

# **DRUID - Annual report 1995-96**

## **and plan and budget for 1996-97**

Bengt-Åke Lundvall  
Copenhagen  
September 1, 1996  
Revised November 25, 1996

### **I. Introduction**

In the letter dated May 30, 1995 where the general terms for the 5-year grant to the DRUID program are spelled out, it is specified that the Board of the Centre for Industrial Economics expects an annual report and a budget for the following year to be delivered September 1 each year starting 1996. The present report builds upon the half-year report from February 1 this year and the budget to be presented covers the period September 1, 1996 - January 1, 1998. In order to keep the report within reasonable size limits DRUID-scholars have been asked to refer to a maximum of 3 instances of:

- Scientific publication
- Participation in scientific conferences and contributions to Ph.D.-training
- Policy relevant and user-oriented activity

Ph.D.-students connected to DRUID have been asked only to specify the theme of their thesis, at what stage they are in their work and their participation in Ph.D.-training.

#### *The structure of the report*

The structure of the report follows the one used in the Half year report and it refers to two types of activities. First, there are the common activities most of which are specifically organised by DRUID. Second, follows a presentation of activities and plans for the themes and projects forming the DRUID research programme. Third, there are individual activities which relate to the research program of the Unit pursued by those belonging to the Unit.

The common activities have been divided into 3 categories:

- building the infrastructure (information system, publication series, data bases)
- more or less regular activities (on-going seminars and visiting scholars)

-specific events (Workshops and seminars in June, November, December, January and April)

The activities of individuals have been presented in three blocks:

- a detailed presentation of the activities of the Research Manager
- a summary report on activities of druid-scholars
- presentation of theses and stage of progress for Ph.D.-students

## **II. Common Activities**

### *Introduction and summary*

The major effort during the first 12 months has, as was foreseen in the supplementary application, been focused on strengthening the coherence of the Unit and building the necessary infrastructure in order to increase the productivity of the Unit as a whole. In general terms, the common activities have been successful and progress has been made in all areas of infrastructure building. Now, at the end of the first 12-month period, a number of DRUID-projects have taken off and entered a more intensive phase and a strong expansion in the Ph.D.-activities (almost a doubling of the number of Ph.D.-students and an intensification of Ph.D. training activities) has taken place.

Not surprisingly, it has proved complicated to create co-operation and interaction between research groups coming from three different universities and five different departments each with its own specific context, tradition as well as technical and administrative systems. For instance, it took quite some time before we managed to implement an efficient e-mail system for the whole unit. We are still having some problems with the fact that the administration follows different rules and routines at the Business School and at Aalborg University. But it is important to note that friction and co-ordination problems have been emanating from administrative structures rather than from the research collaborations established between the different research units.

There has been progress in several specific fields of the infrastructure building. First, the DRUID Working Paper series has now been established and there are already 8 such papers in circulation most of which can be accessed and downloaded via the DRUID Home Page. Second, DRUID-scholars have played important roles in organising Ph.D.-training at the Danish and European level. Finally, at the April conference most of the members of the international Scientific Advisory board took

time off to come to Denmark and the activities organised in this context were extremely useful in establishing working relationships between DRUID-researchers and many leading scholars in the field of Industrial Dynamics.

Some of the projects designed in the final application have been modified. But there have been no major change in the direction of research as it was outlined in the final application. The focus remains on issues relating to:

- the firm as a learning organisation (including its human resource-base)
- the process of structural change (including evolutionary modelling, micro-foundations in the form of user-producer relationships, the spatial dimension and the growing knowledge-intensity of the production system)
- systems of innovation (including the institutional and regional dimension, ecological sustainability and European industrial structure)

The next year will involve regular research in each of these areas and regarding the infrastructure we look forward to implementing an ambitious program of international guest professors, strengthening the efforts in the field of Ph.D.-training and establishing a common set of data bases to which there is general access within DRUID.

### *Building the infrastructure*

#### *Information infrastructure*

At the end of the first 12 months period, several important goals related to the information infrastructure have been achieved. First the e-mail system has now been established so that everyone can reach the whole Unit by one single alias, 'druid', and by means of a single e-mail software package, so, normally, it is now possible to send attachments through the e-mail also when different systems and software is used.

Second, information material about DRUID can now be accessed through the WWW-homepage of DRUID (address: <http://www.business.auc.dk/druid/>). This home-page will be up-dated with information about on-going activities of general interest.

Third, the DRUID-working papers can now be accessed on a WWW-server. These papers have a brief summary attached to them and it is now possible to down-load the papers world-wide.

## Plans

Next step is to increase the degree of utilisation of the information infrastructure both in terms of depth (transmitting more complicated sets of information such as for instance data bases) and width (increasing the proportion of users in areas where productivity and synergy gains are most obvious).

Parts of the DRUID-network are using minority systems (Apple) and word processing (WordPerfect) while the majority solutions are PC-based and using Word. This creates some minor problems in the communication within the network and in the future a mild pressure will be put on the minority to join the mainstream.

### *Data bases and statistics*

There are several important data bases which have been developed or reorganised by DRUID-scholars and which can be made broadly accessible to members of the Unit. This is for instance true for:

- the IKE-data base developed by Bent Dalum and others on the basis of OECD trade statistics. This database is used in the project of Bent Dalum and Gert Villumsen on the path dependency of trade specialisation (project C3).

- the REGSYS-data base developed by Peter Maskell which contains information on all manufacturing firms (enterprises and establishments) in Denmark. Work is in progress utilising the data in two distinct projects: I. "Learning and competitiveness in low tech industries" and II. "Localised Learning, industrial agglomerations and the re-emergence of Marshallian modes" (Responsible for both: Peter Maskell). Poul Rind Christensen utilises the database in his project on the competence base of selected industries in Southern Jutland. These projects are related to the DRUID project on transnational supply chains (project B3).

- the innovation survey data developed by Arne Kristensen and Jesper Lindgaard

- the IDA-database developed by Per Vejrup-Hansen and others which contains longitudinal data on all firms in Denmark

- the IO-database as an instrument for analytical work (see Jensen, Erling, 1995: Brug af input-output tabeller til analyse af strukturel økonomisk dynamik (The Use of Input-Output Tables in Analysing Structural Economic Dynamics, Research Report)).

In the period these data bases have been supplemented in three respects.

- Full access to OECD's STAN-data base which combines production, trade and

R&D-statistics in a comparative form for 10 countries, including Denmark, has been secured.

- A PATENT-data base will be procured in the near future from EPO (the European Patent Office in Munich). This data base covers all European patenting activities.

- The SUBCONTRACTING-data base on subcontracting relations. The data base contains information about more than 1000 Danish manufacturing firms, and their four most important suppliers and customers, as well as the specificity and age of the relations.

## **Plans**

One major new direction of work relates to the combination of the different data-sets. The project on Structural Economic Dynamics (project B2) will combine IO-data with data on innovation and patenting as well as with IDA-data to analyse the knowledge-intensity and the flow of education-based knowledge in the production system. The project on transnational supply chains (project B3) will utilise a combination of data regarding subcontracting with IO-data.

In a long term perspective it is a major challenge to develop new indicators for soft and informal activities such as for instance the volume of routine-based learning within firms. One step in this direction has been taken through the survey-based mapping of organisational innovation in Danish firms (project A3).

## *Publication Series*

The Unit started to publish working papers in its own series in April 96. The series is registered in the Danish Periodicals Index and the single issues in the Danish Book Index. At the moment (August 96) the Unit has published 8 issues and a few more are in the pipeline:

96-1

Bengt-Åke Lundvall: The Social Dimension of The Learning Economy

96-2

Nicolai J. Foss: Firms, Incomplete Contracts, and Organisational Learning

96-3

Bent Dalum and Gert Villumsen: Are OECD Export Specialisation Patterns 'Sticky?' Relations to the Convergence-Divergence Debate

96-4

Nicolai J. Foss: Austrian and Post-Marshallian Economics: The Bridging Work of George Richardson

96-5

Esben S. Andersen, Anne K. Jensen, Lars Madsen and Martin Jørgensen: The Nelson and Winter Models Revisited: Prototypes for Computer-Based Reconstruction of Schumpeterian Competition.

96-6

Peter Maskell: Learning in the village economy of Denmark. The role of institutions and policy in sustaining competitiveness.

96-7

Nicolai J. Foss and Jens Frøslev Christensen: A Process Approach to Corporate Coherence

96-8

Nicolai J. Foss: Capabilities and the Theory of the Firm

Forthcoming:

96-9

Kirsten Foss: A transaction cost perspective on the influence of standards on product development: Examples from the fruit and vegetable market

96-10

George B. Richardson: Competition, Innovation and Increasing Returns

The DRUID Working Papers are available to read (and to download) in the portable document format (PDF) from our homepage

(<http://www.business.auc.dk/druid/>)

## **Plans**

The paper by Richardson is the first with a non-DRUID author. In the future we will invite guest professors and visiting scholars to publish in the DRUID series in

connection with their stays in Denmark. Also, further efforts will be made to establish a number of regular exchanges of working papers with sister institutions in Denmark and abroad.

### *Ph.D.-Training*

At the beginning of the period there were 7 Ph.D.-students affiliated to the program. One HHK Ph.D.-student has got her degree in the period (Kirsten Foss) and at AAU another one will present his thesis early this fall (Allan Næs Gjerding). Today there are 10 Ph.D.-students taking part in the DRUID-network. Most of them had chosen their themes of research before the Unit was established. The themes of theses and the stage of advance is specified in the individual reports by Ph.D.-students below.

Through the IKE Group, DRUID has during the last years contributed to the creation and development of 2 Ph.D. networks, one international network (the ETIC Ph.D. program), and one national network (on the analysis of technological change). During the last year other DRUID members have increasingly been connected to these networks.

The ETIC program (Economics of Technological and Institutional Change) is established by a core group consisting of Bureau d'Economie Theorique et Applique (BETA), Université Louis Pasteur, Strasbourg, Maastricht Economic Research Institute on Innovation and Technology (MERIT), Rijksuniversiteit Limburg, Maastricht and the IKE Group. Furthermore, there is a number of associated institutes (SPRU at University of Sussex, ISI Fraunhofer Gesellschaft in Karlsruhe, PREST at University of Manchester, and others). The program is supported by EU's Training and Mobility of Researchers (TMR) program for the period 1996-98. It covers one month of courses each year, with four topics covered by researchers from the three institutes as well as other European and US institutes.

Another part of ETIC is a common two week Ph.D. seminar based on papers by the students. 30 Ph.D. students and 8-10 seniors participated in the 2 week course in Maastricht 10-21 June 1996 (with two DRUID-IKE contributors), and about the same number is expected to participate in the 2 week courses on the theory of the firm and simulation modelling of technical change in Strasbourg 7-18 October 1996 (with 2 DRUID-IKE contributors). The next course is 14-25 April 1997. Through the ETIC program there has now been institutionalised a forum for the creation of Ph.D. seminars and workshops at the European level within the area of the Economics of Technological and Institutional Change. ETIC is managed by a program committee consisting of a representative from BETA, MERIT and DRUID-IKE (Bent Dalum).

The Danish Ph.D. Network on the Analysis of Technological Change is broader with respect to scientific areas. It consists of 2 departments/research groups at Aalborg University, 2 at the Copenhagen Business School, 1 at Roskilde University and 1 at the Technical University of Denmark. A series of Ph.D. seminars have been arranged

during the last 3 years, normally with support from the Danish Research Academy. Partly the seminars have been training the students academically by mixing the Ph.D. students' presentation of research papers (and thesis chapters) with lectures by invited senior researchers. The secretariat of the network is placed at Roskilde University. It publishes a newsletter which announces the program of coming seminars. The co-ordination with ETIC is done through IKE's representatives in both networks.

## **Plans**

The ETIC-program which is financed by a grant from the EC will be repeated each year for the next coming three years. In the context of the Danish network on technology and society DRUID-IKE will organise a Ph.D.-course/seminar on Innovation Systems and Technology Policy in an Evolutionary Economic Frameworks to take place in 1996/97. The visiting professors program for the next coming years will be used to establish 'extra supervisor relationships' between visitors and DRUID Ph.D.-students.

## **Regular activities**

### *Seminars*

Regular seminar activities have been going on during the last 12 months both at HHK and AAU. Since the beginning of February a permanent DRUID-seminar has been organised at AAU every second Wednesday afternoon. The seminar will be used flexibly to introduce external guests, preliminary papers from senior staff and not least drafts of Ph.D.-Projects. The program for the Aalborg-seminar Spring 1996 has been enclosed.

The DRUID-IKE seminars are organised by Bent Dalum and announced on WWW: <http://www.business.auc.dk/ike/upcoming/ikesem.html>.

## **Plans**

A regular seminar activity will be established also at DRUID-HHK so that every second Wednesday a DRUID-seminar will take place in Copenhagen. The seminar programme for the fall will soon be on WWW: (<http://www.business.auc.dk/ike/upcoming/ikesem.html>).

## *Guests*

There have been a number of international guests at each of the main departments involved in DRUID and most of them have been 'shared' across DRUID through mutual visits or through asking them to give lectures at both places:

Bart Verspagen, Limburg, 18 August to 5 October, 1995, including seminars on Catching-up, Convergence and Divergence: A Survey, and on Technology and trade in an Evolutionary Perspective, AAU.

Olav Sørensen, Stanford, 8 - 12 September 1995, including a seminar on The Complexity Catastrophe and the Evolution of the Computer Industry, HHK.

Charles Edquist, TEMA-T, University of Linköping, Christopher Freeman, SPRU, University of Sussex, Lars Herlitz, Dept. of Economic History, University of Gothenburg, Luc Soete, Merit, University of Maastricht, 10 November 1995. International Round Table on the Economics of Technical Change, AAU.

Staffan Jacobsson, Gothenburg, 6 - 11 November 1995, including a seminar on the application of patent data in the description of technological profiles of countries, AAU.

Kristian Lindgren, Gothenburg and Santa Fe, 23 - 24 November, 1995, including a seminar on models and simulations of the iterated Prisoners Dilemma, AAU.

Morris Teubal, Hebrew University, Jerusalem, 12 November to 5 December, 1995, including a seminar on the transformation of innovation systems, AAU.

Brian Loasby, University of Stirling, 29 November - 2 December, 1995, research co-operation, HHK.

Dominique Foray, Universite Dauphine, Paris, 2 - 7 December, 1995, including a seminar on the economic consequences of the increased codification of knowledge, AAU and HHK.

Bo Carlsson, Case Western University, 10 - 13. January, 1996 including seminar on Four Technological Systems: What have we learned?, HHK.

Paul Robertson., University of New South Wales, 3 - 6 February, 1996 including a seminar on Knowledge and the New Growth Theory, HHK.

Morris Teubal, Hebrew University, Jerusalem, 10 - 17 March, 1996 Research Collaboration in the context of the DRUID project on evolutionary modelling, AAU.

Staffan Jacobsson, Gothenburg, 6 - 11 April, 1996, including a seminar on Regional

Innovation Systems, AAU.

John Cantwell, 12 - 14 May, 1996, Dept. of Economics, University of Reading, including a seminar on Technological Development, Patents and Trade, AAU.

Richard Langlois, University of Connecticut, 9 - 16 June, 1996 including two seminars on respectively, The History of Competitive Advantage in the Semi-Conductor Industry and Do Firms plan?, HHK.

## Plans

Many of our highly qualified international collaborators have expressed their interest to come and stay for a shorter or a longer period and work with issues related to the DRUID-research programme. In early spring a letter of invitation was sent to a number of international scholars where they were asked to specify:

- Areas of research and preferences in relation to the DRUID-programme
- Curriculum Vitae
- Preferred period of visit

On this basis a long term (2-3 years) programme for visiting fellows is now being designed. The programme for 1997 includes the following visitors some of whom will come for brief visits and others for as long as 1-2 months:

Cantwell, John,	University of Reading, Department of Economics, Reading
Carter, Anne P.	Brandeis University, Department of Economics, Massachusetts
DeBresson, Chris	Ocole des Sciences de la gestion, MontrJal
Dose, Giovanni	Dipt. de Scienze Economiche, ISIDE, Rome
Egidi, Massimo	UniversitB di Trento, CEEL, Trento
Fagerberg, Jan	NUPI, Oslo
Freeman, Chris	MERIT, Maastricht
Foray, Dominique	IMRI, UniversitJ Dauphine, France
Jacobsson, S.	Dept. of Industrial Management, Chalmers
Lazonick, William	Aspen
Lipsey, Richard G.	The Canadian Institute for Advanced Research, Simon Fraser University, Vancouver
Llerena, Patrick	BETA, Bureau d'Economie Teoretique et Applique, Strasbourg
Loasby, Brian	Department of Economics, University of Stirling, Scotland
Malerba, Franco	UniversitB Commerciale Luigi Bocconi, Milano
Mowery, David	University of California, Berkeley
Nelson, Richard	Columbia University, New York
Rush, Howard	University of Brighton, Brighton

Saviotti, Paolo      DPpartement d'Economie et Sociologie rurales, Grenoble  
Steinmüller, W.E.    MERIT, University of Limburg, Maastrich  
Teubal, Morris      Hebrew University, Jerusalem  
Verspagen, Bart    MERIT, Maastricht  
Yla-Anttila, Pekka  ETLA, Helsinki

### *Important events*

There have been 3 major events where almost all DRUID-scholars took part; the June-workshop, and the December-workshop in 1995 and the April-workshop in 1996. Other important events with a broad DRUID-participation were the Inaugural Lecture by Lundvall in October, 1995 and the Bo Carlsson-seminar in January, 1996.

### *December workshop*

The Workshop which took place at "Højstrupgaard" in Elsinore December 1-2, 1995 had two objectives. First, it should serve as an outlet for on-going work in DRUID and speed up the process of moving papers in a draft form into papers to be published in journals. Second, it was to be a kind of training seminar making all DRUID-staff and especially the Ph.D.-students less reluctant to go for publishing in international journals.

Five international experts (De Bandt, Dosi, Foray, Loasby and Teubal) were asked to act as referees in relation to 8 papers produced by DRUID-members and all participants, including Ph.D.-students, were given tasks as commentators of the papers. The 2 day-workshop was closed by a panel discussion regarding the experiences of the international experts as authors, referees and editors (Dosi and De Bandt are both chief editors of important journals in industrial economics) in relation to publishing in international journals.

The process was successful in several respects. First, the contributors got a useful feed back often giving them the advice to focus their papers more narrowly. Second, the process of publishing was demystified by the international experts and practical advice was given in this context. Third, the workshop increased the mutual insight in what individual DRUID-scholars are working on. Finally, the contributions by the Ph.D.-students were well prepared and quite qualified and the event must have contributed to give them more self-confidence in relation to acting in an international context.

### *April workshop*

The next major event was the 2-day seminar with the International Scientific Advisory Board which took place April 19-20, at Sophienberg outside Copenhagen. The first day was focused on DRUID-activities with brief presentations themewise

of the 12 projects referred to below and of Ph.D.-plans. The second day was dominated by contributions from members of the Scientific board and focused on two issues. One theoretical, on the economic analysis of learning with special attention to the codification of knowledge, and one policy related, on the design of industrial policy and innovation policy in a learning economy. The detailed programme has been enclosed as appendix A to the report.

The seminar gave an opportunity to establish working relationships to the members of the scientific board the majority of whom did attend the gathering. The guests seemed to appreciate the open discussions on the main topics addressed. It was decided to follow up these discussions via e-mail exchange and at later DRUID gatherings.

## **Plans**

We are now planning the next workshop to take place 8 -10 January outside Copenhagen and here the main emphasis will again be on presentations of on-going work by DRUID-staff and by Ph.D.-students. But in the same way as in December 1995 we will invite a small number of international experts to the seminar.

We have also reserved the dates June 2-3 for a meeting with the Scientific Advisory Board in Jutland. We have not yet decided the format of this meeting but probably we will focus it on knowledge-creation and learning in relation to industrial dynamics and make it a follow-up to the discussions at the April workshop. This time we will be more demanding in terms of written contributions from participants and the aim would be to work out a state-of-the-art publication in the field.

## **III. Research Projects- status and plans**

Many of the individual activities to be referred to in the final part of the report contribute to projects outlined in the application. In this part of the report, we have followed the structure of the final version of the application (March 30, 1995) which divides the research programme into three themes and the co-ordinator of each theme has been asked to specify activities for 1995/96 as well as plans for 1996/97. As foreseen in the application (appendix A) not all of the 12 projects follow the same time schedule. Also, some minor changes in the structure of the research programme have taken place. Some of the projects have been merged while others have been split up into sub-projects. There is no major change in the over all profile of the research programme, however.

The most important changes are the following:

- Theme A: What appeared as projects A1 and A2 under theme A in the half year report have now been merged into a new project A1 which includes 5 related research activities. A3 runs as planned while A4 has been postponed.

- Theme B: Each of the projects B1, B2 and B3 now include a multitude of activities while B4 has been postponed.

- Theme C: Under this theme there will be two active projects (C2 and C3). The two projects (C1 and C4) will operate at moderate level.

### *A brief summary regarding expected DRUID output for 1997*

There will be outputs from all the active projects (i.e. all with the exception of projects C1 and C4) during 1997 in the form of articles, working papers and research reports. The projects differ both in terms of their general character and in terms of how far they are in their research process and such differences will be reflected in their publication patterns for 1997-98.

A1: Includes a number of smaller projects some of them building on well-established theoretical work and here the expectation for 1997 is a number of articles and possibly also a book.

A2: Is a relatively new empirically based project with external deadlines. Here the expectation is a number of research reports and working papers. Articles will be published in 1998. There are 2 Ph.D.-students connected to the project and it involves strong elements of communication to the broader public of its results.

B1: Is a theoretical and experimenting project where it is expected to come a number of progress reports in 1997 while articles and books might come only in 1998. One Ph.D.-student is now to be recruited and connected to this project.

B2: Is a relatively new quantitative empirical project where work on establishing the data set is still on-going. It is a project with external deadlines and there will be an output in terms of research reports in 1997. while articles will be coming in 1998. There is one Ph.D.-student connected to this project.

B3: Includes a number of sub-projects of which many are empirically based and some have external deadlines. The research is to a certain degree a follow up on earlier work in the field and based on established theory. The output in 1997 will include research reports as well as articles.

C2: Is an international co-operation project cutting across traditional scientific disciplines. It has external deadlines and a number of progress reports can be expected in 1997. There is one Ph.D. connected to this project.

C3: Is based on quantitative empirical analysis on a well established data set and rooted in a established theoretical tradition. Both articles and working papers are expected from this project. Another one will be appointed in the near future.

## *Theme A: The Firm as a Knowledge-creating and Knowledge Accumulating Entity*

Co-ordinator: Jens Frøslev Christensen

Undeniably, firms are to some extent moulded by economic and institutional forces in the industry, the region, the nation, and the international context. For example, industries and regions may define the set of resources and capabilities that firms have access to. But firms are also creating their own resources and moulding their environment by, for example, introducing innovations that change the competitive game within its industry. Therefore, within the DRUID research program serious consideration will be given to projects that focus primarily on the firm-level.

Efforts will be made to contribute to, what may be called the emerging "New Theory of the Firm" which provides a more richly faceted conception of the firm and which recognises a greater scope for autonomous behaviour than is the case within the mainstream Theory of the Firm. Within the DRUID research theme on the firm, four general theoretical perspectives are sought aligned as important elements of a new theory of the firm:

1) Recent evolutionary or Schumpeterian theoretical perspectives on economic dynamics (i.e. Nelson and Winter).

2) The resource-based view of the firm and its growth pioneered by Penrose in 1959 and elaborated in recent years by many scholars of business studies, strategic management and organisational economics, among others Barney, Dierickx and Cool, Montgomery, Rumelt, Teece and Wernerfelt.

3) The contractual theory of the firm as pioneered by Coase and further developed by Williamson and other scholars of transaction cost theory.

4) The strategy/structure perspective pioneered by Chandler and further developed by scholars in business studies and strategic management such as Hoskisson, Goold and Campbell, Bartlett and Ghoshal.

The following DRUID-Projects have been or will be started up during 1996 or 1997:

### **Project A1: The Dynamics of Economic Organisation and Knowledge Accumulation in the Firm**

(Jens Frøslev Christensen, Kirsten Foss, Nicolai Foss and Christian Knudsen, all from Department of Industrial Economics and Strategy, Copenhagen Business School).

The purpose of this project is to inquire into central issues concerning the evolutionary

dynamics of firms with respect to diversification and firm boundaries, knowledge accumulation and organisational structure. The project is planned to comprise five relatively distinct sub-projects:

- *Conversations with theorists of the firm and industrial economists* (Christian Knudsen) This sub-project will review critical perspectives in modern industrial dynamics or organisational economics by interviewing leading scholars within the field. This sub-project was started in the autumn of 1995 and will be carried on in 1996 and 1997.

- *Relations between Contractual and Competence Perspectives on the Firm* (Nicolai Foss) This primarily conceptual sub-project examines the relations between contractual (Coasian) and competence- or resource-based theories of the firm. It was started in the autumn of 1995 and will be carried on in 1996 and following years. Several papers have already been published.

- *The Organization of Knowledge Accumulation in the Firm* (Jens Frøslev Christensen and Christian Knudsen) The sub-project will especially focus attention on one critical aspect of knowledge accumulation, namely the balance and tension between static and dynamic efficiency. This sub-project will start up in 1997.

- *Strategy and Structure Revisited: The Evolution and Coherence of Large Firms* (Jens Frøslev Christensen and Nicolai Foss) This sub-project focuses on central issues of corporate strategy and economic organization of large multi-product companies. This project was started up in the autumn of 1995 and will be carried on in 1996 and the following years. Several papers will be published in 1996.

- *Case data-bank on large Danish Multi-Product Companies.* (Jens Frøslev Christensen, Kirsten Foss, Nicolai Foss, Mikael Iversen, Christian Knudsen et al.). The plan is to generate a number of rich case studies of large multi-product corporations (primarily Danish) focusing on the evolution of strategic development, economic organization, corporate coherence and the management of technology. These case studies will be structured in such a way that some comparative analyses can be done. The case studies will provide empirical input into the other sub-projects. This sub-project will be started up in 1996.

## Project A2. Relations between Technical and Organizational Change, productivity and Demand for Labour at the Level of the Firm

(Bengt-Åke Lundvall, Björn Johnson, Allan Næs Gjerding, Poul Thøis Madsen, Reinhard Lund, Søren Nymark, Kenneth Jørgensen, Frank Skov Kristensen and Peter Nielsen, Aalborg University).

This project will analyze how different modes of organizing technical change and innovation influence the structure and development of labour demand. The project will build on previous studies within the IKEA-group at Aalborg University on technical

change and productivity growth.

Below these projects (and related sub-projects) will be described in somewhat greater detail with respect to the plans for 1996 and 1997.

### *Project A1. The Dynamics of Economic Organization and Knowledge Accumulation in the Firm*

This project consists of five sub-projects. With respect to the four analytical sub-projects the content and plans will be further described below:

#### **Conversations with theorists of the firm and industrial economists**

(Christian Knudsen, Department of Industrial Economics and Strategy, Copenhagen Business School)

This sub-project is a follow up on Christian Knudsen's project on "Theories of the Firm, Industrial Economics and Scientific Research Programmes". In this earlier project different schools of thought within the theory of the firm and industrial economics were analyzed from a methodological point of view. The study included neo-classical economics and the SCP-paradigm, modern game theory and the new IO-programme, the behavioural theory of the firm, managerialism and principal agent theory, the property right tradition and agency theory, transaction cost economics, constitutional political economy, evolutionary economics, resource based view of the firm and the competence theory of the firm. Using the late Imre Lakatos' Methodology of Scientific Research Programmes, the project identified the hard core, the protective belt and the positive and negative heuristics, examined the explanatory structure and described the normative use within strategic management and industrial policy of each of these schools.

The present sub-project will complement the study above by making interviews with some of the leading theorists of the firm and industrial economists. The inspirations to this study came from Arjo Klamers study: *Conversations with Macroeconomists* in which he interviewed some of the main contributors to the theory of rational expectations, and from Richard Swedbergs study of *Economics and Sociology* in which some of the main contributors to economic sociology were interviewed. Compared to the more structured analyses above an interview study makes it possible to illuminate the more informal and sociological factors behind each contribution. Factors that are rarely discussed in written media such as books, articles, working papers, etc.

The study is planned to include interviews with James G. March, Oliver Williamson, Richard Cyert, Herbert Simon, Michael Jensen, Edith Penrose, Harvey Leibenstein, Birger Wernerfelt, Ronald Coase, John Roberts, Paul Milgrom, Oliver Hart, David

Teece, Harold Demsetz, Armen Alchian, Sidney Winter, Richard Nelson, etc. Christian Knudsen has already made a few interviews in order to test the feasibility of the project. The plan is to make most of the interviews during the summer of 1996.

## **Relations between contractual and competence perspectives on the firm**

(Nicolai Foss, Department of Industrial Economics and Strategy, Copenhagen Business School).

This conceptual project examines relations between contractual (Coasian) and competence- or resource-based theories of the firm. The approach taken is both theoretical and methodological. Among the issues that are investigated are:

- Methodological issues: What is the character of the relation?

Is there any domain-sharing?

Is the relation competitive?

Complementary (in some sense)?

Etc.

- Theoretical Issues:

Is it possible to construct competence-based, opportunism-independent rationales for Firms?

In which ways does a competence perspective supplement or modify a contractual perspective?

How may the competence perspective help us understand the multinational enterprise, the theory of which has hitherto mostly rested on contractual premises?

How may we utilize competence-based and contractual arguments to arrive at an understanding of corporate coherence?

Possible formalisms for approaching a combined contractual/competence-based theory (e.g., Stuart Kuuffman's NK-model).

The project directly connects to all other sub-projects within project 1: The Dynamics of Economic Organization and Knowledge Accumulating in the Firm.

Some recent papers that lie within the theme of the project:

'On the Rationales of Corporate Headquarters', forthcoming in *Industrial and Corporate Change*

'Firms, Incomplete Contracts, and Organizational Learning', paper forthcoming in *Human Systems Management*.

'The "Alternative" Theories of Knight and Coase, and the Modern Theory of the Firm'. Forthcoming in *Journal of the History of Economic Thought*.

'More Critical Comments on Knowledge-Based Theories of the Firm: Reply to Conner & Prahalad and Kogut & Zander'. Forthcoming in *Organization Science* (1996).

'Knowledge-Based Approaches to the Theory of the Firm: Some Critical Comments'. Forthcoming in *Organization Science* (1996).

'Evolutionary Economics and the Theory of the Firm: Assessments and Proposals for Research'. Forthcoming in Jan Reijnders (ed.) (1996) : *Economics and Evolution*. Aldershot: Edward Elgar.

'Harold Malmgren's Analysis of the Firm: Lessons for Modern Theorists?'. Forthcoming in *Review of Political Economy*.

'The Emerging Competence Perspective'. In N.J. Foss & C. Knudsen: *Towards a Competence Theory of the Firm*. Forthcoming, Routledge.

'Whither the Competence Perspective?'. In N.J. Foss & C. Knudsen. Forthcoming, Routledge.

'Evolutionary Theories of the Firm: Reconstruction and Relations to Contractual Theories', forthcoming in Kurt Dopfer: *Evolutionary principles of Economics*, Boston: Kluwer.

'Veblen, Evolution, and the Theory of the Firm', paper invited for a special issue of *Cambridge Journal of Economics*.

'A Process Approach to Corporate Coherence' with Jens Frøslev Christensen, June 1996, DRUID Working Paper, no. 96-7

'Capabilities and the Theory of the Firm', June 1996, DRUID Working Paper, no. 96-8.

Nicolai Foss plans a book on 'Allocation, Dynamics, and Learning: Studies in the History and Theory of Economic Organization' that integrates his articles on the subject of firm organization. Routledge has expressed interest in publishing the book. Work on this sub-project begins in September this year.

With Paul Robertson of the University of New South Wales, Nicolai Foss plans an edited volume on 'Resources and Technology'. Work on this is scheduled to begin in June this year.

## **The Organization of Knowledge Accumulation in the Firm**

(Jens Frøslev Christensen and Christian Knudsen, Department of Industrial Economics and Strategy, Copenhagen Business School).

The project will especially focus attention on one critical aspect of knowledge accumulation, namely the balance and tension between static and dynamic efficiency. Organizing the firm around a set of core competences reflects a critical balance (and tension) between the exploitation of existing resources, and the exploration of new possibilities through the creation of new resources and competences. The former process reflects the static or reproductive competences of the firm that have been investigated in the literature under various headings such as "static efficiency" and "static routines" (by among others Ghemawat, March and Levinthal). The latter process of generating new resources and competences reflects the more dynamic perspective of the firm. Dynamic competences based on exploration (trial-and-error searching) provide the long-term basis for competitive advantage and new directions of development (diversification).

A firm engaging exclusively in exploitation will tend to manage current economic viability but suffer from obsolescence in the longer term. On the contrary, a firm that exclusively engages in exploration will tend to have problems in gaining returns from its knowledge-base. Two learning traps may be identified : First, firms that engage too much in exploration will tend to build a fragmented and ad hoc knowledge structure. Secondly, firms that engage too much in exploitation will be able to build a hierarchical and coherent knowledge structure. In this case the firm will tend to be too conservative and in the long run experience a diminishing learning (and absorptive) capacity.

The goal of this sub-project is to analyze how the structure of the firm's knowledge-base should be organized in order to secure a sustainable growth process. It can be argued that long-term survival requires that the firm can find a dynamic balance between exploitation and exploration, or between static and dynamic efficiency. This may lead to some normative suggestions on how to organize the firm in order to strike the right balance between these two types of efficiencies. That is, how can we organize the firm in such a way that we accept very different and conflicting rules and reward systems: One that is tailored for a static efficiency and another that provides incentives for exploration and differentiation.

This sub-project will start up in the autumn of 1997 and will be empirically based on the data-bank project.

## **Strategy and Structure Revisited: The Evolution and Coherence of Large Firms**

(Jens Frøslev Christensen and Nicolai Foss, Department of Industrial Economics and Strategy, Copenhagen Business School).

This project focuses on central issues of strategy and economic organization of large multi-product and multi-technology companies. The Chandlerian strategy-structure issue is reviewed in the context of recent tendencies in the M-form structure, the role of the corporate headquarters and the corporate management of technology. One part of this sub-project will deal with the general economic organization of the corporation, corporate coherence and corporate parenting with special emphasis on the role of the corporate headquarter. This analysis will build on the pioneering work on corporate coherence by Teece, Rumelt, Winter and Dosi, and the work on corporate parenting by Goold, Marcus and Campbell. Another part will focus more narrowly on the management and organization of the corporate technology base. This part will connect to similar research activities on management of technology, among others by Rod Coombs and his colleagues at Manchester Business School.

Recent papers from this sub-project:

Jens Frøslev Christensen: Strategy and Structure - and the Management of the Technology Base in Multi-Product Companies. Forthcoming in Rod Coombs and Stan Metcalfe (eds): *The Organizational Dimensions of Technical Change*. Edward Elgar, 1997.

Nicolai Juul Foss: 'On the Rationales of Corporate Headquarters', forthcoming in Review for *Industrial and Corporate Change*.

Jens Frøslev Christensen and Nicolai Foss: Dynamic Corporate Coherence and Competence-Based Competition: Theoretical Foundations and Strategic Implications. Forthcoming in Aim\_ Heene and Ron Sanchez (eds.) (1996): *Competence-Based Strategic Management*. Oxford: Elsevier.

Nicolai Foss and Jens Frøslev Christensen: 'A Market-Process Approach to Corporate Coherence', forthcoming in a special issue of *Managerial and Decision Economics* on 'Strategy and the Market Process'

This sub-project was started up in the autumn of 1995 and will be carried on in 1996 and the following years. Empirical illustration and evidence will be provided by the data-bank project.

### ***Project A2. Relations between Technical and Organizational Change, Productivity and Demand for Labour at the Level of the Firm***

(Bengt-Åke Lundvall, Björn Johnson, Allan Næs Gjerding, Poul Thøis Madsen, Reinhard Lund, Søren Nymark, Kenneth Jørgensen, Frank Skov Kristensen and Peter Nielsen, Aalborg University)

DISKO<sup>1</sup> module 1, studies the relationship between technical and organisational innovation in the Danish private sector. This endeavour is undertaken in two steps: *First*, a questionnaire is submitted to 4 000 Danish firms. The questionnaire is designed in order to be comparable to similar investigations undertaken in Sweden, Finland, Norway, Canada and France. *Second*, some thirty longitudinal case studies are undertaken in order to delve into the results obtained through the questionnaire. The questionnaire took place in May-June, 1996. The final report on the questionnaire is expected to appear during the autumn of 1996. The case studies will commence in September 1996, and the final report on the case studies will appear during the summer of 1997.

Module 1 takes, as its point of departure, the view that the industrialized economies are entering an information-intensive techno-economic paradigm, which implies that an effective utilization of current technical innovation has to be based on organisational innovations in terms of the sharing of information, strategy-making and decision power. Following this approach, module 1 is guided by a number of hypotheses, among which the following are the most important.

(1) Organizations based on a consultative approach and designed in terms of flexibility and the development of human resources tend to become increasingly more fit to extra-organisational changes than organizations designed in terms of mechanistic features.

(2) The recruitment of labour is, to an increasing degree, becoming dependent on the firm's ability to attract labour by means of human resource management.

(3) High performance, measured in terms of productivity and profitability, is more likely to be found in firms that combine a systemic approach to technical and organisational innovation than the firms where the management is guided by a technical approach to competitiveness.

(4) Organisational innovation implies, and is stimulated by, participation and decentralization, and the type of organisational innovations, which occur concomitantly with technical change, are characterised by interorganisational teamworking and job enrichment.

### *Theme B: Competence Building and Interfirm Dynamics*

Co-ordinator: Esben Sloth Andersen

The study of the relationship between competence building and interfirm dynamics has attracted researchers with a variety of backgrounds. Recent developments in evolutionary economics and its interfaces with related approaches (e.g., knowledge-based theories of firms and networks, and certain theories emphasising transaction costs) have helped create the new frontiers of research which are confronted by DRUID's research theme B. The research theme concentrates on cases where the

specialisation of firms is changing, especially the evolution of the vertical division of labour between firms.

Theme B consists of 3 projects which each involves a number of subprojects. The projects are:

**Project B1. Modelling the Evolution of Industrial Systems with Complex Linkages**

(Esben Sloth Andersen, Anne K. Jensen, Mette Præst).

The purpose of the project is to model the transformation of the (mainly vertical) division of labour between firms. At the same time new tools for the design, simulation and analysis of evolutionary economic models will be provided.

**Project B2. Structural Economic Dynamics and Innovation Systems Explored by Means of Innovation Matrices and Input-output Tables**

(Erling Jensen, Ina Drejer, Bengt-Åke Lundvall and Esben Sloth Andersen).

The purpose of this project (which also draws upon is to reconcile inter-industrial analysis with the study of innovation. To do so there is a need of developing measures of technology transfers in input-output systems as well as indices of the interdependence of innovative activities.

**Project B3. Interorganisational Dynamics of Transnational Supply Systems: Concepts, Analytical Frame and Key Issues**

(Poul Rind Christensen, Peter Maskell, Kristian Philipsen, Poul H. Andersen).

The purpose of this project is to develop methods of studying the dynamics of transnational supply systems through the combination of structural and managerial studies.

When the different projects have produced results they will be presented at an international conference on Revitalising the Debate on Dynamics of Complex Division of Labour. To develop theme B as a whole the researchers have met during the DRUID conferences as well as at a workshop in Aalborg 24 January 1995.

Below the results and plans for the projects and subprojects of DRUID theme B is described shortly.

***Project B1: Modelling the Evolution of Industrial Systems with Complex Linkages***

(Esben Sloth Andersen and Anne K. Jensen; related PhD student)

The project attempts to explain the evolution of complex industrial systems, i.e., the

emergence and change of complex industrial structures over time, by modelling the basic components and dynamic interrelations of such systems. The project has its background in several recent approaches to evolutionary economics, including evolutionary modelling of Schumpeterian competition in the Nelson-and-Winter tradition, the study of density-dependent spread of innovations in the evolutionary-ecological tradition, and the evolution of populations in the genetic-algorithm and the classifier-systems tradition (see a survey in Andersen, E.S., *Evolutionary Economics: Post-Schumpeterian Contributions*, paperback, Pinter, London - hardback 1994).

At the core of this project is 'DRUIDIC' which means Dynamic Reconstruction of Unfolding Industrial Diversity by Interactive Computing.

This project started in February 1996 and it employed Anne K. Jensen in the upstart period until July 1996. Later in 1996 a PhD project in evolutionary economic simulation will be connected to the project. Also other persons have been involved (including the MA students Lars Madsen and Martin Jørgensen). The purpose of the project is to develop a family of computer models with special emphasis on vertical industrial dynamics. The subproject is divided into several specific activities. The starting point (completed) was a continuation of the reconstruction of the Nelson and Winter models of Schumpeterian competition that was started in Andersen's book (1996, ch. 4). The next step has been to introduce production chains and possibilities for firms to specialise in parts of the chain, and then to introduce a non-linear production structure, that is branching like a tree. Simulations will be presented during the next year.

A major goal for the DRUIDIC project is to prepare the ground for modelling of the evolution of so-called innovation systems (see e.g. the appendix to Andersen/Lundvall). Based on the model structures several papers have already been published (Andersen, Andersen/Lundvall). Together with Morris Teubal, Andersen is preparing a paper with the preliminary title "Towards the Modelling of National Innovation System Evolution".

The project involves long-term co-operation with several researchers. Most important was Andersen's visit to the TEP program on evolutionary economic modelling, International Institute for Applied Systems Analysis (IIASA), Laxemburg, Austria, 27 June to 11 July 1996. The future development of the subtheme's models will partly be related to the researchers of this program (including Dosi, Malerba, Nelson and Winter). Especially Andersen's involvement in the establishment of a meta system for evolutionary modelling (LSD = Laboratory for Simulation Development) is of major importance. Morris Teubal, Jerusalem University, was guest professor in Aalborg where he worked on one of the projects in November/December 1995 as well as in March 1996. In the autumn of 1996 a PhD student specialising in evolutionary economic simulation models is supposed to be connected to the subtheme (especially to the DRUIDIC project).

Some recent papers related to the project are:

Andersen, E.S. (1996), 'From Static Structures to Dynamics: Specialisation and Innovative Linkages', in DeBresson, C. (ed.) *Economic Interdependence and Innovative Activity: An Input-Output Analysis*, Elgar, Aldershot, pp. 331-353.

Andersen, E.S. (1996), 'The Evolution of Economic Complexity: A Division-and-Coordination-of-Labour Approach', in Helmst dter, E., and Perlman, M. (eds.), *Behavioural Norms, Technological Progress and Economic Dynamics: Studies in Schumpeterian Economics*, Michigan University Press, pp. 97-119.

Andersen, E.S. (1996), 'Theories of Localised Resource-Based Growth and Development: From Marshall to New Evolutionary Economics', in Hyttinen, P., Mononen, A., and Pelli, P. (eds.), *Regional Development Based on Forest Resources: Theories and Practices*, Proceedings of the International Seminar 14-15 December 1995 (EFI Proceedings No. 9), European Forest Institute, Joensuu, pp. 5-16.

Andersen, E.S. (1996), 'The Evolution of an Industrial Sector with a Varying Degree of Roundaboutness of Production', Paper presented at the International Schumpeter Society Conference, Stockholm, 2-5 June, Department of Business Studies, Aalborg University.

Andersen, E.S., Jensen, A.K., Madsen, L., and J rgensen, M. (1996), 'The Nelson and Winter Models Revisited: Prototypes for Computer-Based Reconstruction of Schumpeterian Competition', DRUID Working Papers, Department of Business Studies, Aalborg University.

Andersen, E.S., and Lundvall, B.-\_ (forthcoming), 'National Innovation Systems and the Dynamics of the Division of Labour', in Edquist, C. (ed.) *Systems of Innovation: Technologies, Institutions and Organisations*, Pinter, London.

### *Project B2: Structural Economic Dynamics and Innovation Systems Explored by Means of Innovation Matrices and Input-output Tables*

(Erling Jensen, Ina Drejer, Bengt- ke Lundvall and Esben Sloth Andersen)

The purpose of this project is to combine interindustrial analysis and the study of innovation. To do so there is a need for developing measures of technology transfers in input-output systems as well as indices of the interdependence of innovative activities.

The project combines two lines of thought in an empirically oriented context. On the one hand, several economists (including Pasinetti) have tried to conceptualise economic growth in terms of a changing pattern of an increasingly large number of sectors; this change is driven by parameters of productivity growth and by income elasticities, while innovation is exogenous. On the other hand, the systems-of-innovation approach has as one of its cornerstones that innovative activities are to a large extent path-dependent and follow trajectories defined by the production and linkage structure. Especially, it emphasises that technology is not developed in a vacuum but in close interaction with

customers and suppliers. The project aims at exploiting the cross-fertilisation between the two approaches in an empirically oriented context.

The statistical background for the project is recent large improvements in the data sources on physical and informational flows. This does not mean that the objects in which the project is interested, (knowledge creation and distribution, especially innovative activities and innovation systems) have become easy to define and measure. However, increasingly related and valid indicators can be constructed, and systematic efforts have been made to reinterpret data collected for other purposes. Thus we are now able to discern the interrelation between, on the one hand trade statistics and input-output statistics, (considered as indicators of physical flows), and, on the other hand, innovation and R&D statistics.

The project is divided into three subprojects:

(1) The empirically oriented version of Pasinetti's structural economic dynamics will initially be developed in terms of a study of Danish input-output tables from 1966 to the 1990s.

(2) The development of the empirically oriented version of the system-of-innovation approach will initially be made in relation to the analysis of the structural economic dynamics of Denmark in a pilot project where the focus will be on formal knowledge (R&D-investments and investments in connection with education and training). Against this background, a more ambitious mapping of the 'Danish system of innovation' which also includes learning-by-doing and other forms of informal knowledge generation will be attempted.

(3) Based on the experience gained in the pilot project, the analysis will be extended by means of the OECD STAN database (covers data sets on R&D-, Input-Output Statistics and Trade for 9 countries including Denmark) These data, as well as other emerging international data sets, will be used for a comparative analysis of the interactive aspects of the systems of innovation. This will include inter-industry interactions and embodied flows of technological knowledge which, especially for low-tech industries, are of major importance.

Some publications and working papers are:

Erling Jensen (1996), Construction of a Structural Data Bank (DRUID-SDB), Technical Report, Draft, Department of Business Studies, Aalborg University.

Erling Jensen (1996), Kvantitative empiriske studier af strukturel økonomisk dynamik [Quantitative empirical studies of Structural Economic Dynamics], Research Report, Draft, Department of Business Studies, Aalborg University.

Erling Jensen (1996), Structural Economic Dynamics - Explored by Input-Output Tables and Innovation Indicators, paper for the DRUID-seminar, Sophienberg Castle, Rungsted

Kyst, Denmark, 19 - 20 April 1996.

Lundvall, B.-Å. (1996), 'National Systems of Innovation and Input-Output Analysis', in DeBresson, C. (ed.) *Economic Interdependence and Innovative Activity: An Input-Output Analysis*, Elgar, Aldershot, pp. 356-363.

*Project B3: Interorganisational Dynamics of Transnational Supply Systems: Concepts, Analytical Frame and Key Issues*

(Poul Rind Christensen, Peter Maskell, Kristian Philipsen, Poul H. Andersen, Poul Thøis Madsen and Bengt-Åke Lundvall).

The purpose of this project is to develop methods for studying the dynamics of transnational supply systems through the combination of structural and managerial studies. Traditionally, the focus has been on the role of supply systems supporting the competitive position of multinational enterprises in different lines of industry. The focus on (multinational) contractors is contrasted with a weak understanding of the interplay between localised systems of small and medium sized subcontractors (often treated under the label 'industrial districts') and global contractors.

The major emphasis will be on how transnational supply systems interact with and shape the regional and national industrial structure. The empirical material will mainly, but not exclusively, be Danish. Analytically, we emphasise that the traditional view of the innovative activity of the enterprise - with its main focus on internal resource building - has recently been exposed by studies pointing at the diversity of sources sustaining or leading to innovations in enterprises. External sources - users, suppliers, competitors as well as public research institutions and technical consultancies - seem to be of prime importance.

The basic aim of this project is to study how - and to what extent - competence and skills may be developed and embedded in interorganizational relations between enterprises engaged in joint production and innovative activity. The project will consist of related subprojects on collaborative ventures of a horizontal nature (a), vertical systems of subcontracting in manufacturing industry (b), and theoretical perspectives from (a) and (b) will be confronted and combined.

Several, relatively small, individual subprojects have been developed which form the basis for later, more co-ordinated efforts within the project. The individual subprojects include:

1. *Stainless steel industry in Southern Jutland* (Kristian Philipsen and Poul Rind Christensen). The project analyses an industrial district where subcontractors and subcontractors of subcontractors play an important role historically as well as today.
2. *Corporate Supply Chain Management* (Poul H. Andersen and Poul Rind Christensen).

The project studies the corporate procurement policy of an important pharmaceutical corporation (NOVO) through in-depth interviews, and explores the co-ordination problems created by a very large number of subcontractors.

3. *Convergence and divergence in international subsupplier systems* (Poul H. Andersen and Poul Rind Christensen). The project - based on interviews in Japan - analyses the present reshuffling of the Japanese subcontractor systems.

4. *The 'open account-book' system* (Kristian Philipsen). The project explores the economic rationale behind this kind of contractual arrangement which is e.g. known from Japan.

5. *Long lasting relationships in the supply chain: Their micro economic background and structural consequences* (Peter Maskell). The stylised fact behind the project is that the average length of business relationships to the four most important suppliers and customers is at least 11 years (new and still unpublished Danish results). First the project performs detailed case studies to clarify the importance of old, stable business relations. Second, modern statistical methods will be utilised with the intention to uncover to which degree spatial agglomeration is associated with increasingly stable supplier-customer relationships. Third, a methodology of studying stable relationships will be developed.

6. *The Role of Subcontractors in the Danish Economy* (Peter Maskell and Poul Rind Christensen). Based on the statistical database established with Danmarks Statistik, the project studies the role of subcontractors in the Danish production system. Basic propositions concerning the technical efficiency will be developed and policy-oriented conclusions will be drawn.

7. *Product innovation and inter-firm relationships; An international comparative perspective* (Poul Thøis Madsen and Bengt-Åke Lundvall). As part of the Disko-project an attempt will be made to establish an international project focusing on how inter-firm relationships supporting product innovation differ between different national systems of innovation. A common questionnaire to be used in a number of European countries has been developed and is now discussed with international colleagues.

Some recent papers related to the project are:

Christensen, P.R. (1996), How Entrepreneurial is the Research in Entrepreneurship in Denmark?, RENT IX - European Council for Small Business Research. Nov. 1995.

Christensen, P.R. and Andersen, P.H. (forthcoming), Generic Routes to Subcontractors Internationalization, in Forsgren, M. (ed.), *Scandinavian studies of International Business*, Nyt Nordisk Forlag Arnold Busck. Copenhagen.

Christensen, P.R. (planned), Danish Subcontractors on the Global Market, to be published in Erhvervsfremme Styrelsens Notat-serie.

Maskell, P. (forthcoming 1996), Learning in Industrial Districts: the Role of Institutions and Policy in Sustaining Competitiveness, Cooke, P. and Braczyk (eds.), *Regional Governance Structures in a Globalized World*, IGI.

Maskell, P. (forthcoming), Low Tech Industries in High Costs of Europe: Why are they Still There?, *European Urban and Regional Studies* (UK) (accepted).

Maskell, P. and Malmberg, A. (forthcoming), Proximity, Institutions and Learning: Towards an Explanation of Industry Agglomeration and Regional Specialization, *European Policy Studies* (accepted).

### *Theme C: The learning economy and the competitiveness of systems of innovation.*

Co-ordinator: Björn Johnson.

This theme aims at a stronger conceptual base for the 'systems of innovation' approach to the analysis of international competitiveness. The concept of innovation systems will be linked to the concept of the learning economy and used, also, to analyse the relations between international competitiveness and ecological sustainability.

An attempt will be made to merge theories of innovation and economic development which concentrate on the role of science based-sectors with those which emphasise learning-by-producing and the growing knowledge-intensity of a broader spectrum of economic activities. The focus is on the interaction between organisational, institutional and technical change in a specific structural context and a specified geographical space.

Both the importance of formal as well as informal institutions and the importance of specialisation patterns for innovation performance will be taken into account. Put in other words: there are two main sub-themes within theme C. The first theme is international specialisation patterns between nations and regions. The second theme is on different institutional set-ups. For both themes the same types of questions are raised: Which conceptual and measurement problems are there? Is there convergence or divergence between regions and nations and which are the mechanisms behind these changes and which are the consequences for learning processes and innovation patterns?

There is also an affiliated theme on the relations between industrial dynamics and the environment. It seems more and more important to ask about in which areas there are complementarities and in which areas there are conflicts between industrial development and ecologically sustainable development. Is it possible to bridge some of the conflicts through institutional and technical innovations?

The main empirical and policy issues are related to changes in the structural as well as territorial dimensions of innovation and learning. For example: What remains of the relative autonomy of national systems of innovation? Is there a tendency towards

convergence or divergence between nations and regions in the specialisation in trade and production, innovation and in the knowledge base itself?

It is obvious from the presentation below that the individual projects are at different phases of their development. It is also obvious that the projects are not yet adequately integrated with each other. Therefore a "theme work-shop" aiming at forming a more common conceptual framework and a common understanding of the research questions within the theme will be organised this fall.

The following DRUID-projects have been or will be started up during 1996 or 1997:

*Project C1. Changing industrial structures in Europe*

(Peter Lotz).

Activities and outputs in the period.

There has not been any activity within this project in the period.

Project plans for 1996/97

The project will not start until the end of 1997.

*Project C2: Regional innovation systems and the environment*

(Klaus Lindegaard and Björn Johnson).

This project takes up two important challenges for the evolving field of national systems of innovation analysis by focusing on 1) regional aspects of systems of innovation across countries, and 2) the impact of environmental issues of natural resources and pollution on the functioning, development and performance of innovation systems. The environmental theme is approached by an analysis of the dynamics of cleaner technologies.

The project is linked to the research co-operation project "Sustainable Development Strategies for Central America: Enhancement of the Central American Research Capacity" between Aalborg University, Denmark, Universidad Nacional, Costa Rica and universities in El Salvador and Nicaragua, supported by the ENRECA programme of Danida, Danish Ministry of Foreign Affairs. The joint research project has its major focus on the competitiveness and sustainability of the textile industries and the forestry sectors in Central America.

The present project seeks both to deliver methodological inputs to the Central American

sector analysis and to take advantage of and synthesise results produced here together with relevant results produced by other ongoing projects on innovation systems in Denmark, Europe and OECD. In the same manner, the project will make use of and integrate Danish and international research on the implementation of cleaner technologies and environmental improvements in various industries and sectors. This material will be analysed from an innovation systems perspective and also used as input in relation to the Denmark/Central American co-operation project.

### **Activities and outputs in the period.**

Activities 1995-96: The project organised a research workshop: 'Innovation, competitiveness and Sustainable Development'. at Universidad Nacional, Heredia Costa Rica, March 4-5, 1996.

The following reports have been produced:

1. Summary Report: Project Launch Seminar: Innovation, Competitiveness and Sustainable Development. By Klaus Lindegaard & Arlette Pichardo Muniz. Costa Rica, May 1996.
2. Estado del arte de la dimension ambiental en la investigacion en Centro America. By Jeffrey Orozco Barrantes. Costa Rica, June 1996.
3. Estado del arte de la investigacion en el mercado laboral: Costa Rica, El Salvador y Nicaragua. By Arlette Pichardo Muniz. Costa Rica, June 1996.
4. Estado del arte de la investigacion competitividad: Costa Rica, El Salvador y Nicaragua. By Eduardo Gitli & Leiner Vargas Alfaro. Costa Rica, June 1996.
5. State-of-the-Art: Innovation Systems Analysis. By Klaus Lindegaard. Forthcoming.

### **Activity Plan, 1996-98:**

The following work-shops and seminars are being planned:

1. DRUID research seminar on "ICT, Green Competence Building and Techno-Economic Paradigms", Denmark, 1997. Assessment and development of complementary DRUID research projects.
2. Regional workshop in El Salvador March 1997 on an environment-and-innovation-systems approach to cross-country sector analysis.
3. Regional workshop in Nicaragua 1998 on regional approaches to the analysis of innovation systems and policy development.

4. International research seminar in Costa Rica 1998 on environmentally sustainable regional development strategies in Central America and the lessons from e.g. the textile and dairy sectors of Costa Rica, El Salvador and Nicaragua.

The project involves research in 3 different areas in the following three years:

1996: Assessment and integration of methods and Danish results from research on cleaner technology and innovation systems with emphasis on textiles, forestry and agro-industries.

1997: Industrial sector analysis of innovation and cleaner technology with emphasis on the Central American context.

1998: Analysis of regional innovation systems in Central America and policy implications for competitiveness and environmental improvement. Comparison of Central American results and results from Latin American/OECD contexts.

Publications:

1. Working papers on innovation systems analysis.
2. International article on Innovation, competitiveness and the environment.
3. International book on sustainable development strategies for Central America.

*Project C3.: Competitiveness and national systems of innovation: Path dependency in international specialisation (Bent Dalum, Gert Villumsen and Keld Laursen).*

The basic aims of this project are 1) to study long term specialisation patterns country wise at different levels of aggregation, 2) to relate the observed empirical patterns to the literature on national systems of innovation and the cumulativeness of technical change, and 3) to contribute to the methodological development in relation to the analysis of stability and cumulativeness of trade patterns.

### **Activities and outputs in the period.**

The work in this project runs in parallel with the TSER-project "Technology, Economic Integration and Social Cohesion". Gert Villumsen, Bent Dalum and Keld Laursen participated in the first TSER meeting in Rome 1-2 June 1996. At this meeting agreements were established concerning co-ordination and collaboration with regard to empirical investigations and further research in the area of trade, specialisation and growth.

At the meeting our results were presented under the headings a) "The evolution of

specialisation patterns" and b) "Specialisation and growth" Concerning the first issue we showed that specialisation patterns of OECD countries tend to be relatively sticky over time. Concerning the second issue, we investigated the consequences of specialisation. Preliminary results seems to indicate that the specialisation patterns are important for the rate of growth.

On the conference "Networks: East Meets West" at the Journal of Industry Studies/Industrial Relations Research Centre, University of New South Wales', Sydney 30-31 August 1995, Bent Dalum presented the paper "Local and Global Linkages: The Radio communications Cluster in Northern Denmark". A revised version is published in Journal of Industry Studies, Vol. 2, No. 2.

### **Plans for 1996/97**

The research area consists of two interrelated fields: What shapes the specialisation patterns and what are the consequences of specialisation. Until now our analyses have been limited to the commodity trade within OECD. For the next period, we plan to investigate specialisation in services and to extend the analyses to non-OECD-countries, including the Asian Tigers.

### **Affiliated to project 3 is:**

C3.1. Changing Technological Capabilities in High-Tech Firms: A Study of the Telecommunication Industry (Mette Præst).

This project which is a Ph.D. project aims at a method of measuring and mapping technological and other capabilities in firms using patent statistics as data source and with the telecommunication sector as empirical case.

*Project C4. The role of quasi-integrated organisational forms in the pursuit of technology-based competitiveness (Finn Valentin)*

There has not been any activity within this project in the period. However, there are three related project in which there have been activities and outputs: In the project 'Co-ordinating Science and Technology' data collection about project portfolios in R&D departments in selected American and Danish firms has been planned and will be implemented this autumn. A working paper will be written during the winter 96/97. In the project 'A Behavioural Study of Co-operative Research in Europe' empirical analysis has been carried out and will be reported in September 1996. Finally, in the project 'The Effect of Foreign Acquisitions on the Industrial knowledge base in Denmark' the work has continued and a paper intended for international publication has been written.

## IV. Individual contributions to the realisation to the DRUID-programme

### *Research manager*

### *Publications*

Lundvall, B.-Å. (1995), "Commentary", in Andreassen, L. E. et al. (eds.), *Europe's next step*, Frank Cass, Ilford, pp. 305-308.

Lundvall, B.-Å. (1995), "For en kunskapsbaserad och kunskapsorienterad innovationspolitik", i Teknologiska System, Temanummer i rapport 1'95, i *Næringsdepartementets Skriftserie*, Aktuellt om Næringspolitik och Ekonomi, Stockholm, ss. 75-81.

Lundvall, B.-Å. (1995), 'The Global Unemployment Problem and National Systems of Innovation', in O'Doherty, D. (red.), *Globalisation, Networking and Small Firm Innovation*, Graham&Trotman, London.

Lundvall, B.-Å. (1995), 'Standards in an innovative world', in Hawkins, R., R.Mansell and JimSkea (eds.), *Standards, Innovation and Competitiveness*, Edward Elgar Publishing Limited, Aldershot.

Lundvall, B.-Å. (1995), 'Innovation Policy in the Learning Economy' (in Danish), in Jørgensen, H. and J. G. Rasmussen (eds.) *Festskrift to Reinhard Lund*.

Foray, D. and B.-Å. Lundvall (1996) 'The knowledge-based Economy: From the Economics of Knowledge to the Learning Economy', editors' introduction to OECD, *Employment and Growth in the Knowledge-based Economy*, OECD, Paris.

Lundvall, B.-Å. (1996), Input-output analysis and national systems of innovation, in DeBresson, C. (ed.) *Economic Interdependence and Innovative Activity: An Input-Output Analysis*, Elgar, Aldershot.

### *Ph.D. training*

Key-note address on 'The Learning Economy', at the Annual meeting of Swedish Research Network on innovation, at the University of Uppsala, Nov. 22-24, 1995.

Lectured on ]Technology and employment in the learning economies, at Ph.D.-course: Industrial Networks and Systems of Innovation - implications for the development of government policy, Roskilde University, February 11-14, 1996.

Presented a paper on 'The learning economy: implications for economic theory and economic policy', at the Ph.D.-training workshop on 'National Innovation Systems, or the globalisation of technology', Rome, April 17-20, 1996.

Presented a paper on 'Reflections on how to analyse national systems on innovation', at the Swedish Ph.D.-programme on 'Economics of technical change', Gothenburg, May 8-9, 1996.

Lectured on ]the social dimension of the Learning economy for Ph.D.-students at Dauphine University, Paris, June 6 1996.

### *Policy relevant Activities*

Invited as International expert at ECLAC-UNU/INTECH-conference on Strategies for Industrial Development in Latin America, Santiago-de-Chile, August 26-September 4., 1995.

Contribution on the organisation of research to LO/AC-conference on Research Policy in Copenhagen, Sept. 20,

Gave a paper at the DTI-Seminar on National Information Infrastructures and University Research in Copenhagen, Oct. 23.

Rapporteur for the workshop on national systems of innovation at OECD-conference on Innovation, Creativity and at Holmenkollen, Oslo, January 11-12, 1996.

Presented a paper on Innovation Policy at the Annual meeting of the Nordic Innovation Network, Holmenkollen, Oslo, January 13, 1996.

Participated in KonkurrenceDdets Studiekreds on the measurement of competition pressure, Copenhagen February 22 1996.

Invited as expert by UNCTAD to discuss the design of Science, Technology and innovation Policy Reviews for developing countries and economies in transition, Geneva, February 29 - March 1. 1996

Presented a paper on Technology Policy and competitiveness at the seminar on the Norwegian Innovation System organised by the Norwegian Research Council, Oslo, March 7-8 1996.

Animator for the workshop on research and innovation in connection with Danish Seminar on the EC Green Paper on Innovation, Copenhagen, April 26 1996.

Rapporteur for the EC International Conference on Innovation Measurement and Policies, Luxemburg, May 20-21, 1996.

### *DRUID Scholars*

### *Publications*

Andersen, E.S. (1995), 'Review of G.M. Hodgson, W.J. Samuels, and M.R. (eds.): The Elgar Companion to Institutional and Evolutionary Economics', *Economic Journal*, Vol. 105, pp. 1300-1302.

Andersen, E.S. (1996), 'From Static Structures to Dynamics: Specialisation and Innovative Linkages', in DeBresson, C. (ed.) *Economic Interdependence and Innovative Activity: An Input-Output Analysis*, Elgar, Aldershot, pp. 331-353.

Andersen, E.S. (1996), 'The Evolution of Economic Complexity: A Division-and Co-ordination-of-Labour Approach', in HelmstØdter, E., and Perlman, M. (eds.), *Behavioural Norms, Technological Progress and Economic Dynamics: Studies in Schumpeterian Economics*,

Michigan University Press, pp. 97-119.

Andersen, E.S. (1996), 'Theories of Localised Resource-Based Growth and Development: From Marshall to New Evolutionary Economics', in Hyttinen, P., Mononen, A., and Pelli, P. (eds.), *Regional Development Based on Forest Resources: Theories and Practices*, Proceedings of the International Seminar 14-15 December 1995 (EFI Proceedings No. 9), European Forest Institute, Joensuu, pp. 5-16.

Christensen, J. F. (1995), 'Asset profiles for technological innovations. *Research Policy*, Vol. 24, pp. 727-745

Christensen, J. F. (1996), Teknologisk service: Tendenser og udfordringer. *Udgivet af Institutrådet og Erhvervsfremme Styrelsen, (medforfattere: Kirsten Foss, Peter Lotz og Pauline T. Christensen) (100 s.)*.

Christensen, P. R. & P. Blenker (1995), 'Interactive Strategies in supply chains - a double edged portfolio approach to small- and medium-sized Subcontractorss position Analysess. in *Entrepreneurship & Regional Development*, 7, pp. 249 - 264

Christensen, Jesper L. et.al. (1996), *Kapital og Vækst - Kapitalforsyning til Små og mellemstore virksomheder i Danmark*, Erhvervsfremme Styrelsen.

Christensen, Jesper L. and Tunzelmann, Nick von (1996) : *Innovation in the European Food Products and Beverages Industry*, European Commission, EIMS.

Christensen, Jesper L. and Kristensen, Arne (1996), *Innovation, forskning og udvikling i Europa*, Erhvervsfremme Styrelsen.

Dalum, B. (1995) "Local and Global Linkages: The Radiocommunications Cluster in Northern Denmark", *Journal of Industry Studies*, Vol. 2, No. 2.

Foss, N. J. (1995), 'Types of Price Theorys. *Revista Internazionale di Scienze Sociali*, Vol. 66, No. 4

Foss, N. J. (1996) "Strategy, Economics, and Michael Porter". *Journal of Management Studies*, No. 33: 1-24 (1996).

Foss, N. J. (1996) "The "Alternative" Theories of Knight and Coase, and the Modern Theory of the Firm". *Journal of the History of Economic Thought*, vol. 18, no.1, pp. 76-95.

Gregersen, B. and B. Johnson (1995), 'Systems of Innovation and Economic Integration', *Journal of Industry Studies*, Vol. 2, No.2, 1995.

Laursen, K. (1996), ]Horizontal Diversification in the Danish National System of Innovation: The Case of Pharmaceuticals, *Research Policy*.

Laursen, K. & Christensen, J.L. (1996): *The Creation, Distribution and Use of Knowledge: A pilot study on the Danish Innovation System*, Erhvervsfremme Styrelsen.

Reinhard Lund (1995), *Ny teknologi gennem samarbejde.*, Aalborg University Press.

Maskell, P. (1995), *Transportinfrastruktur i erhvervsudviklingsperspektiv*, Erhvervsfremme Styrelsen.

Nymark, S. (1996), 'Organisations- og ledelsesudvikling i den offentlige sektor - en perspektivering af den offentlige organisation i det aktuelle Danmark', i *Virksomhedens Strategi og Ledelse*, Juli.

Vejrup-Hansen, P.(1995), ]Joboprettelser og jobnedlæggelser blandt forskellige faggrupper. In: Arbejdsministeriet (udg.): *Arbejdsmarkedspolitisk Årbog 1995*. København, pp. 103-111

Valentin, F., P. Andersen, B. Dalum, T. Pedersen, & Villumsen, G. (1995), *Strategic Alliances - the Importance of Globalization for Technological Knowledge and Development in Danish Manufacturing*, Projekt 5 for Kommissionen for fremtidens beskæftigelses- og erhvervsmuligheder (aVelfærdskommissionen)], Copenhagen

Valentin, F. & T. Pedersen, (1995) ]Effects of Foreign Acquisitions on the Development of Danish Firmss, *Økonomi og Politik* no 2

### *Working papers and manuscripts*

Christensen, J. F. (1995), ]The Dynamics of Innovative Assets and the Strategic Coherence of the Technology Bases. Paper presented at the DRUID-seminar, 1-2 December, 1995.

Christensen, J. F. (1996), Innovation og vækst - en analyse af VækstFondens portefølje af innovative projekter. *Institut for Industriøkonomi og Virksomhedsstrategi, Handelshøjskolen i København, Publikation nr. 96-4, juni 1996 (medforfattere: Kenneth Husted og Pauline T. Christensen).*

Christensen, J. F. (1996), A Process Approach to Corporate Coherence *with Nicolai Juul Foss, juni 1996, DRUID Working Paper no. 96-7*

Christensen, P. R. & P. Andersen & P. Blenker, (forthcoming) ]Internationalization of Subcontractors - In Search of a Theoretical Frameworks. In: Forsgreen, Mats (ed): *Scandinavian Perspectives on Internationalization.*

Dalum, B. and Villumsen, G. (1996) "Are OECD Export Specialisation Patterns 'Sticky': Relations to the Convergence-Divergence Debate?", *DRUID Working Papers* No. 96-3, Aalborg University/Copenhagen Business School.

Dalum, B., Laursen, L. and Verspagen, B. (1996) "Does Specialization Matter for Growth?" Working Paper - *EU/TSER Programme on Technology, Employment and European Cohesion*, Maastricht Economic Research Institute on Innovation and Technology, University of Limburg.

Foss, K (1996), 'A transaction cost perspective on the influence of standards on product development - examples from the fruit and vegetable industry', *DRUID Working Paper* 96-9.

Foss, N. J. (forthcoming) ]Firms, Incomplete Contracts, and Organizational Learnings.

Target Journal: Human Systems Management.

Gregersen, B. and B. Johnson (1995), "The Institutional Set-up of National Systems of Innovation and Economic Integration" (with BjÓrn Johnson). Paper presented at the EAEPE 1995 Conference on "Transforming Economies and Societies: Towards an Institutional Theory of Economic Change", Krakow, 19-21 October, 1995.

Erling Jensen, 1996a: Structural Economic Dynamics - Explored by Input-Output Tables and Innovation Indicators, paper for the DRUID-seminar, Sophienberg Castle, Rungsted Kyst, Denmark, 19 - 20 April 1996.

Erling Jensen, 1996b: Kvantitative empiriske studier af strukturel økonomisk dynamik [Quantitative empirical studies of Structural Economic Dynamics], Research Report, Department of Business Studies, Aalborg University, May 1996, Draft.

Erling Jensen, 1996c: Construction of a Structural Data Bank (DRUID-SDB), Technical Report, Department of Business Studies, Aalborg University, May 1996, Draft.

Johnson, B. (1996), 'What are the implications for EU S/T policy of the existence of a diversity of systems of innovation in Europe?' Paper presented at international Workshop on "Systems of Innovation: Implications for the fifth Framework Program". European Commission, DGXII, Square de Meuse, room 8F, Brussels, 6.5.1996

Knudsen, C. Draft: A book about forskningstraditioner inden for virksomhedsteori og industriøkonomi (vil blive publiceret af Jurist- og økonomforbundets Forlag).

Knudsen, C. (Forthcoming), ]The Knowledge-Based Theory of the Firm: A Reconstruction of Edith Penrosess Theory of the Limits of the Growth of the Firms in a volume on The Boundaries of Strategy.

Reinhard Lund (1995), 'Ledelsesformer ved indførelse af ny teknologi'. Working paper 1995-3. *Institut for erhvervsstudier*. AAU. Okt. 1995. (Også optrykt i BØRSEN: Virksomhedens Strategi & Ledelse. Opdatering 1/96).

Madsen, P.T. (1996), Offentligt indkøb og det indre marked - konsekvenser af EU-udbud med særligt henblik på innovations- og integrationsprocesser, (Public procurement and the single market - consequences of EU procurement for processes of innovation and integration), Ph.D.-thesis published as Working paper no. 186, *Department for planning and development*, AAU.

Maskell, P. & Anders Malmberg (1995), ]Localised Learning and industrial competitiveness. *Berkeley Round Table of International Economy*, no. 80, Internet: [HTTP://SERVER.BERKELEY.EDU/BRIE/WPLIST.HTML#WP80](http://SERVER.BERKELEY.EDU/BRIE/WPLIST.HTML#WP80)

Vejrup-Hansen, P. (1995) Jobomsætning og forskelle i beskæftigelsesstabilitet og konjunkturfølsomhed blandt grupper på arbejdsmarkedet. København: Handelshøjskolen i København, 1995. 132 p. (Arbejdsnotat, *Institut for Erhvervs- og Samfundsforskning*, 95-11)

### *Scientific Conferences*

*Andersen, E.S.:*

- 'Neo- and Post-Schumpeterian Contributions to Evolutionary Economics', presented at the Conference on Economics and Evolution, Arranged by the Belgian-Dutch Association for Post-Keynesian Economics, Utrecht, 10 November 1995.

- 'The Evolution of an Industrial Sector with a Varying Degree of Roundaboutness of Production', presented at the International Schumpeter Society Conference, Stockholm, 2-5 June 1996.

- Visiting scholar working on the TEP system for evolutionary economic modelling, International Institute for Applied Systems Analysis (IIASA), Laxemburg, Austria, June 27- July11, 1996.

*Christensen, J. F.:*

- Presentation of paper at the conference "Managing new Technology into the 21st Century", Manchester School of Management, UMIST, 6-8 September 1995

- ]The Theory and Practice of Competence-Based Strategys, Paper presented at the Third International Workshop on Competence-Based Competition, 16 - 18 November, 1995

- Deltagelse med præsentation af paper i den internationale konference, Management and New Technology, Madrid, 12-14 juni 1996

*Christensen, J. L.:*

- Innovation Financing, Workshop arranged by the European Commission in collaboration with FISI, 14 - 15 December, 1995

- Innovation Measurement, Workshop arranged by the European Commission, Luxemburg, May 20.-21, 1996.

*Dalum, B.:*

- ]Local and Global Linkages: The Radiocommunications Cluster in Northern Denmark. Paper presented at the Journal of Industry Studies/Industrial Relations Research Centre, University of New South Wales symposium on Innovation Networks: East Meets West, Sydney 30 - 31 August, 1995

- (with Gert Villumsen) 'Are OECD Export Specialisation Patterns 'Sticky': Relations to the Convergence-Divergence Debate?' at a seminar in the EU/TSER Programme on Technology, Employment and European Cohesion., ISRDS-CNR Rome 30 May - 1 June 1996

*Foss, N.:*

- 'Evolutionary Economics and the Theory of the Firm: Assessments and Proposals for Research', at the conference on Evolution and Economics, Utrecht 10. November, 1995.

- 'Dynamic Corporate Coherence and Competence-Based Competition: Theoretical Foundations and Strategic Implications' at the Third International Workshop on Competence-Based Strategic Management, Ghent, 16 November, 1995.

- 'Evolutionary Theories of the Firm: Reconstruction and Relations to Contractual Theories' presented at Seminar on Evolutionary Economics, Universität Jena, 10. May, 1996.

*Gregersen, B.:*

- ]The Institutional set-up of National Systems of Innovation and Economic Integrations. Paper presented at The EAPE 1995 Conference on Transforming Economies and Societies: Towards an Institutional Theory of Economic Change, Cracow, 19 - 21 October, 1995

- Conference on the History of Technology, Norwegian Technical Museum, Oslo, 8-9 Marts, 1996.

*Johnson, B.:*

- University of New South Wales symposium on Innovation Networks: East Meets West, Sydney 30 - 31 August, 1995.

- International Network on Innovation Systems, 7-10 September 1995, SÓderkÓping, Sweden.

*Knudsen, C.:*

- 'Evolutionary Perspectives on Strategies' presented at Stanford University, 1995.

*Laursen, K.:*

- The Nordic Workshop on Technology and Trade, at Leangkollen, Asker, Oslo, Norway, October 6-8, 1995

*Maskell, P.:*

- The Nordic Workshop on Technology and Trade, at Leangkollen, Asker Oslo, Norway, October 6-8, 1995

- Seminar on Regional Innovation Systems - Designing for the Future, Centre of Technology assessment, Badem Wkrtemberg, Stuttgart, October 11-14, 1995.

*Lotz, P.:*

- EARIE Conference, Nice, September 1995

### *Policy-relevant Activities and Research Popularisation*

*Andersen, E.S.:*

- 'En kompleks historie. Anmeldelse af P. Etwil: Teknologi og innovation i det landbrugsindustrielle kompleks 1900-1940', *Fabrik og Bolig: Det industrielle miljø i Danmark*, pp. 40-43, 1995.

- 'Review of G.M. Hodgson, W.J. Samuels, and M.R. (eds.): The Elgar Companion to Institutional and Evolutionary Economics', *The Economic Journal*, Vol. 105, September, pp. 1300-1302, 1995

- 'Theories of Localised Resource-Based growth and Development: From Marshall to New Evolutionary Economics', International Seminar on Regional Development Based on Forest Resources: Theories and Practices, 14-15 December 1995, European Forest Institute, Joensuu, Finland.

*Christensen, J. L.:*

- Various contributions to the Annual Report on the Industrial Development in Denmark, published by the Ministry.

*Christensen, P. R.:*

- Paneldeltager i konference med Erhvervsministeren angående mindre virksomheders rolle i samfundet. Titel: De mindre virksomheder - samfundets fundament, 16 - 17 March, 1995, Silkeborg

- Erhvervsfremme Styrelsen: Rundbordskonference om innovation af mindre virksomheder og erhvervspolitik i anledning af udgivelse af publikation i Styrelsens Notatserie. 15 June, 1995

- Styregruppemedlem i Erhvervsfremme Styrelsens udredningsprojekt om ledelseskvalifikationer og uddannelse i mindre virksomheder.

*Dalum, B.:*

- ]The Electronics Industry in North Jutlands. Lecture at the North Jutland Development Fund Conference, 21 August, 1995

- Participated in an Internal Evaluation Panel on ]Erhvervsredegørelse 95s, Ministry of Business and Industry, 24 November, 1995.

- Board member of "Erhvervspolitisk Forum" (Business Policy Forum). An independent policy forum organising lectures/discussions on various aspects of business policy.

*Foss, N.:*

- Member of a committee under the Danish Ministry of Industry on the economic efficiency of business regulation ("Børge Dahl-udvalget for vurdering af kvaliteten af erhvervsreguleringen").

*Johnson, B.:*

- Participated in the International Workshop on Regional innovation systems, regional networks and regional policy. Lysebu, Oslo, October 27-29 1995

- Participated in Workshop on "Systems of Innovation: Implications for the fifth Framework Program". European Commission, DGXII, Square de Meuse, room 8F, Brussels, May 6, 1996

*Laursen, K.:*

- Participated in the OECD-study on the Danish National Innovation System, focusing on the Creation, distribution and use of knowledge, commissioned by the Ministry of Industry (Erhvervsfremme Styrelsen)

*Maskell, P.:*

- Member of the Governments Commission on the Future Employment and Industrial Challenges. Member of the Commission's editorial board. Many subsequent public presentations of the work.

- Projects with Erhvervsfremme Styrelsen/Danmarks Statistik on the 'development of business area data' and on 'national and transnational subcontracting relationships'.

- Project with Miljøstyrelsen/Erhvervsministeriet on 'Interaction between environmental and industrial policies'.

### *Ph.D. Training activities*

Esben Sloth Andersen participated in Seminar on Ph.D. Training focused on 'Methodological problems in the context of studying technological development', at Department of Technology and Society, Technical University of Denmark, December 11, 1995.

Dalum, B., Co-organiser of the ETIC PhD seminar on The Economics of Technological and Institutional Change, Maastricht 8-15 June 1996.

Poul Rind Christensen. in the Jury on 2 Ph.D. dissertations in 1995.

Johnson, B., Lecturing and teaching in connection with the ETIC Doctoral Training Program, 1. session June 10 - 21, 1996, Maastricht.

Peter Maskell. Lecturer at Ph.D.-course, University of Joensuu, Finland, November 15-19, 1995.

### *Ph.D.-students*

*Maj Andersen*, Second year student, CBS.

Ph.D.-project: Interorganizational Learning in the Green Transformation: The case of the Danish paper industry

Ph.D. courses:

- Copenhagen Business School: on respectively Methodology and Institutional theory.
- Roskilde University: Innovative Resources of the firm[.
- EAEPE Summer School: Institutions and Technology[, Ribadesella, Spain.

*Henrik L. Bang*, Third year student, CBS.

Ph.D.-project: The Economic Organisation of Construction Contracting Firms: Strategies and Technological Change

*Ina Drejer*, First year student, AAU.

Ph.D.-project: Knowledge and Technology Flows in National Systems of Innovation.

Ph.D.-courses:

- February 11-14, 1996: Ph.D.-course: Industrial Networks and Systems of Innovation - implications for the development of government policy, Roskilde University, DK.

- March 26-29, 1996: Ph.D.-course: The Innovative Resources of the Firm,

Roskilde University, DK.

- May 1, 1996: SPRU D.Phil. Day, Brighton, UK.

- June 10-21, 1996: ETIC Ph.D. seminar, Maastricht, NL.

*Kirsten Foss*, Third year student, CBS.

Title of Ph.D.-dissertation: Aspects of the Economics of Technology Paths, Got her Ph.D.-degree in the spring 1996.

*Kenneth Jørgensen*, First year student, AAU.

Ph.D.-project: On the impact of information technology on the innovativeness and learning capability of small and medium sized firms.

Ph.D.-courses:

- 'Rethinking Work, Learning and Competence Creation in Organizations'. held at Molslaboratoriet in Ebeltoft, 12-15 May. Working hours 100.

*Frank Skov Kristensen*, First year student, AAU.

Ph.D.-Project: Innovation in Manufacturing and Services: a Reassessment of the Pavitt Taxonomy

Ph.D.-courses:

- February 11-14, 1996: Ph.D.-course: Industrial Networks and Systems of Innovation -

implications for the development of government policy, Roskilde University, DK.

- July 10-21, 1996, Economics of Technological and Institutional Change, ETIC-Doctoral Training Programme, European Summer Schools, Kasteel Vaeshartelt, Maastricht, The Netherlands.

*Nana Køster*, First year student, CBS.

Ph.D.-project: Technology and Diversification in Medium-Sized Firms: Internal Growth and Acquisition

Ph.D.-kurser:

- March 26-29, 1996: Ph.D.-course: The Innovative Resources of the Firm, Roskilde University, DK.

*Keld Laursen*, Second year student, AAU.

Ph.D.-project: International Specialisation in Trade and Technology.

Ph.D.-kurser:

- 22. maj- 28. juni 1995, Deltagelse i Ph.D.-sommerskolen ETIC på MERIT i Maastricht, The Netherlands.

- 10.-21. juli 1996, Economics of Technological and Institutional Change ETIC Doctoral Training Programme, European Summer Schools, Kasteel Vaeshartelt, Maastricht, The Netherlands.

*Mark Lorenzen*, First year student, CBS.

Ph.D.-project: Industrial Systems of Production and Innovation and the Evolution of their Institutional Context

Ph.D.-courses:

- Erasmus Intensive Programme, ITC (ILO), Turin, July 1996.

- ETIC Doctoral Training Programme, October 1996/June 1997

*Søren Nymark*, First year student, AAU.

Ph.D.-project: Information technology and organizational innovation - perspectives on change in the philosophy of organization

Ph.D.-courses:

- Rethinking work, learning, and competence creation in organizations, CBS, May 12-15, 1996.

*Annemarie Munk Riis*, second year student, CBS

Ph.D.-project: Towards a new rationale for universal service: How can the traditional telecommunications concept of universal service be re-modeled to stimulate learning in knowledge-based economies?

Ph.D.-courses:

New Ideas in the Theory of Economic Growth, Lund, Sweden, May 1995

National Systems of Innovation, Cambridge, UK, June 1995

National and International Initiatives for Information Infrastructure, Kennedy School of Government, Harvard University, January 1996

National Systems of Innovation, Rome, Italy, April 1996

ETIC Doctoral Training Programme, MERIT, Holland, June 1996

Political Economy of Industrial Nations, UC Berkeley, USA, autumn 1996

*Mette Præst*, Second year student, AAU.

Ph.D.-project: Capabilities, Technological Diversification and Product Specialisation: An Evolutionary Analysis of the Telecommunications Industry

Ph.D.-courses:

- 22. maj- 28. juni 1995, Deltagelse i PhD-sommerskolen ETIC på MERIT i Maastricht, The Netherlands.

- March 26-29, 1996: Ph.D.-course: The Innovative Resources of the Firm, Roskilde University, DK.

## Budget for 1997:

Bevilling	SSF 1997	Forslag 1997
Frikøb BAL	125.000	155.100 (p.g.a. løndifference)
Frikøb	240.000	
Administration	300.000	300.000
Rejser m.m.	120.000	120.000
Adv.board	70.000	70.000
Data etc.	150.000	150.000
Post.doc.	350.000	
Gæsteforskere	312.000	

<sup>1</sup> DISKO - The Danish Innovation System: Comparative Analysis of Challenges, Competitive Strength and Bottlenecks - is a three-year project comprising five modules. Module 1 on the firm analyzes the innovative capabilities of firms in the Danish private sector. Module 2 on inter-firm relations investigates national and international co-operative arrangements and networks within the Danish national system of innovation. Module 3 on infrastructure and bridging institutions analyzes the need for change of the Danish technological and knowledge-producing infrastructure. Module 4 on growth, specialization and structural change investigates the impact of the Danish production system and export specialization on innovative activities and international competitiveness. Finally, module 5 on synthesis and policy implications summarizes the results from modules 1-4 and discusses the Danish industrial policy and the relationship between Danish and international policy-making bodies.