1992

DIVERGENCE AND CONVERGENCE OF ORGANISATIONAL FORMS: An Analysis of the Structuring of the Danish IT Field

Finn Borum

Copenhagen Business School, FinnBorum@emailaddressnotknown

Follow this and additional works at: http://aisel.aisnet.org/sjis

Recommended Citation
Available at: http://aisel.aisnet.org/sjis/vol4/iss1/3

This material is brought to you by the Journals at AIS Electronic Library (AISeL). It has been accepted for inclusion in Scandinavian Journal of Information Systems by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.
DIVERGENCE AND CONVERGENCE
OF ORGANISATIONAL FORMS

An Analysis of the Structuring of the Danish IT Field

FINN BORUM
Institute of Organisation and Industrial Sociology
Copenhagen Business School
Blågårdsgade 23B, DK-2200 Copenhagen N, Denmark

Abstract

The structuring of the Danish IT field since its emergence in the fifties is analysed. The analysis deals with both the Danish IT people and IT organisations (suppliers as well as intermediaries and users).

Seven IT communities representing different configurations of tasks, actors, and value systems are identified as the main constituents of the Danish IT field.

The emergence of these institutions is explained as a consequence of processes of institutionalisation, comprising:

- interaction between a community and its environment,
- IT field interaction,
- societal influences.

These processes create tendencies towards both divergence and convergence between the IT communities.

By engaging in this type of field level analysis we are better able to explain the variations identified at the community and organisational level.

The analysis and recent observations make it debatable whether the identified business system should be regarded as a stable ‘business recipe’, or as a business system in transition.
1 Introduction

The present article is based upon the findings from the CHIPS research project (Computing History: Interdependencies, Power-strategies, and Structure), which was conducted by Finn Borum, Andrew Friedman, Mette Minsted, Jesper Strandgaard Pedersen, and Marianne Risberg from 1986 to 1989. The results of the team’s study are published by de Gruyter (1992) in the book Social Dynamics of the IT Field. The Case of Denmark.

The ambition of the project was to contribute to our understanding of the interaction between technological innovation, the formation of new occupational groups, and the restructuring of work organisations. The object of the study was the Danish Information Technology (IT) field for administrative purposes covering the period from its initiation in the late fifties till the mid eighties. In Denmark this field accounts for around eighty per cent of the current IT applications. The IT field was operationalised as organisations supplying, mediating or using information technology software and services for administrative purposes.

We used the field concept as we wished to analyse a wide range of work organisations and institutions affiliated to the public and the private sector—users as well as suppliers of IT, mediators and consultancies. Our analysis also focused on the characteristics and shaping of the IT people—by which we refer to actors working with the development, maintenance and/or operation of software, and suppliers of advice and other services related to this. Section 2 gives a brief account of our methodology and data.

Section 3 summarizes some of the main characteristics of the Danish IT people. Previous comparative analyses of business systems (Maurice et al. 1982) and IT organisations (Friedman et al. 1987) have identified the national specificity of organisational actors, and the importance of taking this into account when analysing forms of work organisation (Kristensen 1991).

Besides the objective to analyse the social dynamics of a specific technology induced field, another purpose of the study was to contribute to the development of an ‘organisation field type’ of analysis. Scott (1990) regards this as representing an important and critical meso-level analysis which potentially bridges the organisational and societal levels, and which is a necessary element for the understanding of changes at the two other levels. As we were dealing with an empirical field, which has been changing and still is both with regard to its internal structuring and its boundaries, our ambition was to apply and elaborate theoretical models for analysing social dynamics.

This article departs from the observation that our case studies revealed quite different combinations of tasks, actors, and value systems within different IT organisations. According to our data these different communities are rather stable and have acquired a taken-for-granted status. This we interpret as the result of institutionalisation processes that have occurred within this new, technology-driven organisational field since its emergence in the fifties.

The term ‘community’ is preferred to ‘organisation’ or ‘organisation culture’
as the task-actor-value system clusters identified may be properties of populations of organisations or networks of actors, as well as properties of organisations.

Institutionalisation is used here to denote two different aspects. One is the process through which organisational forms and practices gain legitimacy and acquire a taken-for-granted status within social systems. The other is the outcome in terms of institutionalised organisational forms and practices (see Scott 1987b).

As no attempts have been made so far to conduct a field level analysis of Danish IT organisations, the first objective of the article is analytical-descriptive: to produce a theoretically structured picture of the present institutional configuration of the Danish IT field. This may be labelled a ‘variance type’ institutional analysis (Scott 1990). It focuses on the properties of institutions resulting from three decades of institutionalisation processes. The diversity of the communities is captured in terms of different configurations of tasks, persons, and value systems. Following the reasoning of Selznick this analysis comprises both tasks (technique) and value (belief) systems: “...‘to institutionalise’ is to infuse with value beyond the technical requirements of the task at hand” (Selznick 1957, p. 17; cited by Scott 1987b, p. 494).

Seven communities with different configurations of task, actors, and value systems were identified within the Danish IT field (see Section 4). These communities do not comprise the whole IT field, but only the clusters indicating value systems of a certain stability and networks of a certain strength.

Examples of excluded organisations are large public IT users and small and medium sized private IT users.

The second objective is analytical-explanatory. We engage in a ‘process’ type of institutional explanation (Scott 1990), discussing the processes/forces which may have produced the present variation between communities. Three different types of explanations are discussed which both address sources of variance and tendencies towards convergence:

1. Interaction between a focal community and its immediate environment.
2. IT field interaction.

Our interpretations are necessarily speculative and incapable of producing a stringent causal explanation. First, because of the multiple sources of institutional forms and belief systems coexisting in Western society that concurrently influence emerging institutions. The processes studied are highly complex and multifactorial by nature. Second, our analysis is based upon a variety of data and impressions which have been generated through an exploratory research methodology (see Section 2).

This field level analysis interprets the observable properties of a national business system as the result of both international, national, regional, functional, and occupational influences. The interaction of these forces is complex, and hence interpretations are speculative. However, the study of the Danish IT field indicates
that this type of meso-level analysis makes it possible to explain the occurrence of variations identified through organisation level analyses. Furthermore, the analysis enables us to identify significant patterns in what appears to be multitudinous variations of organisational forms. This opens up for discussing whether an identified business system can be regarded as a stable ‘business recipe’ (Whitley, 1990), or as a business system in transition.

2 Methodology and Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: The main phases of the CHIPS project

The general approach of the study was to alternate between theoretical considerations, data collection and data analysis. This meant that certain phases were devoted to data collection in the field. Data were analysed subsequently and this gave rise to phases devoted to adjustments of existing theoretical considerations. This in turn required returning to the field to collect new data for further analysis. Through ‘commuting’ between data and theory, the focus of the project was intensified, the analyses were currently adjusted, and data were currently up-dated.

First a pilot study was conducted in the form of a round of interviews with informants, many of whom were ‘pioneers’ within the Danish IT-field. These informants provided general information about historical developments as well as the trends and ‘state-of-the-art’ within the Danish IT field. Partly on the basis of these interviews and partly on the basis of other material—books, previous research, articles, etc., an overview of the Danish IT field was gradually developed. Based on this pilot study, trends and cases within the field that appeared to be interesting and significant were selected for more focused studies.

Next, a round of semi-structured interviews was arranged with selected organisations. Each of these in-depth interviews lasted approximately from an hour and a half to two hours, and were conducted by two interviewers, using a semi-structured interview guide with open-ended questions.

A total of 102 in-depth interviews were conducted. Of these, 76 in-depth interviews were carried out in 24 case firms. 26 in-depth interviews were conducted with informants from IT unions, trade associations, professional associations and the aforementioned ‘pioneers’ in the field.
<table>
<thead>
<tr>
<th>Source</th>
<th>Interviews</th>
<th>Special Surveys</th>
<th>Other Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>The IT Field</td>
<td>6 interviews with 8 pioneers</td>
<td>Survey 328 IT people in 13 companies</td>
<td>All available available statistics on the Danish IT field (IT people and IT firms)</td>
</tr>
<tr>
<td>IT Institutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Unions</td>
<td>6 interviews in 3 unions</td>
<td>Participation in PROSA conference</td>
<td></td>
</tr>
<tr>
<td>b) Trade associations</td>
<td>10 interviews in 6 trade ass.</td>
<td>Survey on 70 trade ass. + telephone interviews</td>
<td></td>
</tr>
<tr>
<td>c) Professional associations</td>
<td>4 interviews in 2 prof.ass.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Suppliers</td>
<td>14 interviews in 3 int.supl.</td>
<td>Participant observation one week in an int.supl.</td>
<td></td>
</tr>
<tr>
<td>Danish Suppliers</td>
<td>25 interviews in 9 Dan.supl.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Service Bureaux</td>
<td>27 interviews in 2 LSBs</td>
<td>Participation in internal seminars</td>
<td></td>
</tr>
<tr>
<td>Small Users</td>
<td>10 interviews in 10 SMEs*</td>
<td>7 telephone interviews in 6 SMEs</td>
<td></td>
</tr>
</tbody>
</table>

*Small/Medium Enterprises.

Figure 2: Overview of sources of data for the study
A file on each case was established, which included interview reports as well as other written material (internal documents of various sorts, articles from journals, annual reports, case study notes, tabular materials, etc.).

Although the main source of evidence has been the interview data, this is not the only source of data for the analyses. During the field visits other data was collected like archival material (written reports, internal documents, newsclippings, company journals, etc.). We also conducted direct observation (noting the condition of buildings and work spaces, the reception of outsiders, physical artifacts, etc.) using an observation guide.

To supplement this two quantitative studies were also conducted. One survey was made of 328 IT people in 13 IT firms. The sample consisted of 7 internal IT departments, 3 IT suppliers (hardware as well as software) and 3 service bureaus.

Another survey was made of the trade associations and their role as mediators in relation to the introduction of IT in their member organisations. A questionnaire was sent out to all trade associations in Denmark, in total 150. 70 trade associations responded to the questionnaire and 60 responses were valid. Interviews were conducted with 6 informants in 5 trade associations and 7 additional telephone interviews were made to follow up on the results.

Finally, all available statistics on the Danish IT field (concerned with IT people as well as IT organisations) has been gathered and analysed.

3 Characteristics of the Danish IT People

We define the IT people as those actors working with development, maintenance and/or operation of software, and suppliers of advice and other services related to this. In relation to currently used job titles, the IT people thus comprises those listed in Appendix which are based on special surveys conducted by Denmark's Statistical Bureau (Danmarks Statistik) in the years of 1970, 1973, and 1975 and the bureau's annual salary surveys from 1981 and onwards. These surveys provide a crude impression of the actual size and historical development of, the IT people, even though the salary surveys from 1981 and onwards do not comprise the whole population. Small enterprises and EDP-departments within the public sector are excluded (but the large public sector service bureaux are included). This, together with other biases, indicate that the estimated number of IT people is rather twice as big as that derived from the available official statistics (see Borum et al. 1992, Chapter XII).

The IT people only constitute a fraction of the Danish labour force or 3.5 million (defined as the population between 16 and 66 years of age). However, the IT people have both been characterised by a vast growth and by important changes in composition as is illustrated in Appendix. Even though the appendix does not include the very early years of IT, and does not cover the total IT population, it nevertheless reveals important aspects of the development since 1970.
It appears, that the IT people have more than doubled between 1970 and 1988. This growth, however, covers very different trends: ‘Analysis and programming’ has multiplied by 4–5, while ‘operations’ has declined by 10%. The strongest growth is represented by the joint groups of ‘systems consultants’, ‘systems planners’ and ‘analyst/programmers’ which have multiplied by 9, and ‘operations planners’ that have multiplied by 6.

Even though the IT labour force has been expanding during the period, the IT labour market has been tight throughout the period, resulting in both high wages (see Borum & Risberg 1988) and high mobility both between and within firms. On the national level, however, we have indications of a rather modest mobility between the eastern (Copenhagen) area and the western (Jutland) area. There is a heavy concentration of IT people in the Copenhagen (61%). In comparison the Copenhagen area accounts for only 23% of the total labour force and 46% of the total white collar labour force. This concentration of IT people reflects the concentration of administration and services in the capital area. Our analysis is also biased as all our case organisations are located or have their headquarters in the Copenhagen area.

Denmark’s Statistical Bureau’s 1970 survey provides information on the IT people’s educational background that can be contrasted with estimates of the population’s present composition, see (Borum & Risberg 1988, Antonsen & Strandgaard 1988) for further explanations, Figure 3.

<table>
<thead>
<tr>
<th>qualifications</th>
<th>1970 (DS)</th>
<th>1988 (estimate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Certificate of Education (Studentereksamen)</td>
<td>22%</td>
<td>20%</td>
</tr>
<tr>
<td>EDP-assistant (1–1 1/2 years practical oriented education)</td>
<td>–</td>
<td>20%</td>
</tr>
<tr>
<td>“Bachelor” in business economics (HA/HD)</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Vocational business educations (HH/Merkonom)</td>
<td>1%</td>
<td>15%</td>
</tr>
<tr>
<td>Engineers or other technical educations (inclusive of computer science)</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>University degree or equivalent</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>Other (i.e. formal qualifications below General Certificate of Education)</td>
<td>70%</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 3: IT people’s educational background

Two characteristics of the 1970 column are important: The variety of formal qualifications and the low proportion of graduates within IT in the early years. The variety may be explained as a consequence of the educational system not
providing obvious candidates for vacant positions within this new occupational field, and the absence of established norms and traditions for recruitment and selection of applicants. The low proportion of graduates can be regarded as a consequence of the lower production of these at that time, and the graduates' orientation towards more traditional types of jobs. In addition to this, the firms may have been inclined to attach little importance to theoretical competences and thus not trying very actively to attract academics.

Since 1970 the overall trend has been an increasing level of qualification within the IT field. This reflects both the general increase in the Danish society's qualification level, and the emergence of educations that specifically aim at the IT field. The most significant shift is that 'other education' and Studentereksamen (General Certificate of Education) accounted for more than 90% in 1970. In contrast to this a more equal distribution has emerged today—General Certificate of Education, EDP-assistant education, vocational business schools (HH/Merkonom), and University degree contribute with 10–20% each and the category of 'other' has been reduced from 70% to 25%. A contributing factor is the relative reduction in operations staff—and in particular the drastic reduction in the number of data entry operators.

But still, it is the variety of formal qualifications and the open recruitment pattern that characterise the field. Today, only about 30% of the IT people possess formal IT-specific qualifications (EDP-assistant, data-engineer, or computer science degree).

As to ways of acquiring skills, the IT people predominantly seem to apply practical on-the-job training as a means of acquiring competences. Even within the few large organisations that have developed formal internal training of planners, programmers etc., learning-by-doing still appears to be the primary mode of developing IT competences. Our data indicate that these modes of acquiring skills in some ways resemble a craft mode of production. The more experienced IT specialists pass on to the less experienced their knowledge through collaboration and supervision on concrete projects. And this apprenticeship system is controlled by the specialists, who form a relatively autonomous body, only partially submitted to the control of management. This goes hand in hand with a level of unionisation (67%) (Borum et al. 1992, Chapter IX).

Thus, we are left with the impression of an expanding and changing IT population, comprising primarily male actors which are well-paid and extremely mobile. The formal qualifications are diverse, and no single group or institution has monopolised certain positions. The individual may follow a diversity of trajectories and combine competences in many ways, and classical division of labour between analysis and programming appears to be fading. An expanding IT field has enabled the individual to choose between different strategies such as unionisation, entrepreneurship, and job-hopping (see Friedman 1987) and provided the IT people with relative autonomy in relation to management.
4 Summarizing the Variations of Danish IT Communities

An IT community comprises one or more groupings of persons engaged in practical or scientific activities related to information technology around supplier and user organisations. These groupings of actors are intertwined in terms of bureaucratic and clan-like relations (Ouchi 1980). A community is identified by insiders and outsiders and by a demarcation of its field of activities. Within one community, different groups may exist that are different as to degree of centrality, orthodoxy, etc.

This is a sociological approach to the study of IT people and to the development of informatics (the application of information technology). As such it is analogous to Kuhn’s (1970) sociological approach to the study of the structuring of scientific communities. The IT field may be regarded as the equivalent to a scientific discipline, and the IT communities as the equivalents of different scientific schools. If only one school exists the field is paradigmatic, but if more than one community exists the field is either preparadigmatic or multiparadigmatic. Groups within a community are the equivalents of scientific sub-schools.

As the IT field covers application of information technology in many different organisational settings which are only loosely connected, and as the IT field has been expanding rapidly, the relations between communities may be both competitive, disjunctive or symbiotic, and a ‘hard core’ needs not exist.

Our study of IT communities covered the following dimensions, which include elements from Schein’s (1985) cultural model:

**Genesis:** time of birth; important aspects of the community’s historical development.

**Tasks, methods, and norms:** task situation; methods; norms for problems to be considered; repertoire of solutions.

**Persons:** recruitment and qualifications; training and indoctrination; population size; itineraries (career pattern and migration).

**Value system:** values; ideals and basic assumptions; identity.

**Ecology and relations to other communities:** relations of influence and dependency.

It should be emphasised that the ‘community perspective’ emerged through an explorative and combined empirical-theoretical methodology. As such it is to be regarded as a heuristic tool for understanding the structuring of the Danish IT field. Furthermore, as a consequence of the explorative approach, our data are not equally strong in relation to the different communities.

For reasons of space the description of each community’s development (see Borum et al. 1992, Chapter 1) is omitted here and replaced by a summary showing the different configurations of tasks, persons, and value systems. To simplify
the account, IBM Denmark is used to illustrate the important traits of the international suppliers’ community. Regnecentralen is used to illustrate the Technical Community, which at the time of study comprised two other Danish firms: Dansk Data Elektronik, and Computer Resources International, see Figure 4.

The identified communities differ in terms of distinct lines of demarcation and internal properties:

IBM Denmark is a coherent community separated from both the other, smaller international suppliers and from the other Danish communities. IBM’s recruitment practice and comprehensive internal educational system reflect a moulding of the IBM employees that embraces far more than the other communities. This heavy investment in training and indoctrination of employees is facilitated by IBM International’s resources and corporate culture. IBM Denmark is primarily oriented towards sales and profit and technical implementation, and secondarily towards development as this function is located abroad.

In contrast, the Technical community—exemplified by Regnecentralen (RC)—is much more oriented towards technical development, and is affiliated to Danish universities and research laboratories. But the uneven competition with international suppliers has forced it to incorporate a sales and business orientation. This has led to an internal struggle between a technical and a profit orientation.

Datacentralen (DC) is an important community that through its role as a centralised service bureau dealing with large scale public systems has experienced a stable task and resource situation. This has made possible the emergence of a coherent community around software development, systems operation, and user services. The affiliation to the public sector and the large concentration of IT specialists have led to the development of a culture characterised by collective and craftsman-like traits. The public sector affiliation also contributes to explaining the organisational inertia of DC which has made organisational change a difficult exercise.

As a consequence of its genesis and task situation the Kommunedata (KMD) community appears more internally differentiated, the differences between the regional cultures of Jutland and the Copenhagen area emerging as the most important ones. Our data do not indicate that the relations between Datacentralen and Kommunedata are of such a nature, that they form one community. Instead, they have each, via their different recruitment practices, taken colour of their respective users: the state administration and the municipalities.

The Financial sector community has been moving from pioneer IT departments within banks and insurance companies towards either large separate IT organisations or large internal IT departments. Recent years’ mergers and acquisitions within and between banks and insurance companies have contributed to the integration of this community. It is business and implementation oriented, and with user relations as an important dimension of the task situation. The resulting culture is dynamic and influenced by the financial sector’s changing trade culture, and by the other IT communities.

Diversity is pronounced within the Entrepreneurial community that also ap-
<table>
<thead>
<tr>
<th>Community</th>
<th>Tasks</th>
<th>Persons</th>
<th>Value System</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM</td>
<td>sales/profit service</td>
<td>high qualific.</td>
<td>individualism</td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td>practitioners indoctrinated</td>
<td>ambitious</td>
</tr>
<tr>
<td>(1960)</td>
<td></td>
<td>(2.500)</td>
<td>corporate spirit</td>
</tr>
<tr>
<td>Regne-centrælen (RC)</td>
<td>invention</td>
<td>academics</td>
<td>coherent</td>
</tr>
<tr>
<td>(1950)</td>
<td>implementation</td>
<td>practitioners</td>
<td>creativity</td>
</tr>
<tr>
<td></td>
<td>sales</td>
<td>(800)</td>
<td>research</td>
</tr>
<tr>
<td>Data-centrælen (DC)</td>
<td>large systems design</td>
<td>EDP-assistants</td>
<td>internal divide</td>
</tr>
<tr>
<td>(1959)</td>
<td>and implementation</td>
<td>public servants</td>
<td>craftsmanship</td>
</tr>
<tr>
<td></td>
<td>service</td>
<td>academics</td>
<td>collectivism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.800)</td>
<td>control/safety</td>
</tr>
<tr>
<td>Kommunedata (KMD)</td>
<td>systems design</td>
<td>municipal educ.</td>
<td>coherent</td>
</tr>
<tr>
<td>(1970)</td>
<td>consultancy</td>
<td>EDP-assistants</td>
<td>pioneering</td>
</tr>
<tr>
<td></td>
<td>service</td>
<td>academics</td>
<td>group orientation</td>
</tr>
<tr>
<td>Financial community</td>
<td>systems design</td>
<td>practitioners</td>
<td>regional</td>
</tr>
<tr>
<td>(ca. 1960)</td>
<td>(in-house)</td>
<td>clerks</td>
<td>differentiation</td>
</tr>
<tr>
<td></td>
<td>infrastructure</td>
<td>IT specialists</td>
<td>craftsmanship</td>
</tr>
<tr>
<td></td>
<td>rationalisation</td>
<td>(4.700)</td>
<td>collectivism</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>business</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>individualism</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mixed: firms and sectors</td>
</tr>
<tr>
<td>Entrepreneurial Community</td>
<td>systems design</td>
<td>all types</td>
<td>entrepreneurship</td>
</tr>
<tr>
<td>(ca. 1970)</td>
<td>consultancy</td>
<td>few academics</td>
<td>belief in simple structure</td>
</tr>
<tr>
<td></td>
<td>data power</td>
<td>(5.000?)</td>
<td>split networks</td>
</tr>
<tr>
<td></td>
<td>sales</td>
<td></td>
<td>technical</td>
</tr>
<tr>
<td>Systems Programmers' Community (ca. 1970)</td>
<td>technical design and problem solving</td>
<td>IT specialists many academics specialisation</td>
<td>sophistication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.000)</td>
<td>split networks</td>
</tr>
</tbody>
</table>

(In parentheses: year of founding, and number of individuals)

Figure 4: Summary showing the different configurations of tasks, persons, and value systems
pears as loosely coupled internally. It is probably most accurate to conceive it as divided into local communities, and to regard some of the entrepreneurs as ‘satellites’ depending upon one or a few important customers to whom they are subcontractors or freelances. However, our data indicate the existence of networks and a set of values and beliefs that are quite different from those of the other communities within which the entrepreneurs often have started their careers.

The Systems programmers' community represents the only genuine technical IT culture that we have been able to identify. These technical specialists rotate around IT installations without any particular affiliation to the communities or organisations in which they are located. Their technical specialisations tie them to the installations, between which they are able to move around—as long as the equipment originates from IBM and compatible suppliers. This community overlaps the communities above and comprises actors who are regarded as different ('techies') by the other communities’ members. It is the closest we have come to identifying an occupational community (Salaman 1974).

Five of these seven communities (the Financial and the Entrepreneurial Communities being the least coherent ones) can be regarded as having acquired the status of institutions in the sense that they have been infused with value beyond what is required to cope with the technical task requirements. The combinations of tasks and value systems appear not to be completely arbitrary, but other combinations are not unthinkable. For instance, it might have been possible for IBM to perform its sales task with a more collective value system, but this would have required a different reward system. Datacentralen would also have been able to solve its systems design tasks with a value system of a less control- and collective oriented nature.

Furthermore, even within the dynamic IT field these communities appear to be attributed value and a taken-for-granted status by our interviewees. Some of them also reveal considerable stability—again taking into consideration that we are dealing with a young field—as they show stable patterns during a decade.

5 Tracing Processes of Institutionalisation

As mentioned above our empirical analysis of the IT communities encompassed their genesis, their ecology, and the interplay of these factors. Based upon this, historical accounts of the communities' development have been generated (see Borum et al. 1992) indicating processes of institutionalisation which have introduced both variation and convergence among the IT communities. This theme will be pursued in this second analytical-explanatory step of our analysis in which we engage in a 'process' type of institutional investigation (Scott 1990).

In order to explain the IT field’s present state, three different types of institutionalisation processes have been identified through the ‘commuting’ research methodology described in section 2. As a consequence of the methodology our description of the institutionalisation processes is most developed in rela-
tion to the following IT communities: 'The International Suppliers' Community' (IBM), Datacentralen, Kommunedata, and 'The Technical Community' (Regne-
centralen). Consequently, the following process analysis will primarily draw on
examples from these. This bias reflects that these communities, according to our
observations, have had the strongest impact on the shaping of the Danish IT field.
Moreover, they appear to have attained the highest level of institutionalisation.
Therefore, we have invested most time in tracing their historical development at
the expense of the other communities.

The categories of institutionalisation processes have been constructed by mat-
ching empirical observations with possible theoretical categories, primarily from
(Scott 1990, DiMaggio & Powell 1983, Whitley 1990). The categorisation which
appeared as most meaningful is based on a distinction between processes at dif-
ferent levels: community-environment interaction (micro level), field interaction
(meso level), and societal influences (macro level). These categories of processes
introduce divergent and convergent forces of influences, which contribute to ex-
plaining the emergence and properties of the identified IT communities.

*Interaction between a focal community and its immediate environment* is es-
sentially an open systems analysis, which makes an effort to explain the present
properties of a community in terms of two elements. The first is the "genes"
with which it was endowed at its time of birth, the second is the interaction be-
tween the focal community and its ecology. This analysis focuses upon variations
between the communities.

*IT field interaction* has as unit of analysis the organisational field constituted
by the IT communities. The analysis focuses upon dissemination and processes
through which the communities mutually influence each other, and regards these
as causing both divergent and convergent forms and practices.

*Societal influences* looks into the interplay between the IT field and its na-
tional context. According to this analysis properties of the IT field are regarded
as reflecting influences from other fields or society at large. Whitley (1990) has
proposed four main dimensions of a national business system's institutional struc-
ture, which in a modified form are used to identify important societal forces:

1. (a) state structure,
2. (b) state policies,
3. (c) financial systems, and
4. (d) labour market and labour relations.

### 5.1 IT Community—Environment Interaction

The cases of IBM Denmark, The Entrepreneurial Community, Datacentralen
(DC), Kommunedata (KMD), and Regnecentralen (RC) are used to illustrate
these processes. They enable us to trace examples of 'genes' with which the
communities were endowed during their birth. Furthermore, their exposure to
different ecologies have confronted them with different task and value settings—equivalent to different pressures on the individual community and its possibilities of development. Hence, the recruitment of actors differs considerably between communities with respect to both practical experience and level of formal qualifications and expresses adaptation to the communities ecology.

From its early years, IBM Denmark has been the local sales office of IBM International. IBM Denmark has never engaged in research and development tasks. Thus the task orientation has been clear: sales, and the dependency of the IBM corporation strong. The mother corporation has furnished IBM Denmark with both products and competencies, and concepts for marketing, accounting, organisation, and human resource management. Additionally, US business attitudes and beliefs have been imprinted in the Danish office, as expressed in the attitude that the corporation negotiates with the individuals and not the unions.

IBM Denmark has never valued IT experience acquired elsewhere, but moreover emphasised formalised, internal training and indoctrination of new employees. This may be seen as a result of both the lack of relevant practical experience during the early years, and of the pressure from the IBM corporation to adopt its US developed personnel practices. The increasing recruitment of individuals with higher formal qualifications reflects both an effort to get the brightest and most flexible persons, and the need for keeping up with its business partners' increasing qualification level.

In contrast, The Entrepreneurial Community has valued experience acquired elsewhere. Because of modest resources it has been forced to import competencies which subsequently could be supplemented with on-the-job training. In this setting, indoctrination is also attributed a modest role: fits between organisation and individual are attempted through selection, and misfits remedied through exit. Higher formal qualifications are considered irrelevant or potentially dysfunctional in relation to the clients: the issue is practical problem-solving, and the customers are not particularly valuing consultants with a theoretical background.

When Datacentralen was established it was endowed with genes from two different sources: from the early IBM community, and from the Danish public sector. IBM Denmark supplied DC with its first managing director, hardware, and important parts of its methodology and organisational thinking. These were compatible with the task situation of DC: computerisation of large, centralised administrative systems, but less with the public sector's traditions for handling employee and union relations. The imprinting of DC thus encompassed traits which were conflictual.

This potential conflict between the IBM and the public sector traits was activated as DC grew and by means of its centralisation became a stronghold of IT unions. Datacentralen thus offered an organisational arena for the processing of both political demands for a state technology policy, and for political protests against the dominance of international suppliers and their union policies.

As a result, the IBM inspired Management By Objectives system was aban-
doned, IBM consultants were excluded from DC’s premises, and IBM’s monopoly as hardware supplier was broken. This happened gradually, through a laborious process (described in detail in (Borum et al. 1992, Chapter IV). DC’s last two managing directors have been recruited from the public sector which further indicates supplier independency and that IT is regarded as a means subordinated the public sector’s raison d’être.

Kommunedata, in contrast to Datacentralen, was born as regional centres and stamped both by local politics and by local cultures. Even after the centres were merged into KMD, these genes seem to exert significant influence on the structural configuration chosen and the value system. Important subcultural variations between the centres and regions still exist and are articulated in a ‘Jutland’ and a ‘Copenhagen’ orientation, which is reinforced by the centres’ interaction with different municipalities, and the IT people’s low mobility between regions.

Regnecentralen was born as a research and development based organisation with links to both research institutions and practitioners. Invention and creativity were early central values which were compatible with the objective of product development. They were less compatible with the profit orientation which was necessary to cope with international competition. In order to strengthen the profit orientation more business oriented managers were recruited. This resulted in an internal conflict between invention and business oriented groupings, which for many years made internal adaptation difficult and obstructed the bridging of problems related to different segments of RC’s environment.

5.2 IT Field Interaction

Interaction between the IT communities introduces a pressure towards convergence of organisational forms and practices. This happens through the exchange of actors, know-how, hardware and software which leads to the development of shared perceptions of proper practices. This includes methods for problem solving, division of labour in work roles and structural arrangement of roles.

The IBM Community has played an important role in setting standards for hardware and software. This is reflected in both international standards and in competitors’ utilisation of ‘IBM compatibility’ as a sales argument. IBM is an important part of the Danish IT field whose influence on the Danish IT field, however, also extends to general methods for analysis, systems development, and organisation of EDP-functions. Particularly in the early years of computing, and before the ‘unbundling’ of hardware, software and services, IBM by way of manuals and courses occupied a leading role in the development of methods for systems design, programming, and implementation.

IBM Denmark’s Educational Centre constitutes an important element with regard to IT educations. In 1985 the centre offered an important number of courses and training programmes to its customers. IBM also exerts influence on educational matters through its participation in various committees focusing on basic education and further training.
Additionally, IBM exerts influence on the IT field through former employees: even though few employees leave the organisation, they add up over three to four decades. Former IBM employees occupy important positions in other supplier or user organisations (the first managing director of Datacentralen was a former IBM employee, for example). Former IBM employees are perceived by many outsiders as still belonging to the 'IBM-network'.

Datacentralen and Kommunedata in the Danish context represent a concentration of resources and IT competences that, after the early years of IBM-dependency, has assigned them roles as possible counterweights to the international influences. DC in particular has had an impact on the IT environment through the methods and standards it has developed and the 500 annual courses offered both externally and internally. Also, DC was very apt at developing the best 'local' expertise in operating systems necessary to handle the IBM mainframes. Both DC and Kommunedata function as important educational centres in relation to the Danish IT field, and have been important suppliers of actors to the financial sector and the entrepreneurial communities.

Datacentralen has as a consequence of its size and considerable turnover of personnel influenced other communities. The turnover of personnel was a result of the restrictions imposed upon DC's wage policies, and the tight labour market. Thus, several former DC employees occupy high positions within both the public and the private sector. Furthermore, DC established its own educational department in 1969, which has played an important role in relation to other IT communities. Datacentralen regards itself as a sort of 'EDP-university' within the Danish IT field with an obligation to remedy the insufficient capacity of the educational institutions in relation to the demand for skilled IT people. Over time, DC has supplied quite a few computer specialists, primarily to internal DP departments, to small software houses/consultancies, or to other smaller service bureaus. Only in a very few cases they have gone to IT suppliers.

Former Kommunedata employees have also spread to other IT communities. If you want to be in a large organisation, you stay in Kommunedata. Otherwise, you shift to one of the smaller service bureaus within the Financial Sector Community or to the Entrepreneurial Community. Only a few KMD consultants have shifted to hardware suppliers.

The Financial Sector Community mainly influences the other communities through Dataforeningen (an association for IT organisations, managers and experienced IT people) and by the migration of actors to the entrepreneurial community.

Traditionally, Regnecentralen's relations to the IBM community have been of a competitive nature, and DC's choice of IBM as supplier was experienced as the public sector's rejecting to collaborate with RC. The appointment of a former IBM sales consultant as the first manager of Datacentralen was interpreted as the 'IBM spirit' occupying Datacentralen. This led to tense relations between RC and Datacentralen, and RC was squeezed out of the public sector for many years. However, in the sixties RC and Datacentralen started to collaborate on
the development of the SYSKON systems development methodology initiated by the Aarhus IT milieu. This gradually led to easier relations and exchange of expertise.

In general, RC employees have been actively involved in the creation of Danish IT associations, i.a. the founding of the EDP Council in 1966 and Datalogisk Selskab. The participation of RC employees in computer associations and the dispersion of an important segment of the RC employees after a crisis in 1971 may indicate an integration with the financial sector and public sector service bureau communities.

A recent example of IT field interaction which seems to further convergence across previous lines of demarcation and competition can be traced in the interaction between the International Suppliers Community and the Technical Community. Thus, during recent years, international suppliers have furnished Regnecentralen with capital and managerial methods, and IBM has become partner in one of the offsprings of the technical community—the Computer Resources International (CRI) software house. Parallel to this, parts of the Entrepreneurial Community has become sub-contractor of software to IBM and other international hardware suppliers.

This blurring of the so far clear line of demarcation between the International Suppliers' Community, and the Technical and the Entrepreneurial Communities has two aspects. One is a redefinition of the relations from pure competition to a mixture of competition and collaboration, the other is an increased uniformity of organisational and managerial principles. Evidence of the latter are a growing business orientation, introduction of a managerial apex on top of the technical oriented organisations, utilisation of profit-centres, MBO-systems, and efforts to develop corporate cultures.

5.3 Societal Influences and the IT Field

State structure

Denmark has a population of 5 million people of whom one third is concentrated in the Copenhagen area—historically the economic and administrative centre of Denmark. The small size of the country and its cultural homogeneity goes hand in hand with a tradition for standardised public administrative systems. The development of the Scandinavian type welfare state, to which Denmark belong, has resulted in a large public sector which accounts for almost half of the economic activity. However, the Danish public sector only takes care of administration, control, infrastructure and services, and is not allowed to engage in the production of market commodities.

In this context information technology made possible the implementation of centralised administrative systems for keeping track of information about citizens, enterprises, and motor vehicles. Centralised systems are compatible with the Danish tradition for centralised State administration and the welfare State's
specification of individual rights and of treating all citizens equally. Examples of the large data processing tasks handled by the central systems are the P.A.Y.E. tax system (pay-as-you-earn), health insurance, VAT (value-added-tax), registration of motor vehicles, etc.

Thus, Denmark can be regarded as possessing structural traits which have been favourable to the utilisation of information technology. This is reflected by the fact that in percentage of the GNP, Denmark is the country in the world that spends most on computing (0.56% against averagely 0.28% in West European countries).

Another indicator of the advanced position of the Danish public IT systems is that a number of systems have been exported—primarily to developing countries.

State policies

In relation to the emerging IT sector, the Danish State has been pursuing a claimed general principle of liberalistic economic policies. Regnearcentralen and other Danish IT firms, as well as unions and other interest groups have argued in favour of State subsidies to support the development of the national IT industry, which has experienced recurrent crises. This can be compared to the strong foothold gained by foreign suppliers in Denmark. Foreign companies dominate part of the hardware market (of which IBM’s share amounts to approximately 40% (Monopoltilsynet 1988), and more than a third of the software market (OECD 1985)). However, the state has maintained the principle of not directly supporting specific firms—even though both unemployment and dependence of international suppliers have been put forward as national issues legitimating subsidies.

In line with this, the technological programmes launched in the late eighties were aiming at strengthening and encouraging the use of IT in the public sector and in small and medium sized enterprises, and not directly at supporting the suppliers of IT.

However, the policy decisions to establish the two large service bureaus Datacentralen and Kommunedata to cater for software development and services related to the state administration and the municipalities respectively have had significant effects on the structuring of the Danish IT field.

First, it led to the creation of two very large IT communities which internationally are ranked as number 13 and 17 among the world’s IT service bureaus (Hingel 1985), and which account for one third of the national market for software and computer services. Second, as DC and KMD chose to use international suppliers instead of the emerging Danish IT suppliers, the two communities were strongly influenced by these companies that gained a relatively strong foothold in the Danish market. Third, the concentration of IT specialists in large organisations affiliated to the public sector promoted the unionisation of the IT people, and favoured the development of a more collectivist orientation among these. Fourth, it created two large organisations that not only were able to establish
their own educational systems to remedy the deficiencies of the public educational system in relation to IT, but also in a position to furnish the other Danish IT communities with qualified persons.

The public educational system was very slow in responding to the emerging IT field. Right from the beginning the IT suppliers designed their own courses which they offered to the customers. Later on, these courses were supplemented with independent training centres and in-house courses—Datacentralen and Kommunedata being the most important examples. The higher educational institutions responded slowly to the emerging IT field—with the exception of Denmark’s Technical University which started to turn out data engineers. But these, and the computer scientists (datalogs) from the University of Copenhagen only amount to a small proportion of the IT people. When the public educational system finally decided to incorporate IT educations, it was not in the shape of ‘computer science educations’, but via the EDP-assistant education—a practically oriented education of twelve to eighteen months.

This is in line with the Danish IT field’s emphasis upon application and implementation in contrast to research. Furthermore it is compatible with a tradition for skill acquirement and competence development through learning-by-doing, and with an apprentice-like training system.

Financial systems

Four quite different financial systems can be identified in relation to the different IT communities.

A ‘command or planned economy’ functioning in relation to the communities of the public sector service bureaus, to which the political system allocate economic resources in terms of annual budgets. Even though the legal status of Datacentralen and Kommunedata is semi-private, they have as monopolistic suppliers of service actually been operating under the logic of negotiated economy. For many years this situation provided the bureaus with a safe and expanding economic basis for activities—until the mid-eighties. Benevolent factors were the expansion of the public sector, the investments necessary to establish the large basic IT system and infrastructure, and the diffusion of IT for many different purposes.

Since the mid-eighties, this economic setting has been transformed into one of relative scarcity and elements of market economy have been introduced in terms of competition from other suppliers. Some main factors behind this are the efforts to reduce the size of the public sector, the introduction of adapted forms of profit-centres to control the economic performance of the large service bureaus, the introduction of competition between suppliers, and the completion of the large central systems.

The Financial Community serving banks and insurance companies can also be regarded as having operated under a ‘command’ economy. The internal IT departments and the established data centres acted as monopolistic suppliers and
were allocated funds by policy decisions. Today, however, this community is also trying to introduce some ‘quasi-market’ mechanisms through the profit-centre concept.

The changes in the financial system is related to the diffusion of specific organisational forms mediated across sectors by consultancies. McKinsey, for example, has played an active role in the diffusion of the divisionalisation and profit centre concept in Denmark. Datacentralen and Kommunedata are examples of major IT organisations in which McKinsey has implanted such organisational structures. Other examples of consultative influence can be found within the Financial Sector Community in terms of internal IT departments being turned into self-sustaining profit-centres. These organisational forms represent attempts to cope with growing external pressures in terms of market competition and contestation of the economic performance of the large, institutionalised organisations.

This convergence of managerial practices which seems to encompass elements of both competitive and institutional isomorphism (Di Maggio & Powell 1983) between the communities cannot solely be ascribed the influence of consultancies and international suppliers. It also reflects managerial fashion (Mintzberg 1979) and shared rationalised myths about appropriate managerial techniques (Meyer & Rowan 1977) that are disseminated through different sectors (Child 1988). Facing dynamic and complex environments the IT communities are receptive to new managerial and organisational ideas.

‘Market economy’ characterises the conditions under which Danish IT suppliers such as Regnecentralen and parts of the Entrepreneurial Community have been operating. Scarcity and crises have been recurrent phenomena for these firms, even though they have been operating within an expanding field.

‘Subcontracting economy’ can be identified in relation to parts of the Entrepreneurial Community. In many cases small enterprise’s operations have been sustained by one major and stable contractor.

‘Subsidiary market economy’ has been the condition under which international suppliers have operated. Competing on the Danish IT market they have been submitted to performance control by headquarters abroad. But being part of an international corporation has also provided them with an influx of products, expertise, and support—technical, managerial, and financial.

**Labour market and labour relations**

Until the mid-eighties the IT field was characterised by a tight labour market. Supply of qualified IT people was scarce compared to the demands of an expanding field. Within the last few years this situations has changed and EDP-assistants, for example, are experiencing unemployment. Thus the IT people have been in a favourable bargaining position vis-à-vis management: besides being able to gain relatively high wages and promotion, the opportunities for job-hopping and start of own enterprise have been ample (Friedman 1987). This
is reflected in the relative autonomous relations between management and IT employees (Borum et al. 1992, Chapter V and X).

Concurrently with the expansion of the IT field, the public educational system underwent changes and a growing number of young people were offered the opportunity of obtaining a General Certificate of Education giving access to the universities and other institutions of higher education. Hence these institutions produced a larger amount of candidates some of whom looked for a career in the expanding IT field with its open recruitment practices.

Another distinctive trait of the Danish IT field is its high level of unionisation (67%). In a Danish context, however, this rate is moderate compared to the general white collar rate of unionisation (87%) (Scheuer 1989). Among the Danish white collar workers there is a strong tradition for unionisation which is further enforced by the threat of unemployment and the fact that the unions compete for members. For the IT people two factors contribute to the lower rate of unionisation: the favourable labour market, and the affiliation to international suppliers. In contrast, two other factors contribute to sustain the high rate of unionisation: EDP-assistant and IT staff working in the public and financial sector.

The difference in unionisation between the international suppliers’ Danish subsidiaries and the public sector is reflected in the different value systems of IBM Denmark (individualism) and Datacentralen and Kommunedata (collectivity/group orientation). Also, it should be noted that the latter two communities have had a great influx of EDP-assistants. In relation to unionisation the financial sector occupies a position somewhere between the public sector and the international suppliers representing both individual and collectivist orientations.

6 Conclusion

Our variance analysis of the IT communities has not only produced a picture of emerging patterns, but also one of ongoing change processes. This is hardly surprising taking into consideration that the IT field is only thirty years old. Our analysis of the field was conducted at an arbitrary point in time—in the late eighties—with the inherent risk of interpreting the present situation as the outcome of a process, rather than as a phase in an ongoing process.

After the research project was concluded most of the identified communities have experienced tough times—even IBM Denmark. Well established personnel policies have been changed, and the IT people have faced lay-offs, forced early retirements, and deterioration of previous favourable employment conditions. This situation may lead to changes in the task-person-value system configurations, which our analysis has treated as a more final outcome.

The objective of our analysis of the processes of institutionalisation was to improve our understanding of the social forces which have shaped the Danish IT field’s present variance. Three types of processes—community-environment
interaction, IT field interaction, and societal influences were employed as a means of identifying sources of variance and convergence between the IT communities.

As the causal strands woven together are highly complex, the analysis has not produced simple conclusions. While ‘community-environment interaction’, for instance, in relation to four of the IT communities—IBM Denmark, Datacentralen, Kommunedata, and Regnearmalen—does contribute to explaining the subsequent institutionalisation, it only points to potential directions that the processes may follow, and to potential dilemmas which may or may not be evoked.

‘IT field interaction’ identifies forces pressing towards convergence between the IT communities. This convergence of organisational forms may happen via some organisations acquiring the status of ‘models’ which are imitated by other organisations. However, our analysis has identified two other important mechanisms of convergence: the dissemination of ideas and organisational thinking through advice end education, and through the exchange of actors between the IT communities.

‘Societal influences’ contributes to the understanding of important features of the present structuring of the IT field. The strong position of international suppliers in Denmark and the emergence of the two very large public sector affiliated service bureaus can be traced back to state structure and policies. The same applies to the present composition of the IT people’s qualification structure, and the location of important parts of the IT education in the firms.

The labour market conditions and traditions explain the unionisation pattern of the IT people and its relatively high degree of autonomy in relation to management—of which the ‘systems programmers’ community’ is an example.

Thus, by elaborating the process analysis explanation we are able to identify the patterns behind what from the variance analysis appeared as a multitude of variations in configuration types. As such the present analysis sustains the potential of a ‘field type analysis’ for reaching a better understanding of observations at the community and organisational level.

*Can the identified business system be regarded as a ‘business recipe’—i.e. “particular ways of organising, controlling and directing business enterprises that become established as the dominant forms of business organisation in different societies” (Whitley 1990, p. 7)?

The analysis has focused on a dynamic field, and even though certain stable features have been identified, others indicate that the Danish IT field is a business system in transition. One example is the ongoing changes in the communities’ financial systems, and the tendency towards convergence between these—linked to reforms within the public sector. Another is the redefinition of the relations between some of the communities, which potentially indicates that international suppliers, national suppliers, and entrepreneurs may be transformed to (an)other configuration(s).

Also, the IT field seems to be facing a labour market of sufficient supply of IT people—both due to the increasing output of EDP-assistants, and to the general high level of unemployment in Denmark. Recent unemployment figures
from the IT people's two most important unions—Prosa and Samdata—are as high as 13! Powerful software may reduce the demand. This may result in a higher rate of unionisation and make the IT people adopt new attitudes and strategies towards the IT field.

Finally, the IT field may experience new lines of demarcation: currently there is a growing internationalisation of software houses, and the boundaries between the IT field and its environment—the users and other related fields such as communications—may be changing.

Our analysis has dealt with important aspects of the historical development of the Danish IT field and its configuration in the late eighties, but we have probably left it in the midst of transition.

Acknowledgements

I am indebted to Andrew Friedman, Mette Mønsted, Jesper Strandgaard Pedersen and Marianne Risberg for our collaboration on the CHIPS research project, without which I would not have been able to write this article. Special thanks to Marianne Risberg for undertaking the heavy tasks of editing my English.

Three anonymous reviewers of Scandinavian Journal of Information Systems are thanked for their critical and constructive comments.

References


Appendix

The development of the IT population 1970-1988—Private Sector

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>256</td>
<td>228</td>
<td>276</td>
<td>307</td>
<td>321</td>
<td>383</td>
<td>388</td>
<td>512</td>
<td>568</td>
<td>653</td>
<td>600</td>
</tr>
<tr>
<td>EDP-manager</td>
<td>236</td>
<td>228</td>
<td>276</td>
<td>307</td>
<td>321</td>
<td>383</td>
<td>388</td>
<td>512</td>
<td>568</td>
<td>653</td>
<td>600</td>
</tr>
<tr>
<td>Systems manager</td>
<td>137</td>
<td>136</td>
<td>129</td>
<td>158</td>
<td>172</td>
<td>186</td>
<td>151</td>
<td>192</td>
<td>237</td>
<td>231</td>
<td>278</td>
</tr>
<tr>
<td>Progr. manager</td>
<td>113</td>
<td>70</td>
<td>62</td>
<td>92</td>
<td>96</td>
<td>76</td>
<td>71</td>
<td>65</td>
<td>117</td>
<td>92</td>
<td>99</td>
</tr>
<tr>
<td>Systems consultant</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>463</td>
<td>617</td>
<td>818</td>
<td>1,145</td>
<td>1,161</td>
<td>1,916</td>
<td>2,483</td>
<td>3,104</td>
</tr>
<tr>
<td>Systems planner</td>
<td>702</td>
<td>593</td>
<td>676</td>
<td>1,204</td>
<td>1,562</td>
<td>1,321</td>
<td>1,200</td>
<td>1,347</td>
<td>1,511</td>
<td>1,391</td>
<td>1,236</td>
</tr>
<tr>
<td>Systems programmer</td>
<td>32</td>
<td>44</td>
<td>506</td>
<td>594</td>
<td>703</td>
<td>745</td>
<td>920</td>
<td>1,001</td>
<td>1,296</td>
<td>1,278</td>
<td></td>
</tr>
<tr>
<td>Analyst/programmer</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>81</td>
<td>782</td>
<td>926</td>
<td>1,027</td>
<td>1,284</td>
<td>1,433</td>
<td>1,935</td>
<td></td>
</tr>
<tr>
<td>Programmer</td>
<td>1,190</td>
<td>1,211</td>
<td>1,375</td>
<td>1,466</td>
<td>2,198</td>
<td>1,925</td>
<td>1,947</td>
<td>1,844</td>
<td>2,261</td>
<td>2,462</td>
<td>2,300</td>
</tr>
<tr>
<td>Analysis &amp; progr.</td>
<td>2,378</td>
<td>2,562</td>
<td>2,959</td>
<td>4,196</td>
<td>5,641</td>
<td>6,195</td>
<td>6,573</td>
<td>7,068</td>
<td>8,895</td>
<td>10,041</td>
<td>10,825</td>
</tr>
<tr>
<td>Operations manager</td>
<td>154</td>
<td>161</td>
<td>155</td>
<td>79</td>
<td>95</td>
<td>135</td>
<td>154</td>
<td>171</td>
<td>215</td>
<td>225</td>
<td>236</td>
</tr>
<tr>
<td>Operations planner</td>
<td>124</td>
<td>217</td>
<td>300</td>
<td>392</td>
<td>528</td>
<td>553</td>
<td>630</td>
<td>610</td>
<td>651</td>
<td>688</td>
<td>778</td>
</tr>
<tr>
<td>Operator</td>
<td>1,032</td>
<td>1,135</td>
<td>1,260</td>
<td>1,163</td>
<td>1,789</td>
<td>1,862</td>
<td>1,897</td>
<td>1,847</td>
<td>2,114</td>
<td>2,043</td>
<td>1,988</td>
</tr>
<tr>
<td>Data entry supervisor</td>
<td>187</td>
<td>159</td>
<td>164</td>
<td>142</td>
<td>117</td>
<td>127</td>
<td>120</td>
<td>115</td>
<td>116</td>
<td>119</td>
<td>94</td>
</tr>
<tr>
<td>Data entry operator</td>
<td>2,283</td>
<td>1,948</td>
<td>2,087</td>
<td>1,122</td>
<td>908</td>
<td>869</td>
<td>894</td>
<td>858</td>
<td>875</td>
<td>736</td>
<td>699</td>
</tr>
<tr>
<td>Other</td>
<td>567</td>
<td>621</td>
<td>837</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>6,725</td>
<td>6,803</td>
<td>7,762</td>
<td>7,093</td>
<td>9,078</td>
<td>9,741</td>
<td>10,268</td>
<td>10,669</td>
<td>12,866</td>
<td>13,852</td>
<td>14,630</td>
</tr>
</tbody>
</table>

* Job category not listed in the statistics at that time.
1 EDP-managers are in most cases responsible for both analysis and programming and ‘operations’ functions.
2 In the actual organigrams, systems programmers often are placed within the ‘operations department’. This table, however, is based upon a functional grouping of the personnel and not an organisational one.
3 This group appeared in 1981 with 12 persons, but was only separated as a separate category in the DS statistics from 1982 and onwards.
4 This category includes the following job titles that have appeared in the statistics as indicated:

Operator x
Machine operator x x x x
Shift supervisor x x
Console operator x x
Operators assistant x

5 Technicians, who are not included from 1981 and onwards.