

Report to SSF from DRUID (Danish Research Unit for Industrial Dynamics) August 1995-July 2001

Nr. 1016645883

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Finalised March 27, 2002

Introduction

This brief report covers activities for the period August 1 1995 – August 1 2001. The main emphasis is on presenting outcomes in terms of publications, Ph.D.-activities and communication and interaction with users (the summary assessment by the research manager is given in Appendix A below). Annual reports covering 1995-2001 with detailed background data can be found on homepage address:

<http://www.business.auc.dk/druid/druid-attach/annual.html>.

Coverage of the report – defining DRUID-participant

The core of this self evaluation report presents an overview of activities and outputs covering *DRUID-participants*. They are divided into two groups: DRUID-staff and DRUID Ph.D.-students.

In order to define who belongs to each of these groups we have used the following criteria:

Those who are included as 'staff' fulfil all the three criteria:

1. They have contributed to the realisation of the DRUID research programme with books, articles or working papers.
2. They have participated in at least one of the DRUID-conferences.
3. They have confirmed that they still regard themselves as 'druid-participants'.

Those who are included as Ph.D.-students fulfil all the following three criteria:

1. They have/have had a tutor among those registered as DRUID-staff.
2. They have worked on issues that fall within the DRUID research programme.
3. They have participated in at least one of the DRUID-conferences.

With these definitions there were at the end of the period 22 persons registered as staff and 18 as Ph.D.-students – in the period covered 15 Ph.D.-students have successfully defended their thesis (see also appendix B). This report covers the activities of these scholars.

Druid has established itself as an interdepartmental research unit with high international visibility

When DRUID was established the funding authorities emphasised that the evaluation of its activities would focus on three kinds of output: scientific publications, Ph.D.-

training and interaction with users. DRUID has been designed with these main objectives in mind. It has been built as an interdepartmental research unit with strong international network connections to high-quality researchers and research groups abroad.

The major method chosen to enhance productivity in terms of quantity and quality has been to create a supportive environment and infrastructure for senior scholars and Ph.D.-students. This is reflected in the allocation of finance. Only limited resources have been used to finance salary and specific research projects and much more to build infrastructure (to finance the Summer and Winter conferences, the data bases, the working paper series, the guest professorships, information infrastructure and administrative co-ordination).

DRUID has thus hosted and enhanced the quality and impact of several important specific research projects that have been financed mainly from other sources. Within and with support from DRUID Nicolai Foss has established a specialised research group called RESPECT. Another research activity that has been hosted by DRUID is the work on evolutionary modelling led by Esben Sloth Andersen. A third field of a rather unique competence relates to the work on the learning region (Peter Maskell) and empirical research on vertical supplier relationship (Poul Rind Christensen). A fourth major project - DISKO - involved close interaction with policy makers and other users of research and was co-ordinated by Bengt-Åke Lundvall.

DRUID original core competences and their development

DRUID was established on the basis of three core competences. One related to innovation theory and especially to the work on innovation as an interactive process and innovation systems (the Aalborg group with Esben Sloth Andersen, Bent Dalum, Björn Johnson, Bengt-Åke Lundvall and others). Another related to vertical integration and specialisation and especially to the spatial aspects of sub-contracting patterns (Poul Rind Christensen, Peter Maskell and Poul H. Andersen). The third core competence is represented by Nicolai Jul Foss, Frøslev Christensen and others at CBS and it relates to the theory of the firm and not least to systematic comparisons between different approaches in this field.

The DRUID research programme has been structured according to these three areas. At the same time, there has been a certain renewal of the three areas reflecting the synergies obtained by combining them in one research unit. The theory of the firm has been brought into a dialogue with empirical analysis of organisational change and through the concept of national business systems it has been connected to the work on national innovation systems. The analysis of vertical relationships in the industrial system has also been connected to the innovation system approach. Finally the innovation system approach has developed empirical analyses that link changes at the level of the single firm to aggregate change at the system level. This cross-fertilisation and renewal of the core competencies has been brought about by emphasising the importance of knowledge, learning and competence building as a common concern for the research unit as a whole. As a result, new core competencies have been built around the nexus 'the learning economy', the nexus 'the learning region' and the nexus 'the competence based firm'.

New directions of research have been stimulated, for instance through introducing new themes at the annual Summer Conferences. The themes of the five summer conferences have been: Economics of knowledge, Competition and industrial dynamics, Concurring approaches to the theory of the firm, Innovation systems, the Learning Economy and Evolutionary Economics.

Output measures

Publications

The positive interest for contributing to the DRUID-research program has remained strong, the activity level of the researchers involved is high, and the output in terms of publications has been growing over time. The pattern of publication has changed so that more and more of the research output ends up in refereed journals rather than in working papers and reports (see Table 1).

In table 1 the number of refereed contributions have been given for 1995, 1996, 1997, 1998, 1999, 2000 and 2001 – to make the data comparable with the earlier years we have included in the table all publications for 2001.

Table 1: Number of refereed publications from DRUID-participants 1995-98

	1995	1996	1997	1998	1999	2000	2001
Art. in Ref. Journ.	7	6	12	15	29	14	18
Art. In Ref. B.	2	2	17	14	26	22	28
Ref. B.	0	0	1	4	0	4	7

Over the period 1995-2001 there has been a significant growth in the amount and quality of publications. 1998, 1999, 2000 and 2001 we have registered respectively 33, 54, 40 and 53 refereed publications by DRUID-participants. The working paper series has grown in importance both quantitatively and in terms of the quality of contributions. It has become well known among scholars in the field of industrial dynamics all over the world. In 2001 sixteen working papers were published- hereof half were contributions from international scholars – and the average volume of downloads of a DRUID Working Paper is now more than 2000 per issue.

Ph.D. activities

DRUID has been successful in attracting motivated and active Ph.D.-students. The fact that 35 Ph.D.-students have chosen to link themselves to DRUID over the years is quite impressive taking into account that DRUID, as such, only finances one single Ph.D. The fact that they, twice a year (at the DRUID Winter and Summer conferences), have been exposed to the leading international expertise in their own field of research has been crucial for their training. This has resulted that almost all Ph.D.-theses are published in English and that many of the Ph.D.-students produce articles for refereed journals while they are still Ph.D.-students. Almost all of them spend at least 6 months abroad as part of their training.

In the period covered by this report, 15 Ph.D.-students who participated in the DRUID-network have finalised their Ph.D.-studies by successfully defending their theses (see Appendix B). At the end of the period covered by this report there were

close to 18 Ph.D.-students connected to the network. Of these, another five are expected to finalised their theses in 2002.

The role of DRUID as a framework for interaction with users

Many DRUID-scholars have been strongly involved in an interaction with users of research in the private and the public sector, in Denmark, as well as abroad. DRUID has initiated several important events that have brought scholars together with lead users in the public and private sector. The just finished DISKO-project hosted by DRUID was uniquely ambitious in terms of its interaction with policy makers, organisations and firms.

Generally the interaction with users is specialised and network relationships to users are built through a longer period of collaboration. Different DRUID-scholars have different user interfaces. Jens Frøslev Christensen has a good network connection to R&D-managers in major Danish firms. Bent Dalum has extensive contacts with the electronics industry and the regional cluster of electronic firms in Northern Jutland. Peter Maskell interacts with the transport and construction industry and with the Copenhagen region and Poul Rind Christensen with the Kolding region and with producers of Stainfree steel. Lundvall's and Jesper Lindgaard's contacts go to national as well as international organisations such as UNCTAD, OECD and EU.

In this context a major function of the research unit has been to serve as quality control for the interaction with users and to share contacts. Another important role of DRUID has been to enrich the competence of individual experts making it possible for them to analyse what appears to be specific sectoral problems in a broader perspective.

The bi-annual conferences have given scholars a forum where they can present results from applied research and, also, to confront it with work taking place in other countries. Neither should the importance of bringing together different data sets and expertise on different data sets be underestimated. The amount of activities taking place simultaneously in the field of academic research and in the context of user interaction could not have been realised without having DRUID as host and supporting infrastructure.

International visibility

As can be seen from table 2 the international visibility and impact of DRUID scholars has increased quite strongly from the beginning to the end of the period 1995-2000 (the data for 2001 are preliminary – there is always a lag from actual citation to its reflection in the index).

Table 2: Citations to the work by senior DRUID scholars

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
No.	3	14	22	25	40	69	62	81	106	158	153	104

(Number of references according to Social Science Citation index to works by Andersen, Esben Sloth, Christensen, Jens Frøslev, Christensen, Poul Rind, Dalum, Bent, Foss, Nicholai Jul, Johnson, Bjørn, Lundvall, Bengt-Åke, Maskell, Peter).

Another way to get a quantitative idea of international visibility is to register external visits to the DRUID WEB-site. Between the start-up of DRUIDs home page in January 1996 and December 2001, we have had 1,515,311 visitors - 548,856 of these are downloads of PDF-files and of these 242,972 involve downloads of DRUID Working Papers. The statistics exclude hits (requests) from the domains cbs.dk (Copenhagen Business School) and auc.dk (Aalborg University), to avoid any kind of 'home-market' bias in the outcome.

The statistics also show that the popularity of DRUIDs home page has been increasing rather dramatically since the start in January 1996. Between December 1997 and December 2001 there has been a five-fold increase in the number of visitors.

By far the single most popular service on the DRUID Web site is the electronically available Working Papers Series. Each of the 104 Working paper is on average downloaded 2336 times and the top score is over 6000 downloads. There is no doubt that a publication in the DRUID WP series provides a high degree of visibility.

Summarizing

The major impact of DRUID has been to increase the quality of the Ph.D.-training, to create a high quality international network in the field of industrial dynamics and to establish a science-based interaction with policy makers. Specifically, DRUID has established itself as a leading international forum for new ideas on the growing importance of knowledge and learning for firms, network formation, industrial dynamics and economic development. *Without the synergy and scale effects coming from bringing together the most active Danish scholars of industrial dynamics from the different departments these positive effects on productivity, quality, utility and international visibility could not have been realised.*

Appendix A: Major achievements according to the Research Manager – where DRUID has made a difference:

New analytical perspectives on industrial dynamics have been developed through the interaction between the different research groups constituting the Unit. The macro perspective on innovation systems of the IKE-group in Aalborg has been enriched by the theory of the firm approach at CBS and vice versa. New perspectives developed within DRUID, coupling human resources with industrial networking, have important policy and strategy implications. The shared effort to understand what it means for business and policy that there is a move into a ‘learning economy’ has made it possible for DRUID-participants to play a role in developing and diffusing new analytical perspectives.

Productivity in terms of refereed publications has increased substantially and it has become much more oriented toward articles in refereed journals and books. There has also been a strong growth in policy oriented output aiming at Danish and international users in the public and private sector.

Visibility in the international community has increased. The home page statistics, showing the wide dispersion of the working paper series, the constant high level participation in DRUID-conferences and, not least, the citation analysis all point to a dramatic increase in the international visibility of the research. Already after four years, DRUID has become a recognised and central node in the global network of scholars working in the field of industrial dynamics.

The quality of research training has been enhanced. More than 20 Ph.D. students with DRUID-seniors as their tutors have benefitted from the interaction within DRUID and especially from the bi-annual conferences with high level international participation. As a result, most Ph.D.-students have produced their theses in English. Those who have already finished their theses have all got attractive jobs either in the university sector or in the private sector.

Interaction with users has been enhanced in terms of both frequency and quality. Most of the interaction takes place through individual projects and individual senior scholars and it is often sector specific and local. DRUID has created a framework for exchanging experiences and for quality control in this context. DRUID/DISKO has been involved in organising two unique high level policy workshops.

Infrastructure has been built and synergies have been exploited. The establishment and efficient use of the working paper series, electronic publishing, seminar series, guest professorships and the shared data bases have been made possible because of the synergy in the network. The most important dimension of the infrastructure is perhaps the highly competent international network now shared among DRUID-participants. Actually, lately, the network has increasingly been used to open up contacts for other Danish scholars and users.

March 27 2002
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Appendix B: Ph.D.-defenses August 1995 - August 2001

1996:

FOSS, K. "Transaction and production costs paths: The case of Danish Fruit and vegetables industry", Presentation of dissertation September 1996.

1998:

HUSTED, K., "Industriell forskning: styring og autonomi", Presentation of dissertation October 21, 1998.

LAURSEN, K., "A Neo-Schumpeterian Perspective on the Determinants and Effects of International Trade Specialisation", Presentation of dissertation November 6, 1998.

PRÆST, M., "Patterns of Technological Competence Accumulation and Performance: Experiences from Telecommunications", Presentation of dissertation January 15, 1998.

1999

ANDERSEN, M. M. (1999), "Trajectory change through interorganisational learning: On the economic organisation of the greening of industry".(Ph.d.-serie ; 99-8) København. HHK: IVS

BONILLA, S.O. (1999), "Competitiveness and Sustainable Development in the Forest Sector in Central America", Aalborg University.

DREJER, I. (1999), "Technological Change and Interindustrial Linkages. Introducing Knowledge Flows in Input-Output Studies", Aalborg University.

LORENZEN, M. (1999), "Localised learning and community capabilities: On organisation of knowledge in markets, firms, and communities", København: Samfundslitteratur.

MAHNKE, V. (1999), "Intellectual production and strategic theory of the firm", Copenhagen Business School. CBS Handelshøjskolen i København. HHK: IVS.

NYMARK, S. R. (1999), "A discourse on organizational storytelling: Creating enduring values in a high-tech company by storytelling", Ph.D. dissertation, Aalborg: Department of Business Studies, Aalborg University, Presentation of dissertation took place September 2, 1999.

VALENTE, M. (1999), "Evolutionary Economics and Computer Simulations: A Model for the Evolution of Markets", Department of Business Studies, Aalborg University.

2000

IVERSEN, M. (2000), "Organization of industrial synergies", HHK: IVS.

JØRGENSEN, K. (2000), "Organizing new technologies in loosely coupled systems", Aalborg University.

2001

KRISTENSEN, Frank Skov (May 2001), "The Dynamics of Knowledge: A Sectorial Perspective".

VARGAS, Leiner Alfaro (November 2001), "Competitiveness, Innovation and Democracy - Space for Clean Energy Within Electricity Reforms".