry, financing insti- -tutions or public service ?	?		?		
For how many years have they been exercising that job ?	?		?		
How were they appointed ?	?		internal		

France (7)

Does the institution have a published policy on collaboration with industry ?	yes	yes	
Does the institution have a staff/body to implement this policy ?	yes	no	
Such a body includes how many executive positions ?	1		
Are positions for a fixed period of time or not ?	ten		
Are the persons employed on a full or part time basis ?	full		
Do the persons have outside experience in the public or industrial sector ?	no		
Does the institution have a policy on consultancy contracts with industry ?	no	no	
Does the institution have a policy on intellectual property rights ?	yes	no	
Does the institution receive revenus from intellectual property rights ?	/	/	
What are the qualifications of the executive persons liaising with industry ?	Ingen.		
Do they have expertise in industry, financing insti--tutions or public service ?	no		
For how many years have they been exercising that job ?	4 Y		
How were they appointed ?	internal		

Belgium

Does the institution have a published policy on collaboration with industry ?	yes	no	no	no	yes
Does the institution have a staff/body to implement this policy ?	yes (3 bodies)	yes	yes	yes	yes
Such a body includes how many executive positions ?	3	2	2	1+2 planned	7
Are positions for a fixed period of time or not ?	3 ten	2 ten	ten	unlimited	6 ten
Are the persons employed on a full or part time basis ?	2 full 1 part	2 full	1 full	1 full	1 full 6 part
Do the persons have outside experience in the public or industrial sector ?	3 yes	2 yes	yes	yes	1 yes 6 no
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	no	no	yes
Does the institution have a policy on intellectual property rights ?	yes	yes	no	yes	no
Does the institution receive revenus from intellectual property rights ?	yes	yes	/	yes	/
What are the qualifications of the executive persons liaising with industry ?	1 econom. 1 scient. 1 appl.sc.	1 lawyer 1 econom.	civ. eng. + manag.	lawyer	1law,1comp 1fin,1sc. 3univ.adm.
Do they have expertise in industry, financing insti--tutions or public service ?	3 yes	2 yes	yes	yes	1 yes 6 no
For how many years have they been exercising that job ?	2,4,9 Y	8,2 Y	5 Y	3 Y	2 Y
How were they appointed ?	3 internal	pers.cont. advert.	internal advert.	advert.	4 intern. 3 advert.

Belgium (2)

Does the institution have a published policy on collaboration with industry ?	yes	yes	no	no
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	yes
Such a body includes how many executive positions ?	4	4	1	1
Are positions for a fixed period of time or not ?	4 ten.	fixed	ten	ten
Are the persons employed on a full or part time basis ?	4 full	part	part	full
Do the persons have outside experience in the public or industrial sector ?	2 yes 2 no	yes	no	yes
Does the institution have a policy on consultancy contracts with industry ?	yes	no	yes	no
Does the institution have a policy on intellectual property rights ?	yes	yes	no	yes
Does the institution receive revenus from intellectual property rights ?	yes	no	/	yes
What are the qualifications of the executive persons liaising with industry ?	1 scient. 1 engineer 1 econom. 1 financ.	civ. eng.	chemist	economist
Do they have expertise in industry, financing insti--tutions or public service ?	2 yes 2 no	yes	no	yes
For how many years have they been exercising that job ?	15,4,1,2.5	2 Y	?	2 Y
How were they appointed ?	3 intern. 1 second.	internal	appointed	advert.

Denmark

Does the institution have a published policy on collaboration with industry ?	no	no	no
Does the institution have a staff/body to implement this policy ?	no	no	no
Such a body includes how many executive positions ?			8
Are positions for a fixed period of time or not ?			6 fixed
Are the persons employed on a full or part time basis ?			5 full 1 part
Do the persons have outside experience in the public or industrial sector ?			yes
Does the institution have a policy on consultancy contracts with industry ?	no	no	no
Does the institution have a policy on intellectual property rights ?	no	no	no
Does the institution receive revenus from intellectual property rights ?		no	no
What are the qualifications of the executive persons liaising with industry ?			5 civil engineer
Do they have expertise in industry, financing insti--tutions or public service ?			3 yes
For how many years have they been exercising that job ?			11,5,5,2,2 years
How were they appointed ?			2 intern. 3 advert.

Germany

Does the institution have a published policy on collaboration with industry ?	no	yes	no	no	yes
Does the institution have a staff/body to implement this policy ?	no	yes	yes	yes	yes
Such a body includes how many executive positions ?		4 3 planned	1	1	3
Are positions for a fixed period of time or not ?		?	?	ten	ten
Are the persons employed on a full or part time basis ?		?	?	part	full
Do the persons have outside experience in the public or industrial sector ?		?	?	yes	yes
Does the institution have a policy on consultancy contracts with industry ?	no	no	no	no	yes
Does the institution have a policy on intellectual property rights ?	no	no	no	no	yes
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?		Dipl.Ing. Sociolog. Marketing Dipl.Ing.		Dr.Physics	1 econ+law 1 phys. 1 p. r.
Do they have expertise in industry, financing insti- -tutions or public service ?		?		political	3 yes
For how many years have they been exercising that job ?		?		2 Y	11,1,7 Y
How were they appointed ?		advert.	internal	advert.	advert.

Germany (2)

Does the institution have a published policy on collaboration with industry ?	no	no	yes	yes	no
Does the institution have a staff/body to implement this policy ?	yes	yes	yes	yes	no
Such a body includes how many executive positions ?	1	1	1	4	
Are positions for a fixed period of time or not ?	ten.	fixed	?	?	
Are the persons employed on a full or part time basis ?	part	full	full	?	
Do the persons have outside experience in the public or industrial sector ?	yes	political	yes	?	
Does the institution have a policy on consultancy contracts with industry ?	no	yes	no	yes	no
Does the institution have a policy on intellectual property rights ?	no	no	no	?	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	?	/
What are the qualifications of the executive persons liaising with industry ?	Dipl.Ing. Economist	Dr.?	Dr.Ing.	?	
Do they have expertise in industry, financing insti--tutions or public service ?	yes	political	yes	?	
For how many years have they been exercising that job ?	2 Y	2 Y	3 months	?	
How were they appointed ?	?	adert.	advert.	?	

Germany (3)

Does the institution have a published policy on collaboration with industry ?	no	yes	?	no	no
Does the institution have a staff/body to implement this policy ?	no	yes	yes	yes planned	yes
Such a body includes how many executive positions ?		2	1	1	2
Are positions for a fixed period of time or not ?		2 fixed	?		fixed
Are the persons employed on a full or part time basis ?		?	full		full
Do the persons have outside experience in the public or industrial sector ?		?	?		?
Does the institution have a policy on consultancy contracts with industry ?	no	yes	no	no	no
Does the institution have a policy on intellectual property rights ?	no	no	no	no	yes
Does the institution receive revenus from intellectual property rights ?					
What are the qualifications of the executive persons liaising with industry ?		1 scient. 1 econom.	1 econom.	Nat. Sc.	1 econom. 1 math.
Do they have expertise in industry, financing insti--tutions or public service ?		?	?	yes	?
For how many years have they been exercising that job ?		1.5 Y	?	none	1 Y
How were they appointed ?		?	?	advert.	advert.

Germany (4)

Does the institution have a published policy on collaboration with industry ?	no	no	yes	yes	yes
Does the institution have a staff/body to implement this policy ?	yes	no	yes	yes	yes
Such a body includes how many executive positions ?	1 planned		1	2 + planned	1
Are positions for a fixed period of time or not ?	?		fixed	ten.	ten.
Are the persons employed on a full or part time basis ?	?		full	1 full 1part	full
Do the persons have outside experience in the public or industrial sector ?	?		no	yes	yes
Does the institution have a policy on consultancy contracts with industry ?	no	no	no	yes	yes
Does the institution have a policy on intellectual property rights ?	no	no	no	yes	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	?		economist	1 Dr. 1 Dipl.Ing	Dr. Ing.
Do they have expertise in industry, financing insti--tutions or public service ?	?		no	yes	yes
For how many years have they been exercising that job ?	?		1 Y	7,9 Y	7 Y
How were they appointed ?	internal		other	advert.	advert.

Germany (5)

Does the institution have a published policy on collaboration with industry ?	yes	yes	no	no	yes
Does the institution have a staff/body to implement this policy ?	yes	yes	no	no	yes
Such a body includes how many executive positions ?	?	1			2
Are positions for a fixed period of time or not ?	fixed	ten.			fixed
Are the persons employed on a full or part time basis ?	full	full			full
Do the persons have outside experience in the public or industrial sector ?	?	no			1 yes 1 no
Does the institution have a policy on consultancy contracts with industry ?	yes	no	no	no	yes
Does the institution have a policy on intellectual property rights ?	yes	no	no	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	?	Physic.			2 econom.
Do they have expertise in industry, financing insti- -tutions or public service ?	?	no			1 yes 1 no
For how many years have they been exercising that job ?	2 Y	3 Y			3,3 Y
How were they appointed ?	advert.	internal			other

Germany (6)

Does the institution have a published policy on collaboration with industry ?	yes	no	yes	no	no
Does the institution have a staff/body to implement this policy ?	yes	no	yes	yes	yes
Such a body includes how many executive positions ?	8		2	1	1
Are positions for a fixed period of time or not ?	5 ten. 3 fixed		fixed	?	fixed
Are the persons employed on a full or part time basis ?	full		1 full 1 part	?	1 full
Do the persons have outside experience in the public or industrial sector ?	2 yes 6 no		no	?	no
Does the institution have a policy on consultancy contracts with industry ?	yes	no	no	no	no
Does the institution have a policy on intellectual property rights ?	no	no	no	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	6 Dipl.Ing 2 econom		1 prorecto 1 agr.Ing.	Dipl.chim.	Dipl.chem.
Do they have expertise in industry, financing insti--tutions or public service ?	2 yes 6 no		2 no	no	no
For how many years have they been exercising that job ?	1,1,1,6 Y 4 ?		4,2 Y	2 Y	1 Y
How were they appointed ?	2 indust. 5 intern. 1 advert.		1 internal 1 advert.	internal	advert.

Germany (7)

Does the institution have a published policy on collaboration with industry ?	yes	no	no	yes	yes
Does the institution have a staff/body to implement this policy ?	yes	no	no	yes	yes
Such a body includes how many executive positions ?	1			1	1
Are positions for a fixed period of time or not ?	fixed			ten.	ten.
Are the persons employed on a full or part time basis ?	full			full	full
Do the persons have outside experience in the public or industrial sector ?	yes			yes	yes
Does the institution have a policy on consultancy contracts with industry ?	yes	no	no	yes	yes
Does the institution have a policy on intellectual property rights ?	no	no	no	yes	no
Does the institution receive revenus from intellectual property rights ?	no	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	Dipl.Ing.			Econom Ing	Dipl.Ing.
Do they have expertise in industry, financing insti--tutions or public service ?	yes			yes	?
For how many years have they been exercising that job ?	2 Y			2 Y	3 Y
How were they appointed ?	advert.			advert.	adoption institut.

Germany (8)

Does the institution have a published policy on collaboration with industry ?	yes	yes	no	no
Does the institution have a staff/body to implement this policy ?	yes	yes	no	yes
Such a body includes how many executive positions ?	1 1 planned	3		1
Are positions for a fixed period of time or not ?	2 ten	ten (?)		ten
Are the persons employed on a full or part time basis ?	full	full (?)		part
Do the persons have outside experience in the public or industrial sector ?	2 no	no (?)		yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	no	yes
Does the institution have a policy on intellectual property rights ?	no	no	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	Dipl.Ing.	Dipl.Ing. (?)		Dipl.Ing.
Do they have expertise in industry, financing insti--tutions or public service ?	no	?		yes
For how many years have they been exercising that job ?	3 Y + planned	?		?
How were they appointed ?	1 advert. 1 internal	internal (?)		internal

Italy

Does the institution have a published policy on collaboration with industry ?	yes	yes	no	no	no
Does the institution have a staff/body to implement this policy ?	no	yes	no	no	no
Such a body includes how many executive positions ?		31			
Are positions for a fixed period of time or not ?		31 fixed			
Are the persons employed on a full or part time basis ?		31 part			
Do the persons have outside experience in the public or industrial sector ?		?			
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	no	yes	no	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?					
Do they have expertise in industry, financing insti--tutions or public service ?					
For how many years have they been exercising that job ?					
How were they appointed ?		internal			

Italy (2)

Does the institution have a published policy on collaboration with industry ?	no	yes	no	yes	yes
Does the institution have a staff/body to implement this policy ?	no	no	no	yes	yes
Such a body includes how many executive positions ?				9	3
Are positions for a fixed period of time or not ?				9 fixed	3 fixed
Are the persons employed on a full or part time basis ?				9 part	3 part
Do the persons have outside experience in the public or industrial sector ?				?	?
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes	yes	under consider.
Does the institution have a policy on intellectual property rights ?	no	no	no	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?					
Do they have expertise in industry, financing insti--tutions or public service ?					
For how many years have they been exercising that job ?					
How were they appointed ?				internal	internal

The Netherlands

Does the institution have a published policy on collaboration with industry ?	under discussion	yes	no	yes	yes
Does the institution have a staff/body to implement this policy ?	no	yes	yes	yes	yes
Such a body includes how many executive positions ?		5	2	2	5
Are positions for a fixed period of time or not ?		ten	ten	?	1 not 4 fixed
Are the persons employed on a full or part time basis ?		part	full	1 full 1 part	5 full
Do the persons have outside experience in the public or industrial sector ?		?	yes	2 no	?
Does the institution have a policy on consultancy contracts with industry ?	under discussion	yes	no	yes	yes
Does the institution have a policy on intellectual property rights ?	no	yes	yes	no	yes
Does the institution receive revenus from intellectual property rights ?	/	/	yes	/	/
What are the qualifications of the executive persons liaising with industry ?		3 with Dr. Title	Ingen.	1 agr.econ 1 biolog.	3 with Dr. Title
Do they have expertise in industry, financing insti--tutions or public service ?		?	yes	2 no	
For how many years have they been exercising that job ?		1 Y	since 1981	1 since 81 1 since 84	
How were they appointed ?		internal	adv.+sec.	2 internal	

The Netherlands (2)

Does the institution have a published policy on collaboration with industry ?	yes	no	yes	yes	no
Does the institution have a staff/body to implement this policy ?	yes	no	yes	yes	no
Such a body includes how many executive positions ?			6	3	
Are positions for a fixed period of time or not ?	?		6 ten	3 ten	
Are the persons employed on a full or part time basis ?	?		6 part	3 full	
Do the persons have outside experience in the public or industrial sector ?	?		?	3 yes	
Does the institution have a policy on consultancy contracts with industry ?	yes	no	no	yes	no
Does the institution have a policy on intellectual property rights ?	no	no	yes	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	?		1 per faculty	1 Dr. 1 Ing.	
Do they have expertise in industry, financing insti--tutions or public service ?	?		?	3 yes	
For how many years have they been exercising that job ?	?		6 x 1 Y	since 9 Y since 14 Y since 12 Y	
How were they appointed ?	?		internal	1 advert. 2 internal	

Portugal

Does the institution have a published policy on collaboration with industry ?	no	no (under consider.)	no
Does the institution have a staff/body to implement this policy ?	no	no	no
Such a body includes how many executive positions ?			
Are positions for a fixed period of time or not ?			
Are the persons employed on a full or part time basis ?			
Do the persons have outside experience in the public or industrial sector ?			
Does the institution have a policy on consultancy contracts with industry ?	no	no	no
Does the institution have a policy on intellectual property rights ?	yes	no	no
Does the institution receive revenus from intellectual property rights ?	/	/	/
What are the qualifications of the executive persons liaising with industry ?			
Do they have expertise in industry, financing insti--tutions or public service ?			
For how many years have they been exercising that job ?			
How were they appointed ?			

Spain

Does the institution have a published policy on collaboration with industry ?	yes	yes	no	yes	yes
Does the institution have a staff/body to implement this policy ?	yes	yes	no	yes	no
Such a body includes how many executive positions ?	3	1+6		?	
Are positions for a fixed period of time or not ?	3 fixed	7 fixed		?	
Are the persons employed on a full or part time basis ?	3 full	7 part		?	
Do the persons have outside experience in the public or industrial sector ?	3 yes	4 yes		?	
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	no	no	no
Does the institution have a policy on intellectual property rights ?	no	no	no	no	yes
Does the institution receive revenus from intellectual property rights ?	/	/	/	/	/
What are the qualifications of the executive persons liaising with industry ?	1 econom. 1 admin. 1 philos.	?			
Do they have expertise in industry, financing insti--tutions or public service ?	?	4 yes			
For how many years have they been exercising that job ?	3 months	?			
How were they appointed ?	advert. + internal	second internal		internal advert.	

Spain (2)

Does the institution have a published policy on collaboration with industry ?	no	yes	no
Does the institution have a staff/body to implement this policy ?	no	yes	no
Such a body includes how many executive positions ?		1+8	
Are positions for a fixed period of time or not ?		9 fixed	
Are the persons employed on a full or part time basis ?		9 part	
Do the persons have outside experience in the public or industrial sector ?		4 yes	
Does the institution have a policy on consultancy contracts with industry ?	no	yes	no
Does the institution have a policy on intellectual property rights ?	no	yes	no
Does the institution receive revenue from intellectual property rights ?	/	/	/
What are the qualifications of the executive persons liaising with industry ?		?	
Do they have expertise in industry, financing insti--tutions or public service ?		4 yes	
For how many years have they been exercising that job ?		?	
How were they appointed ?		internal second.	

Greece			
Does the institution have a published policy on collaboration with industry ?	yes	yes	yes
Does the institution have a staff/body to implement this policy ?	yes	yes	yes
Such a body includes how many executive positions ?	1	8+ 9	8
Are positions for a fixed period of time or not ?			ten
Are the persons employed on a full or part time basis ?			full
Do the persons have outside experience in the public or industrial sector ?			yes
Does the institution have a policy on consultancy contracts with industry ?	yes	yes	yes
Does the institution have a policy on intellectual property rights ?	yes	yes	yes
Does the institution receive revenus from intellectual property rights ?	/		
What are the qualifications of the executive persons liaising with industry ?			
Do they have expertise in industry, financing insti--tutions or public service ?			yes
For how many years have they been exercising that job ?			
How were they appointed ?			advent.

APPENDIX No. 4

IRELAND

AN A-Z OF UNIVERSITY/INDUSTRY LINKAGE MECHANISMS

(a) Sandwich placements
(b) Student projects (undergraduate)
(c) Student projects (postgraduate)
(d) Sponsored students
(e) Ex-student employees
(f) Use of University facilities
(g) Use of Industry facilities
(h) Consultants/advisors
(i) Contract work
(j) Sponsored research
(k) Collaborative work/research
(l) Endowed or named academic posts (ABC Chair etc.)
(m) Sponsored or named research posts (post doctoral)
(n) Short course support
(o) Part-time course support (MSc)
(p) Donations by Industry
(q) Membership of University committees
(r) Visiting staff (professors, lecturers, etc.)
(s) Secondments (either way)
(t) Non-executive directorships
(u) Joint appointments
(v) University/Industry clubs
(w) Licence or royalty agreements
(x) 'Spin off' companies
(y) Joint meetings/colloquia
(z) Joint patents

APPENDIX No. 5

STANDARD JOB SPECIFICATION FOR INDUSTRIAL LIAISON OFFICERS APPOINTED UNDER THE NBST INDUSTRIAL LIAISON PROGRAMME

1. To promote and facilitate cooperative research and other joint projects.
2. To identify or assist staff in identifying suitable consultancy and research opportunities and to promote awareness of such opportunities.
3. To encourage commercialisation of college research.
4. To identify training needs of industry.
5. To promote greater awareness in industry of the range of college expertise facilities and research to industry available in Colleges.
6. To encourage industry to make a better contribution to Third Level education and research.
7. To establish, foster and maintain links between the colleges and industry, the research institutes and government agencies.
8. To encourage visits, mobility and exchange of personnel between the college and industry or outside agencies.
9. To provide advice and assistance to staff in relation to all aspects of research administration.
10. To advise the College in the preparation of rules and guidelines which may assist the development of relationships with industry and other external bodies.
11. To provide a focus or first point of contact in relation to internal or external requests for information on the supply or demand for training, research and consultancy services.

APPENDIX No. 6

EXTRACT FROM THE DEVELOPMENT OF HIGHER EDUCATION INTO THE 1990's

Links between business and higher education for technology transfer, consultancy, etc.

5.9 Alongside its relations with institutions of higher education for purposes of education and training (2.3), business should aim to take advantage of what higher education has to offer through research, technology transfer, business start-up facilities and consultancy. Higher education, too, stands to gain from this involvement: staff can gain breadth and expertise, can keep up-to-date with the latest developments in industry and can enhance their earnings. Institutions themselves may claim a share of accruing income. There is much scope for the further development of such links between higher education ans industry, commerce and the public services. Researchers should be more aware of the importance of commercial exploitation and of their reponsibilities for its promotion. Institutions should develop explicit policies to encourage exploitation. Firms in the United Kingdom need to be as aware as are many of their foreign competitors of the potential of higher education institutions, particularly as vital partners in product innovation. These matters were discussed in a report from the Advisory Council on Applied Research and Development (ACARD) in collaboration with the ABRC ("Improving Research Links between Higher Education and Industry", HMSO, 1983).

5.10 Institutional attitudes and action are important. The Government hopes that all institutions with something to offer in the areas described will themselves adopt, and encourage all relevant departments to follow, the good practices now to be found in many, such as:

(i) in applied fields, taking consultancy and other beneficial industrial work fully into account when assessing candidates for promotion;

(ii) granting permission to engage in business activity on the basis of an assessment of the effect of this on an academic's overall contribution to the objectives of his institution;

(iii) offering first-rate academics who have particularly strong and time-consuming links with business a part-time contract or seeking to make joint appointments with industry;

(iv) striking reasonable deals with staff over the sharing of income earned from involvement with business;

(v) operating industrial liaison services;

(vi) insuring against any liability for damages arising as a result of the advice offered by academic consultants to industry.

5.11 The Government:

(i) has asked the UGC to ensure that universities' efforts and successes in industrial research and consultancy receive due recognition in the process of grant allocation and that universities are aware of this practice. This does not mean that universities' work for commercial clients should be subsidised, but that universities which are successful in carrying out such work should be helped to build on their strengths;

(ii) has confirmed (9.5) that university earnings from collaboration with employers will not be penalised in the determination or allocation of UGC block grant. Earnings from the commercial exploitation of research results in all higher education institutions should be used to defray the costs of such work and to reinforce research,

(iii) has agreed to regard the costs of necessary infrastructure for collaboration with business as a proper use of an institution's general income;

(iv) has introduced legislation to remove barriers to commercial exploitation of their work by local authority institutions of further and higher education;

(v) has ended the British Technology Group's monopoly of first refusal on research council-funded (this was announced on 14 May 1985). The Government endorses the proposed transfer of responsibility for promoting commercial exploitation from the research councils to institutions of higher education, with the delegation of this responsibility wherever possible to the individual researcher;

(vi) is working with the University Directors of Industrial Liaison (UDILs) and others to develop the UDILs' plans for a national data base of academic expertise and facilities in universities and polytechnics, as recommended in the ACARD Report; a commercial consortium led by Longman Cartermill Ltd (and backed by the Longman Group Ltd) has been selected to build and run the data base, to be known as "British Expertise in Science and Technology".

5.12 The British Technology Group has announced that in addition to its main role of helping to translate new research ideas into commercial products it is now prepared to provide finance on commercial terms for up to half the cost of projects in higher education institutions designed to facilitate technology transfer through means such as consultancy or contract research.

APPENDIX No. 7

UNIVERSITY SPIN-OUT AND INTERFACE COMPANIES

COMPANY NAME	DATE OF FORMATION	PURPOSE	SHAREHOLDING/ REPRESENTATION
Edinburgh Instruments Ltd	1978	Commercial lasers from Heriot-Watt University	Original Agency shareholding now sold
Cruachem Ltd	1981	Chemicals and devices for DNA synthesis	Glasgow University spin-out - Agency 15%
Inmap Ltd	1981	Microprocessor applications consultancy	Original Agency shareholding now sold
M & D Technology Ltd	1981	Design and production of NMR scanners from Aberdeen Uni	Now owned by Basic American (US)
Drug Development (Scotland) Ltd	1982	Clinical testing of new drugs	Dundee Uni 20% R & D Trust 40% Private Co 20% Agency 20%
* Shield Immunologicals Ltd	1982	Production and marketing of diagnostic kits	Dundee University spin-out - now private
Aurora Ltd	1983	Development of medical equipment	Aberdeen Uni 33% Agency 16% Private 51%
Bioscot Ltd	1983	Commercial development of University Bioscience	Edinburgh Uni 30% Heriot Watt Uni 30% Bank of Scotland 10% Agency 30% NOW Cogent 85%
Efamol (Scotland) Ltd	1983	Process development for linolenic acid	Dundee Uni 25% Agency (option) 25% Efamol Ltd 50%

Kelvin Technology Developments Ltd	1983	Venture fund for hi tech starts - mainly from Glasgow/ Strathclyde Unis - 11 ventures funded	Glasgow Uni 25% S'Clyde Uni 25% Agency 50% (NB Only 25% voting)
Scottish Textile Technology Centre Ltd	1983	Provision of technical advice to textile and clothing companies	Scottish Woollen Ind 33 1/3% Scot.College of Textiles 33 1/3% Agency 33 1/3%
Strathclyde Technology Transfer Ltd	1983	Technology Transfer out of Strathclyde University	Strathclyde Uni 52% Agency 48%
* Flexigage Ltd	1984	Products using piezo-electric polymer	Grand Met 75% Promotors 25% Strathclyde University royalties
Medical Laser Centre	1984	Develop medical applications of lasers	Heriot Watt University Unit
Turing Institute	1984	Development of computer applications esp expert systems	Agency holds 3 out of 20 founder places.
Artificial Intelligence Applications Institute	1985	Based on Edinburgh University expertise	Agency holds 3 of 20 founding places
Sirco Ltd	1985	Liver function analysis with stable isotopes	Dundee Uni 95% Prof Rennie 5%
Unitech Ltd	1985	Technology transfer for Dundee Uni	Dundee Uni 56% Agency 44 (Uni has made offer for Agency shares)

Innovation Scotland Ltd	1986	Dundee University based product development	Private 68% Universities 32%
Scotgen Ltd	1986	Aberdeen Uni based genetic engineering company	Aberdeen Uni 15% Agency (option) 15%
Transgenics Ltd	1986	Biomedical products from AFRC trans-genic animals	Agency 26% Private 74%
Tulbero Ltd	1986	Fish diagnostic kits from Stirling Uni	Stirling Uni 25% Agency (option) 25% Private 50%
Dundee ICAEM Ltd	1987	Application and training in CAE and management	Dundee Uni 33% Agency 33% Industry 34%
Industrial Controls Company Ltd	1987	Commercialising service and product development	Strathclyde Uni 29% Agency 29%
PGC Ltd	1987	Chromatographic materials	Edinburgh University spin-out - Agency 25% option
Strathclyde CIM Ltd	1987	Application and training for CIM	Strathclyde Uni 33% Agency 33% Industry 34%

* No Agency financial involvement

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May 1987

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APPENDIX No. 8

HEDEL

POLICY
ON
HIGHER EDUCATION - INDUSTRY
INTERFACE

Higher Education Directors of External Liaison

HIGHER EDUCATION/INDUSTRY INTERFACE

Introduction

International practice in developing meaningful interaction between universities and industry is well established. The benefits from the pursuit of such coordinated industrial policies by universities are clearly seen especially in the United States of America. The deliberate and institutionalised approach adopted by certain universities has been the driving force for the development of high technology based industry. It has also resulted in stable economic growth ensuring a capacity to adapt to and in many cases exploit change.

Over the past number of years the American based experience has led to many initiatives throughout the world to build on the American experience. This has resulted in the establishment of Industrial Interface Units on many university campuses. Ireland has also responded to this stimulus with Interface Units on various third level campuses. The establishment of The Higher Education Directors of External Liaison (HEDEL) results from a realisation by the Directors of Irish Interface Units that a coordinated effort would make for a more effective use of resources.

HEDEL is concerned that the MIT, CALTECH and similar experiences in the U.S.A. are not lost on the Irish Higher Education system. The positive approach of these American institutions to centralised Interface activity monitored and coordinated at senior management level has resulted in many gains to the American economy at Regional as well as National Levels. It is pertinent to note that the approach adopted by these Institutions has resulted in the development of such International names as Wang, Hewlett Packard, Digital, Analog Devices, Xerox and many others.

Vast tracts of industrial development have sprung up attracting business and high technology industry and employment to special parks around these institutions. Such examples as Route 128 Development (Boston), Stanford Industrial Park and Silicon Valley all serve to illustrate the power of positive University initiatives in developing the Industrial Interface.

The American Universities take the Industrial Interface seriously and it has paid off. In MIT for instance the "Industrial Liaison Programme" employs 15 Industrial Liaison Officers to assist the Director of the Interface Unit. This unit performs multitask and specialist functions ranging from compiling directories to negotiating contracts and promotional activities. The Unit is highly structured and receives support at the most senior Academic and Administrative levels.

European Institutions have read the signs and have responded by establishing similar Units on their campuses. Over Sixty (60) such units exist in the U.K. whilst Germany, Holland, France and the Scandinavian countries all have well defined and coordinated structures.

In Ireland, North and South, the Directors of the various Industrial Interface Units have come together to form the Higher Education Directors of External Liaison HEDEL. Through this group it is intended to pool experiences, develop interface mechanisms and to facilitate effective use of resources. Through HEDEL it is envisaged that economic activity can be stimulated by creating a positive climate for interface activities.

HEDEL (HIGHER EDUCATION DIRECTORS OF EXTERNAL LIAISON)

HEDEL has been formed to promote, develop and coordinate the industrial/commerce interface in Ireland. HEDEL also provides a mechanism whereby a body of professional experience can be utilized by policy makers and others considering initiatives to encourage co-operation between educational institutes and industry and is associated with other international organisations. It is charged with the promotion of a two way flow of information between Industry and it's member institutions for the following purposes:-

1. <u>Education</u>

1.1 To identify, in consultation with industry, the education and training needs of industry which the Higher Education Institutions can help meet.

1.2 To promote an awareness among employers of the types of course provided in Higher Education Institutions and the available graduate expertise.

1.3 To coordinate and promote the placement of students in suitable in-course employment where such employment is considered to be either a necessary or a desirable element of the course being provided.

1.4 To promote work for undergraduate and postgraduate students.

1.5 To promote and assist in the employment of graduates.

2. Research & Consultancy

2.1 To promote the development of co-operative research with industry.

2.2 To make available and market the Higher Education Institutions' staff expertise and facilities to industry.

2.3 To identify suitable consultancy and research opportunities.

2.4 To cooperate with Industry, where appropriate, in joint venture activities.

2.5 Research Administration - provision of advice and assistance in:-

preparation of proposals
sources of funds,
preparation of contracts
regulations and guidelines of Institutions
publications policy

2.6 To encourage the development of innovation, entrepreneurship and commercialization of research in Higher Education Institutions.

2.7 To encourage the establishment of Industrial Interface Units.

2.8 To develop patent and licencing policy procedures.

3. Information

3.1 To promote an external awareness of expertise, facilities, and objectives of the H.E. Institutions.

3.2 To promote an internal awareness in academic staff of industrial needs and perceptions.

HEDEL POLICY ISSUES

(a) The Industrial Interface operates on a two way basis with benefits to be gained on both sides of the Academic/Industry interface. The gains to the H.E. Institution are widespread and not confined to financial considerations alone.

(b) Technology transfer from "Higher Education Institutions" to Industry must be seen within the context of education and research. That is: the primary objectives of these Institutions create the backdrop against which the external interactions take place.

(c) HEDEL is committed to Regional Development through the utilisation of Third Level resources.

(d) Development of small indigenous enterprise through the exploitation and development of campus based technology is a prime goal. It is HEDEL policy to encourage such initiatives as Science Parks, Innovation Centres, campus companies and etc.

(e) HEDEL has noted the low investment in R & D in Ireland particularly as compared to our European partners. This is seen as an obstacle to technical and economic growth, it is HEDEL policy to encourage increasing investment in Science and Technology both at industrial and state levels.

(f) The Industrial Interface Unit has an important role in ensuring the effective use of limited resources. It is apparent that great potential for new industrial products and technologies exists within the research pool already on H.E. campuses. There are difficulties in Ireland regarding available finance to develop new (and sometimes speculative) technologies at the pre-prototype stage. It is HEDEL policy to develop and foster initiatives such as the U.K. SEEDCORN Scheme to overcome this type of difficulty.

(g) HEDEL supports the view that realistic and equitable arrangements should be established to encourage academic staff to become involved in technology transfer activity.

(h) It is important for each Institute to present a coherent external identity and the Industrial Interface Unit must represent the entire Institution.

(i) The Interface Unit is constantly involved in effective interaction with the most senior industrialists and academics. The Industrial Interface Unit must, therefore, receive the support of the College management.

Finally, HEDEL believes that a serious committment to the Industrial Interface within the Higher Education Institutions is necessary if we are to approach the full development potential in this area. Interface Units tend to be understaffed and underfunded leading to severe workloads which in turn militate against maximum effectiveness. Much has been achieved so far but still more remains to be done as the pace of technological and sociological change increases. HEDEL believes that a significant Irish technological base exists and can be exploited given careful handling and adequate support.

APPENDIX No. 9

U D I L

UNIVERSITY DIRECTORS OF INDUSTRIAL LIAISON

THE ROLE AND FUNCTIONS OF UDIL AND UNIVERSITY INDUSTRIAL LIAISON SERVICES

The paper which follows has four sections. Two deal with UDIL: they explain in Section A its role and function and in Section B its priorities and procedures.

The words used in Section A are carefully chosen. They are intended to be read in high places and there to reflect the concern of Universities for industrial liaison and for a professional approach to that task. One point to stress is that since industrial liaison has a very broad interface with the outside world, responsibility for collective declarations must be very clearly defined. UDIL makes that very clear: CVCP consultation is paramount.

The remaining two sections describe the activities which you might find within an Industrial Liaison Office: they describe what is typical. Not all of us do all the things listed; some of us do things which are not on the list - though UDIL would argue that such tasks are not industrial liaison as conceived. These two sections constitute a very useful check list. All the tasks listed will be going on somewhere in each University and it is appropriate to ask whether they are going on in the right offices. UDIL makes no judgement about this.

The paragraphs within Section D report the diverse solutions applied by Universities to the control and management of their Industrial Liaison functions. UDIL has noted many practices. Comparative evaluation is not appropriate so our paper ends with remarks which point up the decisions which have to be taken in setting up (or overhauling) an Industrial Liaison Office.

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A. UDIL ROLE AND FUNCTIONS.

A.1 INTRODUCTION

A.1.1 UDIL is the association of directors and managers of university industrial liaison service units. Since formation in 1968 membership has grown to cover most of the universities within the United Kingdom and Eire.

A.1.2 This document sets out the present role and functions of UDIL as seen by its members.

A.2 THE ROLE OF UDIL

A.2.1 Through the cooperation and self-help of members UDIL seeks to develop and promote the professional activities of university industrial liaison service (ILS) units in serving the interests and aspirations of the member's institutions.

A.3 UDIL FUNCTIONS

Within the overall role the present functions of UDIL are seen to be to:-

A.3.1 create a greater awareness of the work of ILS units and their benefit to industry, the community and the country. UDIL achieves this by participation in exhibitions, conferences, meetings and through publications, reports, advertisements and other means.

A.3.2 help to develop the effectiveness of ILS units by information exchange and the establishment of common practices.

A.3.3 assist in marketing the range of services, resources and facilities that universities offer to outside undertakings, and help in developing ways of making these more easily accessible.

A.3.4 express the views of UDIL members on matters relating to industrial liaison both within the university system and, where appropriate after consultation with CVCP, outside it.

A.3.5 facilitate greater collaboration between universities and outside undertakings, both private and public, to the mutual benefit of the participants.

A.3.6 draw the attention of UDIL members to any new commercial, revenue-earning or funding opportunity of a national or international nature.

A.3.7 give help and guidance to UDIL members on the exploitation of intellectual property rights, research discoveries and inventions.

A.3.8 foster cooperation with those holding similar positions in foreign universities, other educational establishments and research institutions.

B. UDIL PRACTICES AND PROCEDURES.

B.1 INTRODUCTION

B.1.1 UDIL seeks to carry out its activities through the voluntary cooperation and collaboration of members, who are normally expected to donate their time and to pay any incidental expenses. This document describes the procedures and practices adopted in conducting UDIL affairs.

B.2 UDIL MEMBERSHIP

B.2.1 Membership of UDIL is open to persons responsible for, and actively involved in, the control and operation of University Industrial Liaison Service (ILS) units. Membership is normally restricted to one such person from each university. Where universities have a number of independent institutions UDIL may grant membership to a representative from each institution , so long as each such person is actively involved in industrial liaison.

B.3 UDIL FEES

B.3.1 An annual membership fee is payable to UDIL. The amount of this payment is decided by members at a Business Meeting.

B.4 APPOINTMENT OF UDIL OFFICERS.

B.4.1 Appointments are made at an ordinary Business Meeting of UDIL.

B.4.2 The Chairman is elected to serve for a period of two years commencing in September. He is elected one year in advance; during the intervening year the Chairman-elect serves as Deputy Chairman. The retiring Chairman normally serves as Deputy Chairman for a furthur year.

B.4.3 Appointments to Standing Committees and Working Parties are made at Business Meetings. Members of Standing Committees normally serve for a period not exceeding two years.

B.5 UDIL MEETINGS

B.5.1 UDIL holds two ordinary Business Meetings a year at which policies are decided and appropriate business conducted. The minutes are distributed to all members.

B.5.2 Members who are unable to attend a Business Meeting may nominate an alternate.

B.5.3 The Chairman of UDIL may invite visitors and interested observers to attend Business Meetings. Such persons have no voting rights and may be required to leave the meeting when specific items are discussed.

B.6 STANDING COMMITTEES AND WORKING PARTIES

B.6.1 A UDIL Business Meeting may appoint Working Parties to recommend policies or to undertake specific duties, and Standing Committees to implement specific agreed policies.

B.6.2 Non- members may be co-opted onto Standing Committees and Working Parties.

B.7 EXTERNAL RELATIONSHIPS

B.7.1 Members may be appointed as representatives of UDIL on external bodies/ committees/ meetings/ conferences with responsibility to report back to a Business Meeting.

B.7.2 UDIL may, from time to time, consult with CVCP and with outside bodies such as Government Departments, CBI, etc, to put forward the professional views of members and discuss matters which may have implications for university industrial liaison policy. However, where outside bodies are concerned, UDIL would not normally proceed with such activities without prior consultation with the CVCP.

B.7.3 UDIL, through members, participates on matters of common interest in consultative and discussion meetings at national and international level with representatives of other organisations.

C. UNIVERSITY INDUSTRIAL LIAISON SERVICES - ROLE AND FUNCTIONS.

C.1 INTRODUCTION.

C.1.1 Most universities have established some form of industrial liaison service (ILS) unit as one of their principal links with industry.

C.1.2 No two universities are alike and the facilities offered may be markedly different, as are the responsibilities of the ILS. These may range from acting as an information broker or contracts officer within the university's central administration, to acting as manager of associated companies or special research units.

C.2 ROLE OF AN ILS UNIT.

C.2.1 The role of the ILS unit is to advise on and implement the industrial liaison policy of the university. This will include technology transfer and the effective commercial exploitation of the facilities and resources available in the university.

C.3 THE FUNCTIONS OF AN ILS UNIT.

C.3.1 The following list indicates functions that may be included among the responsibilities of an ILS unit.

C.3.2 Promote and publicise the university's facilities resources and expertise, and create a general awareness of the beneficial contribution made by the university to industry and commerce.

C.3.3 Seek and negotiate training, research, and consultancy contracts from public and private sector institutions to generate income for the university in accordance with university policies.

C.3.4 Organise beneficial collaborative ventures involving the university and industry or commerce.

C.3.5 Act as an initial contact through which external organisations may avail themselves of the facilities and resources of the university.

C.3.6 Respond professionally to the needs and requirements of external organisations, deploying the facilities and resources of the university as appropriate.

C.3.7 Facilitate the beneficial transfer of new technology and the protection, marketing and exploitation of university intellectual property.

C.3.8 Establish good working relationships with external bodies, particularly at local level, and represent the university's industrial liaison interests through service on committees and attendance at meetings and conferences.

C.3.9 Help and advise local businesses on technical or business matters particularly in relation to sources of funding for business development and product research/development.

D. UNIVERSITY INDUSTRIAL LIAISON SERVICES - METHOD OF OPERATION.

D.1 INTRODUCTION.

D.1.1 There is a wide variation in the circumstances of individual ILS units. However, UDIL thought it would be helpful to list duties which may be included in the remit of a unit, and to refer to management arrangements which have been found successful in some instances.

D.2 TYPICAL DUTIES OF A UNIVERSITY ILS UNIT.

D.2.1 Make personal contact/visits with outside undertakings in order to inform them about the resources and facilities of the university and find ways in which the university might be of service.

D.2.2 Receive requests for assistance from outside undertakings and ensure prompt and appropriate response.

D.2.3 Identify and record the facilities, resources and expertise that are available within the university for access when required.

D.2.4 Discuss requests for assistance with departments and/or staff and if necessary set up meetings between prospective clients and members of staff.

D.2.5 Ensure that commercial work undertaken by the university is properly defined, evaluated and costed and that the necessary contracts, proposals, quotations or cost estimates are prepared and agreed.

D.2.6 Receive orders, documents, instructions, equipment and parts from clients and ensure that these are dealt with and forwarded to the appropriate departments/members of staff.

D.2.7 Maintain good customer relations by expediting and checking the progress of contracted work and looking after the interests of clients. Where necessary negotiate contract amendments. Ensure that the work is carried out to the client's satisfaction and that the results are properly reported.

D.2.8 Carry out the secretarial and administrative work involved with commercial jobs, including the invoicing of clients for work completed and disbursement of the income received in accordance with the agreed university procedure.

D.2.9 Safeguard the university's interests and reputation by ensuring that commercial jobs are placed with the right departments and members of staff, that confidentiality is honoured and that the service expected from the university is provided. Seek to protect the university and its members against possible claim for unprofessional conduct, product liability, libellous and fraudulent statements etc.

D.2.10 Advise and assist with patenting, copyrighting and the other forms of protection of university intellectual property, discoveries and inventions and help with the commercial exploitation of these by way of sale, licensing and royalty agreements.

D.2.11 Advise and assist with publicity materials, exhibitions, conferences and meetings where these relate to industrial liaison work.

D.2.12 Develop and establish good working relationships and channels of communication with academic departments, staff members, the administrative services of the university as well as with local and national bodies such as Chambers of Commerce, CBI, Trade Associations.

D.2.13 Publicise the commercial activities and interests of the university through membership and service on committees of relevant organisations.

D.2.14 Assist in the transfer of new technology between university and industry, whether directly or through joint ventures involving third parties.

D.2.15 Seek new commercial initiatives and opportunities for university exploitation.

D.2.16 Encourage both university and local business and industry to take full advantage of funds especially provided to finance collaborative ventures between universities and industry.

D.2.17 Create a university corporate image of industrial liaison consistent with university policy.

D.2.18 Generally be "alive" to new developments, initiatives, commercial opportunities and sources of funding by which the university can benefit.

D.2.19 Where appropriate, participate in Science Park tenant selection.

D.3 <u>RELATIONSHIPS WITH UNIVERSITY DEPARTMENTS AND SERVICES.</u>

D.3.1 The ILS unit needs to have close links not only with academic departments but also with the other administrative offices which provide important support services such as finance, information, publicity and legal advice (particularly on contractural liabilities and matters which govern the conduct of a university and its members).

D.4 <u>CONTROL, MANAGEMENT AND FINANCE.</u>

D.4.1 Many universities have found it advantageous to have either a management committee or an advisory committee to oversee the implementation of the university's policy on industrial liaison and to assess the performance of the unit. In some cases the chairman of this committee is a senior executive from industry or commerce.

D.4.2 The director/manager of the ILS unit should have clearly defined responsibilities and authority. He should command the respect and confidence of senior members of the university and executives in industry; managerial experience in industry or commerce is an advantage, as also are professional qualifications appropriate to the seniority of the position within the university.

D.4.3 Where a unit is operating semi-independantly, for example as a company accepting contracts in its own right, it may be necessary to adopt procedures different from those governing the normal academic arrangements of the university.

D.4.4 A university may choose either to support the ILS unit from its central overhead funds or to seek to make the unit self-funding by charging for the services which it renders.

UDILWG1. 3.3.86.

APPENDIX No. 10

UN RÉSEAU DE CELLULES DE VALORISATION ET DE RELATIONS INDUSTRIELLES

Les établissements universitaires mettent progressivement en place des cellules de valorisation et de relations Université - Industrie, qui permettent une ouverture vers le monde de l'économie.

Ces cellules ne sont pas un point de passage obligatoire, mais jouent plutôt le rôle d'un organisme d'assistance. Elles interviennent dans plusieurs domaines :

- dans la mise au point des contrats de collaboration de recherche entre l'établissement et les entreprises;
- dans la préparation des dossiers de valorisation;
- dans la prospection des besoins des entreprises et dans la détection des idées et réalisations valorisables des laboratoires;
- dans les propositions de développement à faire aux entreprises;
- dans l'organisation des relations avec les institutions socio-économiques régionales;
- dans l'aide à la mobilité des étudiants et des chercheurs (stages industriels ou actions de consultation).

Organisées peu à peu en réseau, les cellules correspondent entre elles et avec la *Direction de la Recherche,* afin d'assurer une information réciproque et continue.

LES TRANSFERTS

PROPOSER A L'INDUSTRIE DES *"PRODUITS"* NOUVEAUX

Les inventions effectuées dans les établissements universitaires sont d'abord soumises a une évaluation nationale, effectuée par un groupe où siègent des experts de l'enseignement supérieur, du *Centre national de la recherche scientifique* et l'*A.N.V.A.R.* Si le produit apparaît intéressant, il est ensuite, après protection juridique (brevet), proposé aux partenairesindustriels.

Chaque année, de nombreuses licences sont ainsi cédées, avec l'aide de la *Direction de la Recherche* et de l'*A.N.V.A.R.* Les transferts donnent déjà lieu a de belle réalisations, dont on trouvera ci-dessous quelques exemples.

PROPOSER A L'INDUSTRIE DES *"HOMMES"* NOUVEAUX

Depuis quelques années, la *Direction de la Recherche* développe une politique en faveur de la mobilité, en application des objectifs fixés par la loi sur l'enseignement supérieur de 1984 et ses textes d'application. La formation de futurs ingénieurs par la recherche, l'échange des connaissances et des résultats de la recherche en sont les instruments: cette politique se traduit par de nombreuses délégations de chercheurs dans des entreprises, par des contrats de consultation, et par la création, depuis 1985, de pôles de formation d'ingénieurs par la recherche dans des technologies de pointe (pôles FIRTECH).

DES CONTRATS,

DES HÉBERGEMENTS,

DES PARTICIPATIONS

Les contrats de collaboration en matière de recherche sont un moyen simple de transfert de connaissances. Ils associent la recherche fondamentale aux besoins et contraintes industrielles et commerciales. Ils établissent ainsi des liens entre deux milieux qui ont été trop longtemps éloignés, et permettent d'ouvrir la porte à de nouvelles collaborations.

Cette forme traditionnelle de la collaboration ponctuelle entre hommes n'est plus aujourd'hui la seule : un contact plus suivi est rendu possible par la nouvelle politique d'hébergement temporaire d'entreprises sur les campus universitaires.

La mission de valorisation des résultats de la recherche peut enfin conduire les établissements universitaires à prendre des participations dans des sociétés industrielles ou à créer, seuls ou avec des partenaires des sociétés commerciales ou industrielles, ainsi que le permet la loi sur l'enseignement supérieur de 1984. L'objectif n'est pas de faire concurrence au secteur industriel existant, mais de favoriser le développement et la création d'entreprises dans des secteurs technologiques de pointe mal représentés dans le tissus industriel.

SUP
Bulletin d'information des personnels de l'enseignement supérieur et de la recherche
l'actualité de l'enseignement supérieur

supplément au n° 7 d' AVRIL-MAI 1984

Valorisation de la recherche universitaire

Durant l'année 1983, la Direction de la Recherche a affirmé sa politique de valorisation. Désormais, en effet, de la recherche fondamentale à l'exploitation commerciale ou industrielle d'un procédé, d'un produit ou d'un savoir-faire, chaque étape et chaque aspect de la recherche sont pris en considération.

Cette politique est appuyée par différentes aides : appel d'offres permanent "Recherche universitaire/Entreprises", destiné à inciter les laboratoires universitaires à orienter une partie de leur activité de recherche vers les besoins des entreprises, appel d'offres visant à développer la recherche appliquée et technologique dans les I.U.T. et les E.N.I., coopération avec le C.N.R.S. et l'A.N.V.A.R. dans de multiples fonds dont "l'aide à l'innovation laboratoire"...

Cette politique concerne aussi l'implantation de cellules universitaires dont la mission est de mettre en rapport les laboratoires générateurs d'innovation et les besoins régionaux liés au contexte socio-économique.

Elle favorise également la possibilité d'ouverture de nouveaux créneaux et le déblocage de verrous technologiques par une meilleure utilisation de potentialités locales.

Enfin, cette politique se manifeste dans la participation au "groupe de valorisation" qui, avec les représentants du C.N.R.S. et de l'A.N.V.A.R., effectue une évaluation nationale des demandes présentées pour une protection et pour des accords de licence. C'est dans ce contexte général qu'a été mis au point avec l'A.N.V.A.R. un mémento à l'usage des inventeurs, en vue d'évaluer les suites à donner à leur proposition dans le cadre de cette procédure.

Le fonds "valorisation / universités"

Certaines étapes tendant à la mise en valeur des résultats de la recherche et conduisant ultérieurement au transfert d'une technologie à l'industrie nécessitent une préparation (évaluation technico-économique, prise de brevets, etc...) qui induisent des frais importants. Ceci a conduit à la création d'un Fonds de Valorisation du Ministère de l'Education nationale (Direction de la Recherche).

POURQUOI CE FONDS ?

Ce fonds est destiné à couvrir les dépenses des laboratoires entrant dans le processus de "valorisation". En particulier la prise de brevets, dès l'apparition des premiers résultats appliqués (et avant une publication ou une communication publique), peut constituer une garantie fondamentale pour le laboratoire, lorsqu'une application industrielle devient tangible.

A cet égard, l'ANVAR peut apporter sur la demande du Ministère de l'Education Nationale, des conseils et prestations spécifiques : évaluation technico-économique d'un résultat, définition d'une stratégie de propriété industrielle, assistance pour la recherche d'industriels, négociation d'accords d'exploitation.

Le Ministère de l'Education Nationale, représenté par la Direction de la Recherche, a donc décidé de créer un Fonds de valorisation (1,5 MF en 1983) placé auprès de l'ANVAR, pour financer les dépenses de brevets et la rémunération des prestations demandées à l'ANVAR. (1)

A QUI S'ADRESSE CE FONDS ?

Le CNRS, ainsi que les divers organismes, ayant leur propre procédure de financement, ce fonds s'adresse exclusivement aux chercheurs (inventeurs) appartenant à des laboratoires universitaires, non associés à un grand organisme de recherche.

Les autres cas possibles sont traités dans le cadre des conventions existantes. Par exemple :
. laboratoire universitaire associé au CNRS : appel au Fonds CNRS de valorisation
. laboratoire universitaire associé à l'INSERM : ce cas entrera dans le cadre de la convention signée avec l'INSERM.

COMMENT FAIRE APPEL A CE FONDS ?

Un dossier spécifique doit être élaboré et déposé :
. soit au Ministère de l'Education Nationale : Direction de la Recherche - à l'attention de M. BEDIN, 61/65 rue Dutot - 75015 PARIS ;
. soit à l'ANVAR : Direction des Applications de la Recherche - 43, rue Caumartin, 75436 PARIS CEDEX 09 (transmission possible par la délégation régionale).

CRITERES ET MODALITES D'ATTRIBUTION

Les dossiers sont examinés par une instance d'évaluation composée de représentants de la Direction de la Recherche, du CNRS et de l'ANVAR, qui apporte son soutien scientifique et juridique. Le Ministère donne alors son accord pour accomplir tout ou partie des prestations proposées et autorise l'ANVAR à engager le montant correspondant des dépenses sur le Fonds.

Le critère de décision est basé sur l'opportunité de protéger tel résultat (et de confier certaines prestations de "valorisation" à l'ANVAR).

Après acceptation du dossier, les modalités d'aide par l'intermédiaire de ce Fonds de valorisation peuvent s'appliquer à différents stades du processus de valorisation de la recherche, et conduire à :
. la prise d'un brevet français ou d'un brevet international, par l'intermédiaire du groupe de valorisation de l'ANVAR, composé d'experts scientifiques et de juristes,
. l'ouverture d'un dossier technique correspondant par exemple à une invention non brevetable, ou à caractère confidentiel,
. la commande d'une expertise technico-économique permettant d'évaluer l'intérêt du dossier en terme de valorisation,
. la recherche de partenaires et l'appui pour la négociation du contrat de licence (action menée par l'ANVAR en liaison avec l'inventeur). →

(1) Plus de 100 dossiers ont été examinés en 1983, conduisant à 23 brevets français, 6 extensions à de multiples pays, 25 accords de licence et une dizaine de dossiers techniques.

Au delà de ces modalités, l'ANVAR dispose également de moyens en propre et d'une procédure "d'aide à l'innovation au laboratoire", pour financer la mise en forme des résultats, afin de faciliter le transfert à l'industrie (ex. réalisation d'une maquette ou d'un prototype en laboratoire).

COMPOSITION DU DOSSIER

Le dossier à constituer pour faire appel à ce Fonds comprend, en trois exemplaires :
. la note de présentation de la demande, rédigée selon le modèle de canevas ci-joint,
. le "questionnaire inventeur" complété, qui comprend un questionnaire succint relatif à l'invention, une fiche par inventeur et une déclaration des co-auteurs d'éventuelle(s) publication(s) sur l'objet de la présente demande.

CANEVAS POUR LE DEPOT D'UNE DEMANDE AU "FONDS DE VALORISATION-UNIVERSITES"

1 - DESCRIPTION SUCCINTE DE L'ACTIVITE DU LABORATOIRE

. Travaux réalisés par les différentes équipes
. Collaboration avec d'autres organismes de recherche

2 - DESCRIPTION DE L'ETAT ACTUEL DU PRODUIT OU PROCEDE, OBJET DE LA DEMANDE

a) Point de départ : Historique
. indiquer la nature des travaux et recherches exécutés (en précisant les problèmes que vous avez cherché à résoudre)
. donner les résultats obtenus
. les recherches débouchent-elles sur un produit ou procédé nouveau ou un perfectionnement ?
. quelles solutions neuves proposez-vous ?

b) Techniques concurrentes :
. quels sont les travaux concurrents en France ou à l'étranger dont vous avez connaissance ?
. préciser l'état de la technique tel qu'il est connu au niveau de la recherche ou au stade industriel, en résumant l'objet des publications ou des brevets les plus proches (y compris les vôtres) et en faisant ressortir les différences et inconvénients (joindre copie des publications ou brevets les plus proches).

3 - PROPRIETE INDUSTRIELLE

a) Indications sur les résultats obtenus, objet de l'invention :
S'il s'agit d'un
. produit : indiquer formule, schéma, caractéristiques physico-chimiques ou à défaut procédé de préparation et propriétés,
. dispositif : éléments essentiels appuyés par des figures,
. procédé : étapes essentielles et originales (préciser pour le cas de la chimie : conditions opératoires, produits initiaux et finaux, propositions).

b) Description détaillée :
. état d'avancement des travaux et réalisations pratiques
. fonctionnement
. essais-résultats avec données chiffrées
. domaine d'application (avec exemples à l'appui)

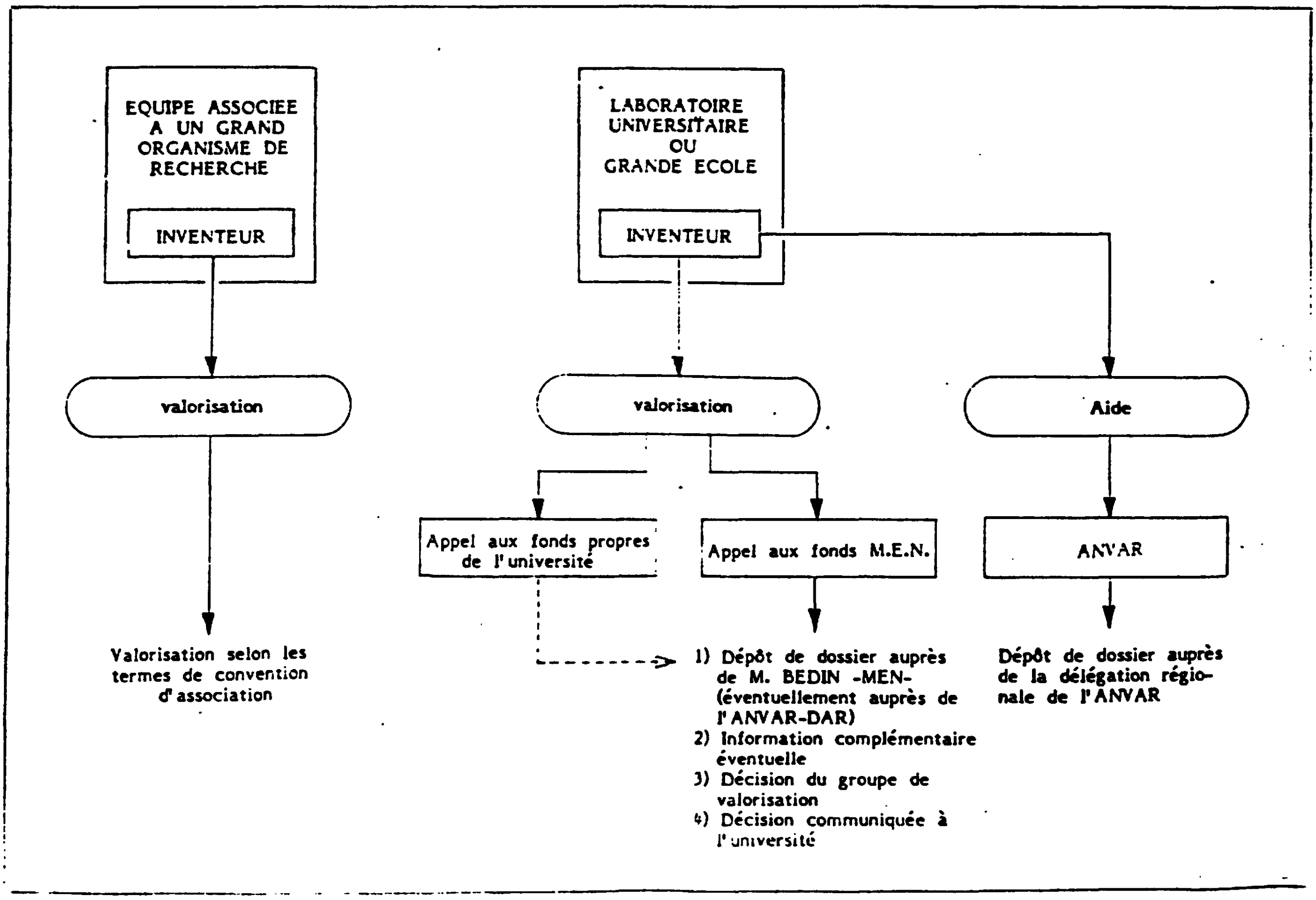
Remarque : Pour un médicament, prendre soin de fournir également le procédé de préparation du médicament, son mode de présentation, ainsi que des indications sur les conditions de posologie, les essais in vitro, et si possible, in vivo.

4 - PERSPECTIVES D'APPLICATIONS

a) Marques d'intérêt d'industriels :
. état actuel des marques d'intérêt manifestées par l'industrie,
. contacts éventuels en cours, état des négociations éventuelles.

b) Perspectives industrielles :
. quel type de partenaire pourrait être intéressé par les applications de cette invention (préciser les secteurs concernés)
. l'industriel doit-il être fabricant et distributeur (de quel type de réseau devrait-il disposer ?)
. préciser le cas échéant les travaux restant à faire pour mieux cerner les applications et débouchés de votre invention
. la technologie mise en oeuvre pourrait-elle s'appliquer à d'autres domaines ?

c) Clientèle visée :
. qui achètera le produit (ou procédé) en question ?(ex. grand public, industriel, laboratoire, établissement d'enseignement, etc...)
. à combien peut-on estimer (approximativement) le marché visé ?(préciser s'il s'agit de ventes annuelles ou d'un potentiel global).



APPENDIX No. 12 a

L'article 7 de l'annexe du protocole du 13 janvier 1984 entre le MEN et le CNRS précise les conditions dans lesquelles le CNRS valorise des résultats de recherches des unités associées ou mixtes dépendant de ce ministère.

« ARTICLE 7 :

Sauf dispositions contraires fixées par les conventions particulières à la demande de X, le CNRS assure pour les unites ou services mentionnés à l'article 2 le service de la valorisation des résultats de la recherche sur le plan technique et financier. Les inventions issues de travaux menes au sein de l'unité seront, quel qu'en soit l'auteur, communiquées à la Direction de la valorisation et des applications de la recherche du CNRS et au signataire pour le compte de X, en vue du déroulement des actions de valorisation correspondantes.

Pour les unités associées et les unités mixtes, les produits financiers de la valorisation des inventions issues de travaux menés au sein de l'unité seront distribués par l'organisme valorisateur (CNRS ou X) selon les modalités suivantes :

25 % pour le ou les organismes
25 % pour l'unité
15 % pour X
15 % pour le CNRS
20 % pour l'organisme valorisateur. »

Le service compétent du CNRS est :
Le Service des relations avec l'industrie
(Direction de la valorisation et des applications de la recherche)
15, Quai Anatole France - 75700 PARIS

CONVENTION GENERALE

Entre : X

représentée par son Président,

D'une part,

Et : LE CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (C.N.R.S.)
représenté par son Directeur Général,

D'autre part,

IL A ETE CONVENU CE QUI SUIT

ARTICLE 1er.-

Le C.N.R.S. ET X décident de coordonner pour cinq ans des activités relevant des domaines suivants :

- La recherche fondamentale et appliquée,
- La valorisation et le transfert des résultats de la recherche,
- L'information scientifique et technique,
- La formation par la recherche et à la recherche.
- L'hygiène et la sécurité.

ARTICLE 2.-

La présente convention règle les modalités de cette coordination, en ce qui concerne les activités, les responsabilités et droits des personnels, et les moyens mis à la disposition par les deux parties, dans :

1) Les unités de recherche de X associées au C.N.R.S.,

2) Des unités de recherche du C.N.R.S. associées à X

3) Des unités de recherche mixtes, dont la gestion est assurée en commun par X et le C.N.R.S.,

4) Des services collectifs de X ou du C.N.R.S.

La liste de ces unités et services est jointe en annexe : elle est mise à jour annuellement pour tenir compte des modifications intervenues.

La présente convention, conclue pour une durée de cinq ans, prend effet à la date de sa signature.

.../...

Un an avant l'échéance, les cocontractants feront un bilan de l'ensemble des activités visées à l'Article 1.

A son échéance, cette convention sera renouvelable annuellement par tacite reconduction et pourra être dénoncée par l'une ou l'autre des parties avec un préavis de six mois par lettre recommandée avec accusé de réception.

Cette convention peut à tout moment être modifiée par avenant.

DISPOSITIONS GENERALES.

ARTICLE 3.-

Les deux parties s'engagent, pour favoriser la coordination mentionnée à l'article 1er, à assurer un échange régulier d'informations sur les activités de recherche, de formation, de documentation, de valorisation et d'information scientifique et technique développées dans les unités ou services énumérés à l'article 2. Elles s'informent mutuellement, en temps utile, des projets de créations, de suppressions ou de modifications importantes touchant ces unités ou services.

Les listes nominatives des personnels permanents affectés par les deux parties aux unités et services mentionnés à l'article 2 sont mises à jour annuellement, à la date du 1er juillet.

ARTICLE 4.-

Les deux parties procèdent également à des échanges de vues sur les objectifs de leur politique scientifique ayant une incidence régionale, et sur les moyens qu'elles peuvent mettre en oeuvre pour les atteindre dans le cadre de leurs projets communs. Le Président de X , ou son représentant, et le Délégué Scientifique Régional du C.N.R.S. procéderont à de tels échanges avec la prériodicité qu'ils jugeront souhaitable.

ARTICLE 5.-

Des actions coordonnées de recherche sectorielle ou thématique impliquant plusieurs unités ou services mentionnés à l'article 2 peuvent faire l'objet de contrats particuliers. Ceux-ci peuvent également viser l'entretien et le développement des installations collectives. La liste de ces contrats particuliers est jointe à la présente convention et mise à jour annuellement.

ARTICLE 6.-

Les unités de recherche visées à l'article 2 sont appelées à participer à la formation par la recherche et à la recherche. L'accueil et l'encadrement d'étudiants en formation et de stagiaires font partie des missions de leurs personnels.

L'exercice de ces missions confère aux chercheurs qui les assument, tout comme aux enseignants-chercheurs, des responsabilités en matière de direction de recherche et de participation aux instances règlementaires prévues pour la définition des formations correspondantes ainsi qu'à celles relatives à la carrière des enseignants-chercheurs.

ARTICLE 7.-

Les unités de recherche visées à l'article 2 sont appelées à faire un effort pour développer la valorisation et le transfert des résultats de leur recherche.

Dans cette mission, elles sont assistées au sein des deux parties et dans le respect des responsabilités respectives des deux établissements, par le Chargé de Mission Industrie du C.N.R.S. et le I.L.U. de X qui, dans la mesure de leurs possibilités et compétences, et en étroite liaison, facilitent les actions de prospection et d'évaluation en vue d'applications industrielles, l'établissement de conventions de recherche et d'accords d'exploitation des résultats.

Lorsque les inventions issues de travaux menés au sein des unités visées à l'article 2 conduisent au dépôt de brevets ou cession de licences, sauf dispositions contraires fixées dans les conventions particulières, la préparation des dossiers techniques, des demandes de brevets, leur dépôt, leur maintien en vigueur, leur défense à l'égard des tiers, la gestion du portefeuille de propriété industrielle ainsi obtenu, sont assurés par le C.N.R.S. (D.V.A.R.).

Dans tous les cas, les inventions issues de travaux menés au sein des unités et services mentionnés à l'article 2 seront, quel qu'en soit l'auteur, communiquées à la Direction de la Valorisation et des Applications de la Recherche du C.N.R.S. et au I.L.U. de X.

Pour les unités associées et les unités mixtes, les produits financiers de la valorisation des inventions issues de travaux menés au sein de l'unité seront distribués par l'organisme valorisateur (C.N.R.S. ou X) selon les modalités suivantes :

25 % pour le ou les inventeurs,
25 % pour l'unité,
15 % pour X
15 % pour le C.N.R.S.
20 % pour l'organisme valorisateur.

Les dispositions du présent article ne font pas obstacle à la possibilité de dépôt de brevet par un industriel à la suite de travaux menés dans le cadre des contrats de recherche visés à l'article 22 et 35.

ARTICLE 8.-

Le Président de X , ou son représentant, et le Directeur de l'Information Scientifique du C.N.R.S. ou son représentant s'informent et se concertent sur les actions de diffusion et d'information scientifique et technique entreprises par les unités et services mentionnés à l'article 2.

.../...

ARTICLE 9.-

Le Président de X et le Directeur de la Recherche du Ministère de l'Education Nationale sont informés de tout projet de GIP, ou de tout projet de convention d'association avec un partenaire extérieur impliquant nominativement une unité ou service mentionnés à l'article 2. X est co-signataire de tout GIP impliquant nominativement une unité ou service de X associés au C.N.R.S. ; X peut co-signer une convention impliquant nominativement des unités associées au C.N.R.S., en particulier si elle y apporte des moyens spécifiques. Elle peut être co-signataire de GIP ou de conventions impliquant des unités ou services du C.N.R.S. associés à X notamment si des personnels ou des moyens de X sont parties prenantes du GIP.

ARTICLE 10-

Les personnels de chacune des parties affectés aux unités et services mentionnés à l'article 2 sont membres des collèges électoraux des instances délibératives ou consultatives de l'autre partie, dans le cadre de la législation et de la réglementation en vigueur.

ARTICLE 11.-

Chaque partie est chargée, dans le cadre des lois et règlements en vigueur, d'assurer un fonctionnement normal des activités dans l'enceinte des unités et services de son ressort. Elle définit le règlement intérieur qui s'impose à l'ensemble des personnels. Elle veille, notamment, au respect des règles d'hygiène et de sécurité.

Toutefois, les conséquences d'accidents du travail et de maladies professionnelles restent à la charge de la partie dont relève l'agent concerné, sous réserve de recours contre la partie responsable de l'unité ou du service si celle-ci a manqué à ses obligations.

ARTICLE 12.-

Les temps de service dans les unités et services visés à l'article 2 sont fixés, pour les personnels de X comme pour ceux du C.N.R.S., par référence à la règlementation en vigueur dans la Fonction Publique. Sous réserve de modifications législatives ultérieures, ils comprennent 32 jours ouvrés de congé et un horaire hebdomadaire de 39 heures, ou toute obligation de service jugée équivalente d'un commun accord entre les parties.

ARTICLE 13.-

Chacune des parties assure sans discrimination aux personnels de l'autre partie le bénéfice de ses services sociaux.

Des conventions particulières concernant les activités diverses (action sociale, sécurité, formation permanente, surveillance médicale, restauration) établiront précisément les contributions dues par les deux parties.

.../...

ARTICLE 14.-

Chaque unité est dirigée par un Directeur qui veille à l'accomplissement des activités rappelées dans l'article 1. Il maintient un lien étroit entre l'unité et les deux parties.

Conjointement avec le responsable de la formation doctorale concernée, et après avis des instances statutaires compétentes, il exerce en particulier la responsabilité du recrutement des chercheurs en formation dans son laboratoire, de leur orientation, du suivi de leurs travaux et de l'aide à leur apporter pour leur avenir professionnel.

ARTICLE 15.-

Le Directeur de l'unité rédige tous les deux ans un rapport d'activités qui traite des activités de recherche, de documentation, des travaux de valorisation, de l'effort d'information scientifique et technique, de la participation à des actions de formations par la recherche et des problèmes administratifs et financiers.

Ce rapport est adressé à chacune des parties.

DISPOSITIONS RELATIVES AUX UNITES DE RECHERCHE DE X ASSOCIEES AU C.N.R.S.

ARTICLE 16.-

Chaque unité de recherche de X associée au C.N.R.S. fait l'objet d'un contrat spécifique qui précise la thématique dans laquelle s'inscrivent les activités dans les domaines mentionnés à l'article 1er.

L'association d'un laboratoire de X au C.N.R.S. maintient la co-responsabilité de X dans l'orientation scientifique.

L'association est prononcée pour une période déterminée. Si cette période s'achève pendant la durée de la présente convention, la reconduction de l'association ou sa transformation est soumise à l'appréciation des instances règlementaires des deux parties.

ARTICLE 17.-

Conformément à la procédure fixée par le décret n° 82-993 du 24 novembre 1982, le Directeur de l'unité est nommé par le Directeur Général du C.N.R.S. avec l'accord de X. Au préalable, et afin de prévenir toutes difficultés internes ultérieures, les deux parties s'engagent à procéder à des consultations mutuelles en vue de présenter une proposition commune à l'appréciation du Conseil de Laboratoire, du Comité National du C.N.R.S. et du Conseil Scientifique de X.

En cas d'interruption du mandat du Directeur en cours d'association, son remplacement sera effectué suivant une procédure analogue.

.../...

ARTICLE 18.-

Le Directeur assure la gestion de l'ensembqle des moyens mis à disposition de l'unité par les deux parties. Il doit donner son accord à toute affectation de moyens à des membres de l'unité par des tiers sous réserve des dispositions de l'article 22.

ARTICLE 19.-

Lorsque leur taille le justifie, ces unités de recherche sont dotées d'un Comité de Direction par référence aux règles en vigueur au C.N.R.S. et à X Le Président de X est représenté à ce Comité.

Le Comité de Direction est notamment chargé de présenter au responsable de l'unité toute recommandation utile sur l'orientation des activités. Il est destinataire des rapports visés à l'article 15, et procède à une évaluation détaillée des activités de l'unité.

ARTICLE 20.-

Le Directeur de l'unité institue un Conseil de Laboratoire dont les règles d'organisation sont approuvées par X et par le C.N.R.S. Ce Conseil, dont le rôle est consultatif, est notamment appelé à donner son avis lors de la nomination du Directeur de l'unité. Il est nécessairement consulté sur l'utilisation des moyens affectés à l'unité.

ARTICLE 21.-

L'unité dispose de locaux mis à sa disposition par X

X s'engage à garder des locaux en bon état d'entretien et utilisables à l'exercice des missions définies à l'article 1er pendant la durée de l'association ; à cet effet, X assurera l'accès aux locaux pendant les périodes d'interruption des activités pédagogiques et aménagera les horaires d'ouverture les plus favorables.

X met à la disposition de l'unité les services administratifs et techniques communs de l'établissement dans les conditions normales de celui-ci et prend en charge les dépenses de soutien général de la recherche.

Le C.N.R.S. peut mettre des locaux à la disposition de l'unité. Dans ce cas, X prend en charge les dépenses de soutien général de la recherche, induites par l'affectation de ces locaux à l'unité, sous réserve des dispositions prévues dans des conventions particulières.

ARTICLE 22.-

Les contrats de recherche que l'unité souhaite établir avec des organismes tiers, publics ou privés, français ou étrangers, sont soumis à l'avis des deux parties qui disposent de quinze jours pour donner leur avis. Au-delà de ce délai leur avis est réputé favorable.

.../...

Les contrats sont signés par X Ils peuvent être gérés par X ou le C.N.R.S.

Les deux parties sont obligatoirement co-signataires des contrats de recherche qui prévoient les modalités d'exploitation des résultats éventuels.

Ils peuvent comprendre des clauses de confidentialité réservant toutefois la faculté pour les chercheurs concernés de faire état de leurs travaux dans leur rapport d'activité.

Les contrats devront prévoir explicitement la couverture des dépenses de soutien général à la charge de X induites par les activités qu'ils permettent de développer et les sommes correspondantes affectées au budget de X.

ARTICLE 23.-

Pendant la durée de l'association, le C.N.R.S. et X mettent à la disposition de l'unité des moyens matériels de recherche, libres de toute affectation, ou affectés à des missions particulières définies conjointement. Sauf disposition contraire, les deux parties s'efforceront pour la durée du contrat de maintenir ces moyens à un niveau réel au moins équivalent tant en personnel qu'en crédits. Si une diminution des moyens apparaissait néanmoins nécessaire, elle serait obligatoirement motivée.

Chacune des parties notifie annuellement à l'autre le montant des crédits affectés à l'unité, ainsi qu'un état récapitulatif des moyens affectés à l'ensemble des unités associées à X . Cet état est joint, pour le premier exercice, à la présente convention.

Le C.N.R.S. et X affectent à l'unité des personnels enseignants-chercheurs, chercheurs et I.T.A. Ils s'informent mutuellement des mouvements de personnels ; chacune des deux parties peut, dans un délai de 15 jours, formuler à l'autre son refus motivé de l'affectation d'un agent.

En cas d'augmentation significative du nombre des membres de l'unité, il est procédé avec le Directeur à un réexamen des moyens matériels nécessaires.

ARTICLE 24.-

Toutes les publications des personnels de l'unité devront mentionner le lien d'association avec le C.N.R.S. en portant l'indication :

Nom de l'auteur.................................
X
Laboratoire.....................................
Unité associée au C.N.R.S.

.../...

DISPOSITIONS RELATIVES AUX UNITES DU C.N.R.S. ASSOCIEES A X

ARTICLE 25.-

X contribue aux activités de l'unité en mettant à sa disposition des personnels enseignants-chercheurs ainsi que des moyens de recherche libres de toute affectation ou affectés à des missions particulières définies conjointement.

Les dotations de X en personnel et en crédits de recherche aux unités propres du C.N.R.S. qui lui sont associées sont effectuées suivant les mêmes règles que celles appliquées pour les unités de l'Université installées dans ses propres locaux.

ARTICLE 26.-

X peut mettre des locaux à la disposition de l'unité. Dans ce cas, le C.N.R.S. prend en charge les dépenses de soutien général de la recherche induites par l'affectation de ces locaux à l'unité, sous réserve des dispositions prévues dans des conventions particulières.

ARTICLE 27.-

Compte-tenu des dispositions de l'article 25, les contrats de recherche que l'unité souhaite établir avec des organismes tiers, publics ou privés, français ou étrangers, sont soumis à l'avis des deux parties qui disposent de quinze jours pour donner leur avis. Au-delà de ce délai leur avis est réputé favorable.

Les contrats sont signés par le C.N.R.S. Ils peuvent être gérés par X ou le C.N.R.S.

Compte tenu des dispositions prévues à l'article 25, X peut être co-signataire des contrats qui prévoient des modalités d'exploitation des résultats éventuels.

Ils peuvent comprendre des clauses de confidentialité réservant toutefois la faculté pour les chercheurs concernés de faire état de leurs travaux dans leur rapport d'activité.

Les contrats devront prévoir explicitement la couverture des dépenses de soutien général à la charge du C.N.R.S. induites par les activités qu'ils permettent de développer et les sommes correspondantes affectées au budget du C.N.R.S.

ARTICLE 28.-

Le Président de X est représenté au sein du Comité de Direction de l'unité.

.../...

ARTICLE 29.-

Les publications des personnels de l'unité devront mentionner le lien de convention avec X portant l'indication :

Nom de l'auteur..............................
Centre National de la Recherche Scientifique,
Laboratoire..................................
Unité associée à X

DISPOSITIONS RELATIVES AUX UNITES DE RECHERCHE MIXTES.

ARTICLE 30.-

Dans des domaines spécifiques, des unités de recherche mixtes X - C.N.R.S. peuvent être créées. Elles sont placées sous la responsabilité conjointe de X et du C.N.R.S. qui leur attribuent des moyens. Les crédits de fonctionnement sont gérés par l'établissement de rattachement expressément désigné dans la convention particulière.

ARTICLE 31.-

Après consultation du Comité National du C.N.R.S. et du Conseil Scientifique de X , le Directeur d'une unité mixte est nommé conjointement par le Directeur Général du C.N.R.S. et le Responsable de X Son mandat est renouvelable dans les conditions habituelles applicables aux Directeurs d'unité du C.N.R.S. et de X

ARTICLE 32.-

Lorsque leur taille le justifie, les unités sont dotées d'un Comité de Direcion par référence aux règles du C.N.R.S. et de X Les deux parties sont représentées à ce Comité. Le Comité de Direction est notamment chargé de présenter au responsable toute recommandation utile sur l'orientation des activités. Il est destinataire des rapports visés à l'article 15; et procède à une évaluation détaillée des activités de l'unité.

ARTICLE 33.-

Le Directeur de l'unité institue un Conseil de Laboratoire dont les règles d'organisation sont approuvées par X et par le C.N.R.S. Ce Conseil, dont le rôle est consultatif, est notamment appelé à donner son avis lors de la nomination du Directeur de l'unité. Il est nécessairement consulté sur l'utilisation des moyens affectés à l'unité.

ARTICLE 34.-

Des conventions particulières définissent le (ou les) organisme(s) prestataires de locaux, ainsi que les responsabilités en matière de moyens. Elles prévoient explicitement le responsable des dépenses de soutien général.

Pendant la durée de la présente convention, le C.N.R.S. et X s'engagent en matière d'affectation de moyens matériels de recherche et de personnels, à respecter les mêmes règles que celles mentionnées à l'article 23 et qui régissent les unités associées.

ARTICLE 35.-

Les contrats de recherche que l'unité souhaite établir avec des organismes tiers, publics ou privés, français ou étrangers, sont soumis à l'avis des deux parties qui disposent de quinze jours pour donner leur avis. Au-delà de ce délai leur avis est réputé favorable.

Les contrats sont signés par la partie gestionnaire des moyens de fonctionnement. Ils peuvent être gérés par le C.N.R.S. ou X.

Les deux parties sont obligatoirement co-signataires des contrats de recherche qui prévoient les modalités d'exploitation des résultats éventuels.

Ils peuvent comprendre des clauses de confidentialité réservant toutefois la faculté pour les chercheurs concernés de faire état de leurs travaux dans leur rapport d'activité.

Les contrats devront prévoir explicitement la couverture des dépenses de soutien général à la charge du signataire induites par les activités qu'ils permettent de développer et les sommes correspondantes affectées au budget du signataire.

ARTICLE 36.-

Toutes les publications des personnels de l'unité devront mentionner les deux organismes en portant l'indication :

Nom de l'auteur.................................
Unité mixte Centre National de la Recherche Scientifique,
Laboratoire.....................................
X

Fait à .... en deux exemplaires

Le

Le Président de X — Le Directeur Général du C.N.R.S.

APPENDIX No. 13

Bundesverband der Deutschen Industrie e.V.
Gustav-Heinemann-Ufer 84-88
Postfach 510548
5000 Köln 51 (Bayenthal)

Tel.: Sa.-Nr. (0221) 3708-00
Fernkopieranschluß 3708-730
Telex 8882601 · Bildschirmtext 54600 #
Teletex (17)2214058
Telegramme Bundesindustrie

BDI

II/1 Abteilung
Forschungs- und
Bildungspolitik

Vorsorge treffen... ausbilden

Datum 01.07.86

Tel. Durchwahl: (0221) 3708- 530

Ausschuß für Forschungs- und Wissenschaftspolitik

Ausschuß für Bildungspolitik

Mitgliedsverbände

Landesvertretungen

Ihr Zeichen

Ihre Nachricht vom

Unser Zeichen
II/1-03-07

Zusammenarbeit zwischen Hochschule und Wirtschaft

Sehr geehrte Damen und Herren,

am 16. Mai 1986 hat der Wissenschaftsrat eine Stellungnahme zur Zusammenarbeit zwischen Hochschule und Wirtschaft verabschiedet. Der Rat begrüßt die in den letzten Jahren verstärkte Zusammenarbeit zwischen Hochschulen und Wirtschaft und fordert den weiteren Ausbau dieser Zusammenarbeit. Die Hochschulen sollten sich dabei von folgenden Grundsätzen leiten lassen:

- Die Entscheidungsfreiheit der Hochschule und der Hochschullehrer muß gewahrt bleiben.
- Die primären Aufgaben der Hochschulen - Forschung, Lehre und Förderung des wissenschaftlichen Nachwuches - sollen durch die Kooperation nicht beeinträchtigt werden.
- Das breite Spektrum der Forschung an den Hochschulen muß erhalten bleiben.
- Der beste Weg der Wissensvermittlung zwischen Hochschule und Wirtschaft ist der Austausch von Personen.
- Die Ergebnisse der Hochschulforschung sind zu veröffentlichen.

Aus diesen allgemeinen Grundsätzen leitet der Rat eine Reihe von Vorschlägen ab, die sich weitgehend mit den wissenschaftspolitischen Vorstellungen des BDI decken. Hierzu zählen:

- Die Hochschulen müssen sich darauf einstellen, daß anwendungsnahe Forschung und Entwicklung bei der Zusammenarbeit mit der Industrie auch von deren Rahmenbedingungen bestimmt werden. Dazu zählen die Einhaltung vorgegebener Termine und Fristen, die Vorlage von Kostenkalkulationen und die Erfüllung der Verträge.

- Die Hochschulen müssen sich vermehrt darüber Gedanken machen, wie ihre aktuellen Forschungsergebnisse rascher als bisher und besser aufbereitet einem Nachfragemarkt angeboten werden können. Dabei sollten die Hochschulen ihre Berichterstattung so weiterentwickeln, daß sie auch dem Informationsbedürfnis von mittelständischen Betrieben entsprechen können.

- Unterschiedlichen Interessen von Hochschulen und Wirtschaft in bezug auf die Veröffentlichung von Forschungsergebnissen kann z. B. dadurch Rechnung getragen werden, daß vereinbart wird, in bestimmten Fällen Forschungsergebnisse zu einem späteren Zeitpunkt zu publizieren.

- Beratungs- und Technologietransferstellen an den Hochschulen sollten regelmäßig einer Erfolgskontrolle unterzogen werden. Transferstellen sollten nur dann fortgeführt werden, wenn sie Erfolge vorweisen können.

An die Wirtschaft richtet der Wissenschaftsrat die Forderungen:

- Nicht nur auf das Angebot der Hochschulen zum Wissens- und Technologietransfer zu warten, sondern selbst Ergebnisse der Grundlagen und anwendungsorientierten Forschung in den Hochschulen frühzeitig zur Kenntnis zu nehmen.

- Von sich aus die Beratung durch Wissenschaftler anzustreben und Kooperationen anzubieten.

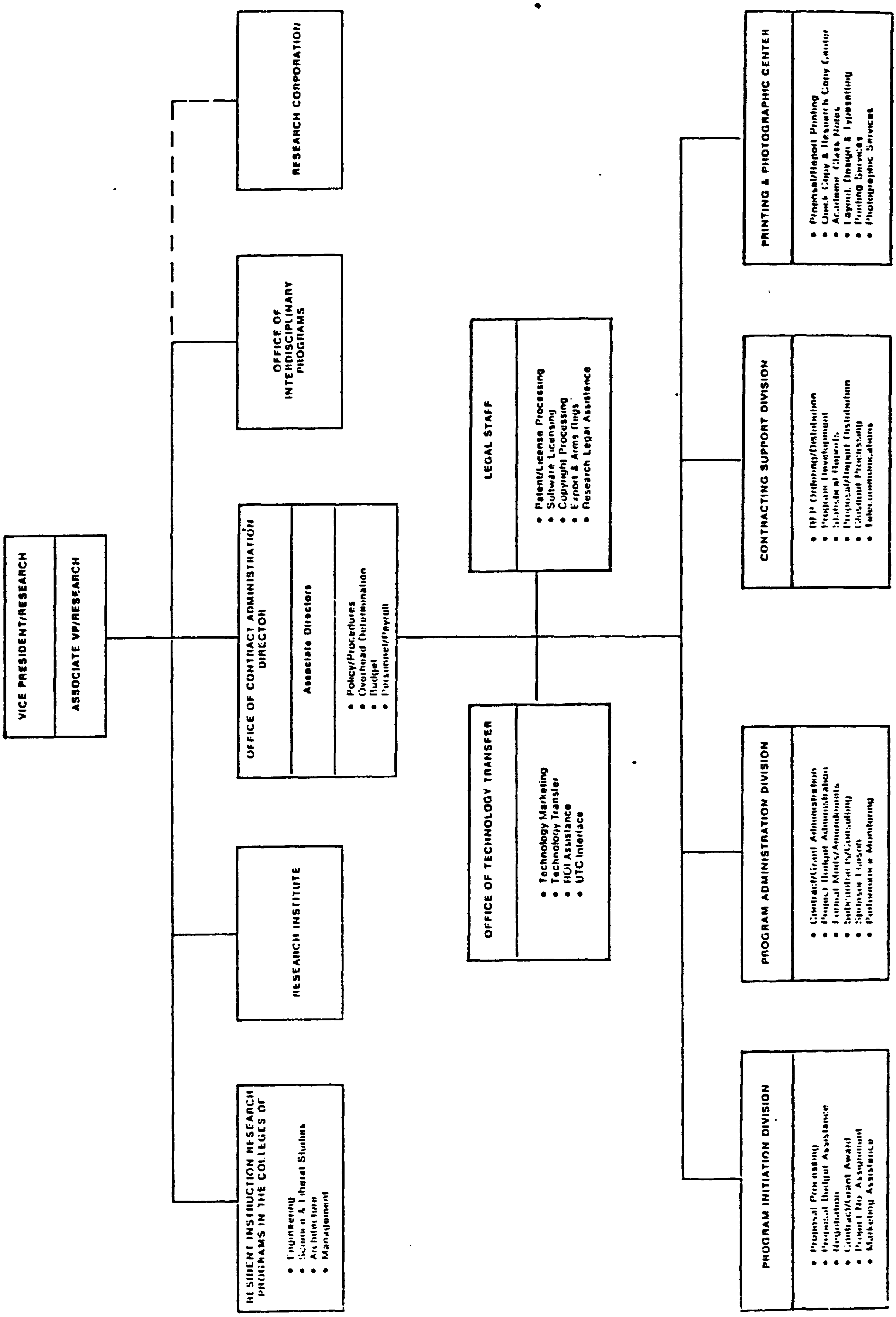
- Vermehrt Praktikumsplätze für Studenten anzubieten.

Ein Exemplar der Stellungnahme des Wissenschaftsrates haben wir zu ihrer Information beigefügt.

Mit freundlichen Grüßen

Dr. Kreklau   Dr. Haß   Anlage

APPENDIX No. 14



APPENDIX No. 15

GhK

Gesamthochschule Kassel · Universität

Technologie- und Innovationsberatung

Projekt: Training von Transferstellen-Mitarbeitern
Veranstaltungsprogramm

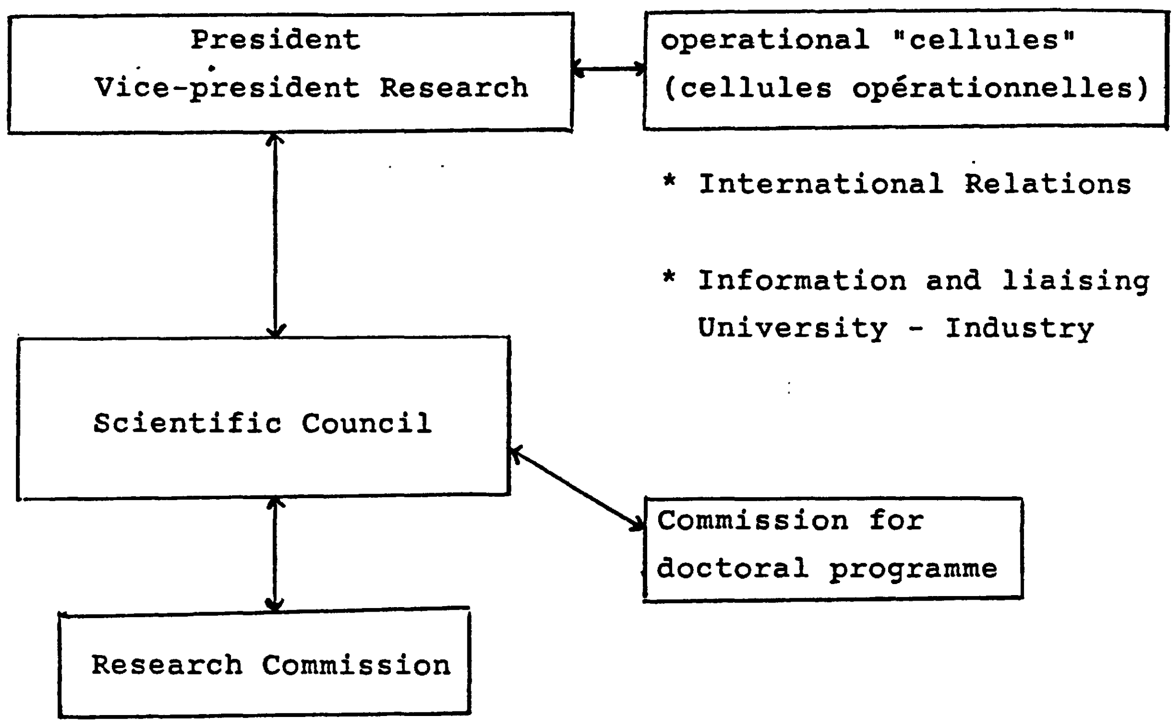
Thema	Dauer in Tagen	Termin
o Haushalts- und personalrechtliche Probleme der Drittmittelforschung unter besonderer Berücksichtigung der vertraglichen Aspekte im Wissens- und Technologietransfer	3	KW 49 **) 1986
o Gesprächs- und Präsentationstechniken, Öffentlichkeitsarbeit und Akquisiton als Grundlagen einer erfolgreichen Transferarbeit	3	KW 4 *) 1987
o Management von industriellen Innovationsprozessen und Projektmanagement	4	KW 9 1987
o Information über Förderprogramme o Existenzgründung in technologieorientierten Bereichen	3	KW 19 1987.
o Moderation von Arbeitsgruppen o Strategien der Konfliktlösung	3	KW 23 1987
o Arbeitnehmererfinderrecht und Erfindungsverwertung o Patente und Lizenzen o Allgemeine Rechtsfragen	5	KW 39 1987
o Recherchen auf Datenbanken o Informations- und Kommunikationstechnologie zur Unterstützung der Transferarbeit	5	KW 41 1987
o Strategien zur Weiterentwicklung von Wissens- und Technologietransfer - Personaltransfer - transferorientierte Weiterbildung - Institutionenkenntnisse	3	KW 7 1988

*) Das Seminar wird voraussichtlich in der angegebenen Kalenderwoche stattfinden.

**) Das Seminar fand bereits für Hochschulangehörige vom 03.12.86 - 05.12.86 statt.

APPENDIX No. 16

EXAMPLES OF INSTITUTIONS' RESEARCH ORGANISATION



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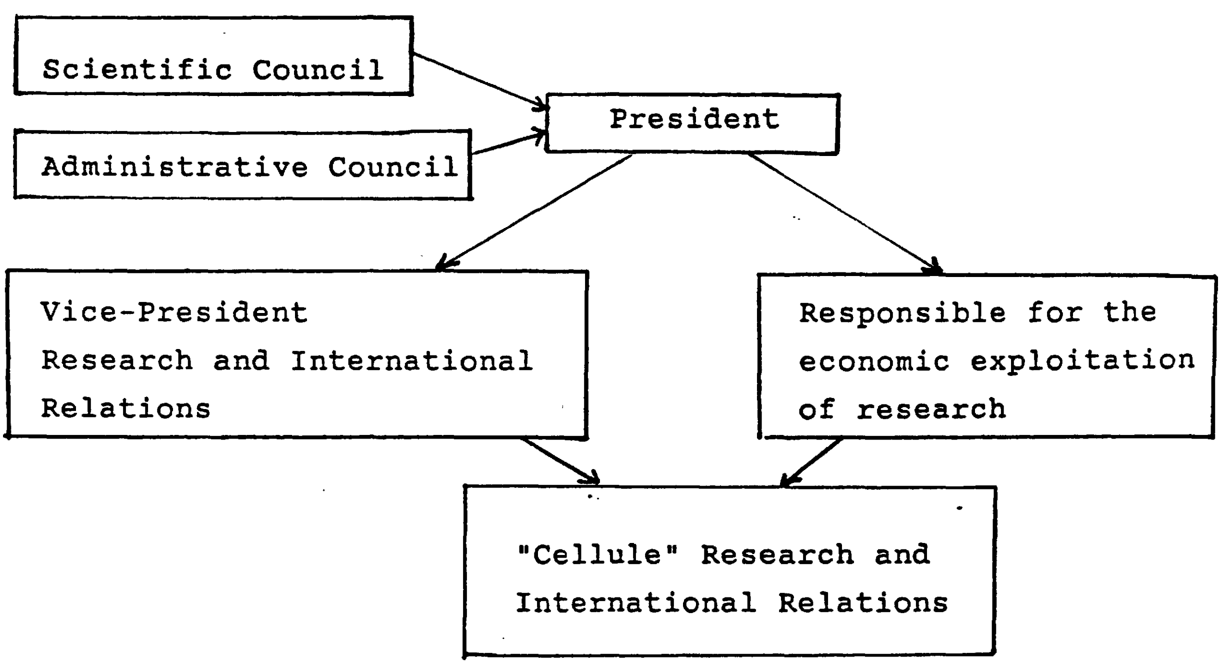

APPENDIX No. 17

"GRUENDERZENTREN" AND SIMILAR STRUCTURES IN GERMANY

Structure	links with HE-institution
Technologiezentrum Aachen (*)	RWTH Aachen is member of the Aachen association; collaboration with the I.L.B. of the institution;
Gründerzentrum Bochum (planned)	cooperation with the Ruhr-Universität Bochum is planned;
Technologiepark Braunschweig	informal cooperation with the university;
Technologie-Zentrum GmbH, Dortmund (*)	informal cooperation with the Dortmund University Dortmund
Düsseldorfer Technologiezentrum	planned cooperation with HE-institutons
Gründerzentrum Gronau	cooperation with FHS Münster; contacts with TRH Twente
Gründerwerkstadt HH (Hamburg)	cooperation with all universities in Hamburg, especially with the technical university;
Technologie-Centrum Hannover	cooperation with several Hannover HE-institutions
Technologiepark Karlsruhe (*)	coop. agreement with university Karlsruhe

Structure	links with HE-institution
Mafinex e.V., Mannheim	contacts with FHS für Technik Mannheim
Centrum für Innovation und Technologie, Osnabrück	University and FHS cooperate
SITZ, Saarbrücken (*)	cooperation with INEX - FHS des Saarlandes
Technologie-Centrum Schwerte (*)	individual links with universities
Technologie-Zentrum Siegen	cooperation with Universität-GHS Siegen
Technologiezentrum Stuttgart-Pfaffenwald (*)	cooperates with University Stuttgart
Gründerzentrum Uelzen(*)	cooperation with FHS Nordost-Niedersachsen and others
Technologiefabrik Ulm	cooperation with FHS and university Ulm
Innovations- und Gründerzentrum Wartstein-Rüthen	cooperation with University/GHS Paderborn

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(*) See also appendix 18

APPENDIX No. 18

	Aachen Aachen Technology Centre	Berlin Technology and Innovation Park TIP	Berlin In the TIP: Berlin Innovation Centre BIG	Bonn Bonn Commerce and Technology Centre GTB	Dortmund Dortmund Technology Centre	Heidelberg Heidelberg Science Park GmbH
ORGANIZATION	operating company: AGIT GmbH chamber of Industry and Commerce city and district authorities, sponsor association	Berlin Technical University (Technology Transfer Unit) in cooperation with the Senator for Economic Affairs and Transport	Berlin Technical University (Technology Transfer Unit) in cooperation with the Senator for Economic Affairs and Transport	City of Bonn Bonn Chamber of Industry and Commerce, Bonn Chamber of Crafts	operating company: Dortmund Technology Centre, City of Dortmund and Chamber of Industry and Commerce, Process Automation Company GmbH, 5 banks	operating company: Heidelberg Science Park GmbH, City of Heidelberg, Chamber of Industry and Commerce
TARGET GROUP	high-tech entrepreneurs from science, crafts and service sectors	innovative small and medium-sized enterprises, research institutes, young high-tech firms in the Berlin Innovation Centre (BIG), private research institutes	new high-tech entrepreneurs with close university links (firm should not have been founded more than 2 years earlier	small and medium-sized industrial and craft businesses	high-tech small and medium-sized businesses, new entrepreneurs	high-tech and research-orientated small and medium-sized firms, new entrepreneurs
CAPACITY	approximate total 4 050 m^2 floor area for about 30–40 firms	total 80 000 m^2 floor area	at present total 5 250 m^2 floor area fully occupied; another 5 000 m^2 being added	approximate total 80 000 m^2 floor area	approximate total 4 800 m^2 floor area	total 6 000 m^2 floor area
SERVICES	business consultancy, secretariat services, offices and conference centre, telex ect, word processing, data processing, financial aid	concentration on certain areas of technoloy : telecommunications, building engineering and new materials, biotechnoloy, and software, environmental and power engineering vehicle and traffic engineering	business consultancy, office and secretariat services, offices and conference centre, telex etc, word database service financial aid	business consultancy	business consultancy secretariat services telex etc. offices and conference centre word processing data processing financial aid	financial aid
ADDRESS	Technologiezentrum Aachen Herr Hepple Jülicher Str. 336 D-5100 Aachen	TIP Technologie- und Innovationspark Jürgen Allesch Fasanenstr. 4 D-1000 Berlin 12	BIG Berliner Innovations- und Gründerzentrum Jürgen Allesch Heinz Fiedler Ackerstr. 71-76 D-1000 Berlin 65	GTB Gewerbe und Technologiezentrum Bonn Siemensstr. 6-12 D-5300 Bonn 1	Technologiezentrum Dortmund Klaus-Dieter Otto Klaus Günzel Ostwall 54 D-4600 Dortmund 1	Technologiepark Heidelberg GmbH Karsten Schröder Palais Graimberg Kornmarkt 5 D-6900 Heidelberg

	Hildesheim Hildesheim Technology Centre	Karlsruhe Karlsruhe Technology Factory	Kassel Kassel Venture Park	Cologne Cologne Innovation Centre GIZ	Osnabrück Centre for Innovation and Technology CeFIT	Saarbrücken Saarbrücken Innovation and Technology Centre
ORGANIZATION	City of Hildesheim	operating company: Chamber of Industry and Commerce, Karlsruhe Business and Technology Consultancy GmbH, Karlsruhe University and College of Vocational Training, Steinbeis Foundation, Fraunhofer Society, Nuclear Research Centre	Wiggins AG/ London Job Creation Ltd	operating company: GIZ GmbH Cologne, City of Cologne, Stadtsparkasse Köln	City of Osnabrück (Business Promotion Office)	operating company: Innovation and Business Promotion Company GmbH, City of Saarbrücken, Sparkasse Saarbrücken, Saarbrücken municipal utilities
TARGET GROUP	young high-tech firms and new entrepreneurs	new entrepreneurs from the new technology field	new entrepreneurs and small-scale businesses of all kinds	new high-tech entrepreneurs	technology transfer to existing local firms, new entrepreneurs	high-tech small and medium-sized businesses
CAPACITY	total 6 700 m^2 floor area	approximate total 5 000 m^2 floor area	about 156 000 m^2 floor area	about 2 300 m^2 floor area	new entrepreneurs 6 units of about 65 m^2 each	about 37 000 m^2 floor area
SERVICES	secretariat services, offices and conference centre, telex etc, data processing	business consultancy, secretariat services, copies, laboratories	business consultancy, secretariat services, offices and conference centre, telex etc, financial aid	business consultancy, secretariat services, offices and conference centre, telex etc, word processing, financial aid	use of infrastructure of Osnabrück Engineering Centre, business consultancy, secretariat services, telex etc, offices and conference rooms	business consultancy, secretariat services, telex etc, word processing, data processing
ADDRESS	Stadt Hildesheim Stadtdirektor Walter Hoffmann Rathaus D-3200 Hildesheim	Technologie-Fabrik Karlsruhe Haid- und Neustrasse D-7500 Karlsruhe	Job Creation Ltd. Unternehmenspark Kassel Keith Freestone Lilienthalstr. 7-25 D-3500 Kassel	GIZ Gründer- und Innovationszentrum Köln Dr. Stark Eupener Strasse 146 D-5000 Köln-Braunsfeld	CeFIT Centrum für Innovation und Technologie (im Ingenieurzentrum Osnabrück) Frau Cartemann Mindener Str. 205 D-4500 Osnabrück	Saarbrücker Innovations- und Technologiezentrum Herr Britz Herr Schuch Alten-Kesseler-Str. 17 D-6600 Saarbrücken

	Schwerte Schwerte Technology Centre	St. Georgen St. Georgen Technology Centre	Stuttgart Stuttgart-Pfaffenwald Technology Centre	Syke Syke Science Park	Uelzen Uelzen Innovation Centre
ORGANIZATION	(private firm) Herrmann	operating company: Technology Centre GmbH Municipality of St. Georgen, Holding company Perpetuum Ebner GmbH and Co KG, St. Georgen Industrial Association (company in accordance with German Civil law), 2 banks	operating company: Stuttgart-Pfaffenwald Technology Centre GmbH, 6 banks	operating company: Syke Science Park GmbH, Municipality of Syke	Municipality of Uelzen (Business Promotion district Rural)
TARGET GROUP	business founders, small firms	business founders, sections of local industry (not always high-tech)	new high-tech entrepreneurs	young high-tech businesses, new entrepreneurs	small craft enterprises, master craftsmen, technicians
CAPACITY		present total 4 000 m^2, expansion planned	about 5 000 m^2 floor area	1 080 m^2 floor area	
SERVICES	business consultancy, secretariat services, conference room, cafeteria	business consultancy	business consultancy, secretariat services, offices and conference centre, telex etc.	business consultancy, secretariat services, offices and conference centre, communications equipment, word processing, data processing, laboratories, workshops, data bank service	business consultancy, marketing help, secretariat services, data service
ADDRESS	HTC Technologie-Centrum Schwerte Herr Marx D-5840 Schwerte	Technologiezentrum St. Georg Herr Dr. Kerrer Leopoldstrasse 1 D-7742 St. Georgen	Technologiezentrum Stuttgart-Pfaffenwald GmbH Dr. Alfred Storz (Landesgirokasse) Königstrasse 3 D-7000 Stuttgart 1	Technologie-Park Syke GmbH Robert Franzen Siemensstr. 16-18 D-2808 Syke	Gründerzentrum Uelzen Herr Bohne Amt für Wirtschaftsförderung Veerffer Strasse 2 D-3110 Uelzen

European Communities — Commission

COMETT — The training needs of staff in the Community's higher education sector engaged in cooperation with industry
Final report
prepared by European Research Associates

Document

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