The Human Side of Innovation Systems

– Innovation, Organizations and Competence Building in a Learning Perspective

Peter Nielsen

The Human Side of Innovation Systems is the second book in the series
Perspectives on Inventions, Innovations and Imitations.
First book in the series is *Produktinnovation i Danmark*.

The Human Side of Innovation Systems

– Innovation, Organizations and Competence Building in a Learning Perspective

By Peter Nielsen

ISBN: 87-7307-770-4

Cover & Layout: Sisse Harrington
Cover Illustration: Else Alfelt "Stjernetåger"

Printed by: Publizon A/S

Published by:
Aalborg University Press
Niels Jernes Vej 6B
9220 Aalborg Ø
Phone +45 96357140
Fax +45 96350076
E-mail: aauf@forlag.aau.dk
www.forlag.aau.dk

The Human Side of Innovation Systems is the second book in the series *Perspectives on Inventions, Innovations and Imitations*. First book in the series is *Produktinnovation i Danmark.*

Contents:

Preface

Knowledge production and innovation are often seen as linear processes, assuming that scientific results are followed by technological invention, production and market introduction. This book, however, chooses an interactive and learning approach to innovation. Thus, product innovations are considered expressions of learning processes taking place inside firms and involving different functional groups and various decision levels, as well as relations with the firm's customers and subcontractors. A theoretical framework is constructed which combines the system of innovation approach and the system of employment approach. This framework is applied in a dynamic empirical study of enterprises in the private urban sector in Denmark. The empirical study utilizes a unique longitudinal data set. The data set combines two large surveys and detailed register data on 524 Danish firms, and it includes information on the behaviour of the firms and all employees employed in each of the 524 firms for shorter or longer tenures in the period 1990 to 2000. The ambition of this book is to open some of the black boxes in the empirical relationship between innovation, employment and competence development within the context of new learning organization forms.

The book is primarily addressed to researchers, policy makers and students of innovation, organization and employment, but I sincerely hope that it will also find its way to real life actors: business leaders, employee representatives etc. As for theoretical inspiration and analytical encouragement, I am greatly in debt to professor Bengt-Åke Lundvall, and especially professor emeritus Reinhard Lund, who read the manuscript and commented on it in detail. Without the cooperation with these two scholars, this book would not have been possible. Lis Sand did a splendid job on language revision, and Connie Krogager as well as Sisse Harrington on layout. I would like to express my warmest gratitude to the above-mentioned, and I hope that I can pay back their inspiration by publishing this book. The book is dedicated to my mother, who died shortly before I finished the manuscript.

Peter Nielsen

Chapter 1

Introduction

1.1 A system of innovation and employment in enterprises

When attempting to understand the conditions of economic growth and employment development in the new millennium, the importance of innovation, learning and knowledge development is widely recognized. Innovation, learning and knowledge are considered of almost universal importance. It is considered important in individual human development, in the way firms organize modern production relations, and in our understanding of the dynamics of the economy and society at the regional, national and global level. We are inclined to consider this importance almost self-evident. Often we do not even bother to question terms like knowledge economy or learning organization and individual competence development. We do not endeavor to go beyond the terms, to try to understand why they have become so relevant and important in modern working life. The terms have become part of the everyday mindset and self-evident facts which are accepted without reflection.

Why is it that innovation, learning and knowledge have become such pervasive and all-important concepts in modern working life? In order to answer this question, it seems suitable to focus on the decade leading up to the new millennium. It was in the nineties that learning became widely accepted as a key concept at all levels of society, and the knowledge economy or "new economy" became part of politicians' standard vocabulary anywhere in the world (OECD 1996). The reason for this development was the emergence of two important trends, which reinforced each other and penetrated the context of economic and social life worldwide.

Globalization, understood in economic as well as social terms as high mobility of goods, capital, labor, information and social values across countries and continents, was one important trend. Globalization had important im-

pacts, not only as growing competition on markets in the highly industrialized part of the world. It also gave rise to large fluctuations on the markets. As a result of globalization, growing competition and fluctuating markets, enterprises came under increasing transformation pressure in the nineties (Lundvall and Nielsen 1999). A new context of mobility, instability and transformation pressure demanded reaction at the enterprise and employment level. The ability of enterprises and the labor force to adapt quickly and offensively came to be seen as the immediate answer to these challenges (NUTEK 1996). The age of flexibility for firms as well as the labor force had emerged.

The growing importance of new information and communication technology (ICT) was another important trend, which supported and intensified the globalization trend. The innovative and rapid development of ICT in the nineties played a decisive role for the emergence of new markets as well as new goods and services. In addition, the technology became an important tool for handling the transformation pressures inside firms. It created the technical prerequisites for a firm's ability to react and adapt instantly and dynamically in turbulent market environments. Judged by its impact and pervasiveness, ICT turned out to be the leading technology of the global knowledge economy (Freeman 2001).

Globalization and the technological developments placed innovation high on the agenda in the industrial countries. Innovation became the dominant, strategic way to handle the market threats and opportunities of enterprises offensively. Developing new and improved products or services became the important response to competitive pressures and volatile markets. Product and service innovation created new markets, often lowering prices, and giving innovating firms primary gains of profits. It thus presumably supported labor demand and employment growth. However, innovation as enterprises' strategic answer also meant new ways of organizing the production processes, and it meant increasing demands on the flexibility, learning and competence development of employees within the individual firm and on the labor market in general. Furthermore, as the ICT technology became part of the innovation process and strategy, employment and employees also came under pressure. Besides its information and communication function, ICT also has

a rationalization and labor saving function. As part of technical and 'process' innovation, it puts employment under pressure.

The relationship between innovation, organization and employment is indeed quite complicated. Often it has counteracting primary and secondary effects. The aim of this book is to analyze the relationship between innovation, employment and competence development within the framework of new learning organization forms. In order to focus on the most important elements and relations, a theoretical framework will be applied which combines two system approaches at enterprise level: a system of innovation approach and a system of employment approach. The two system approaches will be combined in a learning perspective. The system approaches are both theoretically well developed (see Lundvall 1992 and Hendry 1995), but the two approaches are seldom combined analytically. A system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge (Lundvall op.cit. 1992). Enterprises play the most important role in innovation systems (Lundvall 2006). Focusing on the firm as the center of the system of innovation, the external context of the firm is defined by institutional and organizational elements such as other private enterprises, government agencies, science & technology institutions and education & training organizations etc. The internal context is defined as those of the firm's institutional and organizational elements that are important for learning and promoting product and process innovation. By institutional elements we here refer to norms, values and habits that shape modes of interaction, preferences and innovation outcomes (Lundvall ibid.). The perspective and analysis in this book will concentrate on the internal context of learning; however, it will also relate to the external frames of the firm as they are crucial in the interactive approach to learning and innovation.

The system of employment provides a framework for understanding the nature of employment relations in the firm (Marsden 1999). The system comprises elements such as recruitment, integration, competence development, training and mobility, and the relations between these elements. Again, it is institutional and organizational elements that constitute the system. Em-

ployment systems provide a framework for analyzing the application and allocation of employees, quantitatively and qualitatively, minimizing transaction costs in relation to the firm's business strategy. (Hendry 1995). The key concepts common to the system of innovation and the system of employment will be organizational and institutional elements related to learning and the innovative behavior of enterprises. Analytically, the two systems are approached as complementary. In this way, the system of employment constitutes a loosely coupled subsystem of the system of innovation, where the core elements in the latter are the organization of product and process innovation. The employment system constitutes the human side of the innovation system, and here the concept of learning and competence building is important.[1] The combined or coupled systems establish the theoretical framework for a dynamic empirical analysis of the relations between elements and their developments over a decade.

1.2 Data and longitudinal design

The dynamic analysis is possible because of a unique longitudinal data set. This data set combines two large surveys and detailed register data on 524 Danish firms, and it includes all employees employed in each of the 524 firms for shorter or longer tenures in the period 1990 to 2000. The panel connects a survey from 1996 (DISKO[2]), covering the period 1993-95, to a survey from 2001, covering the period 1998-2000.[3] Information links between the two surveys are established by comprehensive register data from the Danish Inte-

[1] Bengt-Åke Lundvall stresses the importance of human resources in a recent publication: "While globalization means that codified knowledge moves quickly, the most localized resource remains people – i.e. their tacit knowledge, their network relationships and their accumulated organizational experiences. Therefore all parts of the innovation system that contribute to competence building are becoming increasingly important" (Lundvall 2006).

[2] DISKO is a comprehensive research project carried out by a research group at Aalborg University. The purpose of the DISKO project is to analyze the strengths and weaknesses of the Danish Innovation System from an international COmparative perspective, hence the name.

[3] Both quistionnaries including marginal distributions are available on http://www.socsci.aau.dk/carma/index.htm. Methological and other questions are welcome on peter@socsci.aau.dk.

grated Database of Labor Market Research (IDA) and the register of Business Data at Statistics Denmark.

The 1996 DISKO survey was sent to 3,993 firms in the private urban sector, and 1,900 firms responded. The questionnaire focused on the period 1993-1995 and measured product and service innovation, organizational changes, qualifications demands, competence development, education and training. The idea behind establishing a panel connecting the DISKO data to the data collected in the 2001 survey meant that the two samples should have identical population and empirical designs. The core of the sample for the 2001 survey was to be 1,363 firms from the 1996 DISKO survey which had "survived" as units in the Danish Integrated Database of Labor Market Research covering all firms with longitudinal information. From those 1,363 firms, longitudinal register data were already available back from 1990 and up to 1997, covering information on enterprise performance, employee education, job dynamics and employment turnover. The 2001 survey was sent to 6,991 firms and collected information from management as well as from employee representatives by means of two separate but matching questionnaires, implemented through two phases of data collection in each of the firms selected. Beside the exact DISKO questions on product and service innovation, organizational changes, qualifications demands, competence development, education and training, this last survey also measured issues such as participation and involvement, personnel policy and planning, and the social responsibility of the firms. In total, 2,007 usable responses from management and 473 responses from employee representatives were collected in this survey and integrated in a cross-section data set.

The main focus in the 2001 survey's data collection was on the 1,363 surviving firms from the 1996 DISKO survey. The result was 637 useable responses from firms in manufacturing, construction, trade and service industries. The rate of response among this core group of firms was 47%, which is comparable with the 48% response rate in the first (DISKO) survey. After a data validation process, the result was usable longitudinal data on 524 firms. This reduces the response rate to 38%, which is not very satisfying. However, a response analysis broken down on industry and firm size indicates no unac-

ceptable bias. In order to give a general overview of the form and substance of the data sets, the panel *"Innovation, Organization and Competence"* is shown in Appendix A.

The possibility of combining analysis of micro and meso level information on product and process innovation with job dynamics and personnel turnover establishes the foundation for analyzing the relationship between innovation and employment in a learning perspective. Fundamentally, innovation leads to both destruction of jobs and creation of jobs in a so-called process of creative destruction emerging at the macro level (Schumpeter 1911), but it also leads to the emergence of new forms of organizations at the meso level, and learning, competence building and knowledge development among the employees at the micro level. Thus the relationship between innovation and employment involves complicated contradictions, founded at different levels. These contradictions have not yet been analyzed systematically and empirically in a dynamic perspective.[4] It is therefore the ambition of this book to open some of the black boxes at the micro and meso level of analysis and present new knowledge on this important and interesting subject.

1.3 Innovation in enterprises

As a strategic response to the transformation pressures of globalization, increasing competition and fluctuating markets, innovation in enterprises has gained growing importance up through the nineties. Having achieved this central role, an appropriate nominal definition of innovation is called for as a corner stone in building the theoretical framework of this book. In her definition of innovation, Rosabeth Moss Kanter focuses on the enterprise as the central context of the innovation process. She defines innovation as "…the process of bringing any new, problem-solving idea into use… Innovation is the generation, acceptance and implementation of new ideas, processes, products and services. It can occur in any part of a corporation and it can involve

[4] Edquist C. Hommen, L. and McKelvey (2001) have made an excellent hypothesis generating study in their book: "Innovation and Employment". Much inspiration and overview of the innovation system is owed to their book.

creative use as well as original invention. Application and implementation is central to (the) definition", (Kanter 1983). This definition is appropriate in our theoretical framework, because it emphasizes innovation as a learning process. Implicitly it highlights competence, learning and knowledge as the necessary preconditions, fundamental principles and intangible results of the innovation process. The definition includes both external market-related products and services and internal, work-related processes in enterprises. This is perfectly in line with Charles Edquist et. al. (2001), who builds a taxonomy distinguishing between product innovation and process innovation. Product innovation includes both new goods and new services, while process innovation includes new technology and new organization forms. Their taxonomy is appropriate and will be used as building blocks in our theoretical framework, because it establishes a bridge between the external market relations and the internal work relations of the firm. This is one of the important prerequisites for bringing together the system of innovation and the system of employment.

An important proposition in the empirical analysis is that product innovations and process innovations are systematically related inside the firm. In this light, process innovation and the human side of innovation system may be viewed as necessary preconditions for product innovation. New organization forms promoting learning and knowledge production among employees in enterprises are expected to be systematically related to the probability of product innovation such as new goods or services on the market. The same relationship is expected for new technology, making it possible to develop new production or communication processes. Finally, product innovation may also change work processes and in this way promote organizational innovation.

However, in a system perspective, it is crucial to distinguish between product and process innovation. It may be difficult though, because the same new technology in one setting may be a process innovation, but in another setting it may be a product innovation (Edquist et. al. 2001). We define product innovation as new goods or new services launched on the market. The goods or services are the results of a production process and sold on a market.

They may be new to the world market or new to the national market. In other words, using Shumpeter's definition: "Goods with which the consumers are not familiar". But this definition is too narrow in our context. Product innovation must include goods and services which are new to the firm, but not necessarily new to the market. In this way we deliberately emphasize the internal learning processes of the firm in our understanding of innovation. From a theory point of view, this is important because it establishes a relation to the firm's organization and technology configurations as frames of the learning process. This relationship is fundamental in our theoretical understanding of the innovation system of enterprises. Fundamentally, we expect innovation to be an organizational competence. By organizational competence we mean competence which is embedded in the organizational structure, culture and processes within the firm, promoting, but at the same time depending on, the employees' ability for continuous learning and knowledge production.

Another important aspect of product innovation is that the innovations may be more or less radical. Product innovation may be small but important changes in existing goods or services; i.e. innovations are not necessarily radical, but still significant results of learning and organizational competence. We are, however, in line with the European Community Innovation Survey and "leave out changes which are purely aesthetic, or which simply involve product differentiation while leaving it technically unchanged" (European Commission 1993). To sum up, our definition of product innovation will be as follows: "Goods or services introduced on the market and new to the firm, excluding minor improvements of existing products".

In regarding process innovations as systemically related to product innovation, often as a precondition, we follow Edquist et al. (op. cit. 2001) in defining process innovation as new ways of producing goods and services. The new ways of producing goods and services may involve new technology or new organization forms, or both. As already mentioned, among the new technologies, information and communication technology (ICT) has been gaining increasing importance in the nineties. Chris Freeman considers information and communication technology a leading technology in the knowledge or learning economy (Freeman 2001, se also Freeman and Perez

1988). In his view, the knowledge economy can be characterized as a techno-economic paradigm. His approach to techno-economic paradigms analyzes leading technologies in a process of structural development, interacting with new production processes, industries, communication infrastructures and managerial as well as organizational changes. According to this view, a match between the leading technology of the paradigm and the socalled socio-institutional factors, i.e. production processes, industries, organization forms etc., will trigger a "Kondratieff wave" or a long wave of economic development. If, however, the development of the leading technology and the socio-institutional factors do not match, the result will be structural problems in the economy (Lundvall 2003).

Since the eighties, the productive use of ICT has developed through at least two important phases. In Danish firms, the first intensive "take-off" in the use of ICT took place in the mid-eighties (Velfærdskommisionen 1995). Before that time, the main use of ICT was for rationalization of work processes; a process of substituting capital (ICT) for labor. However, the expected results in the form of increasing productivity often failed to materialize for the firms investing in ICT. Quite the contrary, aggregate productivity showed negative growth in Denmark in the mid-eighties (Kallehauge and Madsen 1990). First of all, this development can be taken as an evidence of what has been named Solow's productivity paradox. In Solow's words: "Computers can be seen everywhere except in the productivity statistics" (Spiezia and Vivarelli 2000).

During its "take-off" in the mid-eighties, the use of ICT in various functions such as design, production, logistics and communication in enterprises increased. The more narrow rationalization phase dominated up to the end of the eighties; then in the early nineties a more organic, pervasive and information-oriented approach to the use of ICT started to emerge. The importance of thinking new ICT into, as an integrative part of, new managerial and organization forms became more widely recognized. Even though rationalization was still an important function, information and communication came to be seen as more and more important functions. This development of ICT from pure rationalization towards information and communication functions is in line with Zuboff (Zuboff 1985); the phases, however, are not

"clean" and in this analysis we still empirically presume rationalization to be an important function in the use of ICT. With some caution, a proposition might be stated that the use of ICT in enterprises has developed from an emphasis on rationalization towards increasing emphasis on internal information (MIS, cad/cam), and later on external communication (Internet, e-trade, EDI) (Nielsen 2004).

In the innovation system approach, management and organization forms are of central importance. At the meso level, new forms of management and organization constitute the organization side of the relationship in the internal context of the system. The other side of the relationship at the meso level – the internal institutions – will be dealt with later in this section. From a theory point of view, the importance of developing new forms of work organization is not new at all: "history has shown that the driving force of successful capitalist development is not perfection on the market mechanism but building organizational capabilities" (Lazonick 1994). Rational thinking, social considerations, employee influence and ability to adapt to contingencies can make all the difference when it comes to an organization's production performance in the economy. This importance ascribed to new organizational forms is a central element in the theoretical discussion of developments in techno-economic regimes as understood by Freeman (Freeman and Soete 1997). It is also central to various management theories, ranging from Scientific Management and Human Relations to Total Quality Management and Human Resources Management. Human Resources Management is considered part of the wave of management and organization forms emerging in response to the challenges of the socalled "Japanese model". In the seventies and eighties the "Japanese model" had obvious competitive strengths, founded as it was on principles or institutional standards such as employee involvement, commitment, continuous improvement and quality control. By means of such standards the Japanese economy established strong comparative advantages, combining high quality and low costs (Sisson 1995).

The parallel developments of new technologies and new management and organizational forms established the foundation for more flexible organizations. The new technologies created a scope for contingency in the configura-

tion between technology and employees in enterprises. Integration of external relations and internal functions was furthered by the technology. Standards were promoted and institutions developed which improved organizational learning. If the organizational structure and culture developed into what has been called integrative frames of "willingness to move beyond received wisdom, to combine ideas from unconnected sources, to embrace change as an opportunity to test limits, to treat problems as "wholes" and consider the wider implication of action", then product innovation flourished. This was the important finding of Rosabeth Moss Kanter (1983), and it is in line with the learning organization introduced by Peter Senge in his "Fifth discipline" (Senge 1990).

Integrative organizations were structured by organizational considerations related to "empowerment" principles (Peters and Watermann 1982). Employee involvement and responsibility establishes the preconditions for the efficiency of horizontal integration and interdisciplinary project teams. Communication and power relations became decentralized, making it possible to react instantly and directly to fluctuating environments. Quality circles, or groups with formally delegated quality control tasks, became important as well as systems for collecting ideas from employees. Job rotation and functional flexibility, along with integration of functions, were seen as important for individual learning, and the demarcations between different employee groups became blurred and less important. More overall concepts such as Human Resources Development and Performance Related Compensation Systems were also part of these integrative organization structures.

In sum, technological changes and the process of globalisation triggered a wave of new organizational "solutions", which have formed what Kjell Arne Røvik calls global "institutional standards". Basically, this refers to value systems or institutionnal elements related to areas of organization and management, representing competitive advantages for the firms in the new international division of labour (Røvik, 1992, 1998). It was these global "institutional standards" which continuously found their way into the practical configuration of individual firm's work organization as combined "solutions" of the external challenges.

The empirical analyses will investigate how such organizational "solutions", which from a theoretical perspective are expected to promote learning and product or service innovation, have found their way into Danish private sector firms as "institutional standards" over the nineties. The important analytical question is whether the combined "solutions" do in fact in a continuous and significant way improve the chances of product innovation in the individual firm that adopts them. The aim of the analysis here is to identify the new organization forms which by means of their combined "solutions" facilitate learning and the creation, communication and use of knowledge in promoting innovative enterprise behaviour. An important point to bear in mind is that no standard solution or model exists of a "learning organization". Quite the contrary, "learning organizations" are individually shaped organizations, suited to and configured by the individual firm's strategic situation and decisions. In shape and substance, they depend, on the one hand, on the external context and internal frames, and on the other hand on the evolving competences of the human resources.

As already stated, at meso level the local set of institutional elements is an important aspect of the internal relations of the innovation system. We have discussed the new organizational "solutions" as "value systems", and complementary to this we expect that innovative behaviour is strongly related to a firm's embedded organizational competence. Embedded competence relies on the ability and willingness of employees to learn continuously and to develop knowledge as a collective resource, as well as their authority to apply and introduce new knowledge and ideas in the integrative organization. In this perspective we must understand the importance of cooperation as an institutional element inside the individual firm, as well as between firms and customers. Theoretically, cooperation inside firms between employers and employees has been classified as indirect participation when referring to participation through local union representatives and institutions, and direct participation or involvement when it takes place mainly through communicative and cooperative relations between management and employees (Hyman and Mason 1995). Involvement and participation are important standards in the institutional foundation of Danish firms (Nielsen 2004).

Thus, and together with the organisational elements, these standards form the structural and cultural framework for learning and knowledge production. Through the involvement and participation principles applied, it is possible to mobilize the necessary commitment among employees. This commitment is an essential precondition for continuous competence building, learning and knowledge production in a firm. It is a catalyst of the social capital of the firm. From this follows, then, the importance of analysing the employment system as a sub-system complementing the innovation system of enterprises, and of considering the human resources as the most important underlying element of the innovation system (Lundvall op.cit. 2006).

1.4 Employment in enterprises

Studying employment in enterprises usually implies focusing on the following core elements: recruitment, competence development, training, retaining and separation. Analytically, these elements can be approached from a strategic, a tactic or an operational angle. From an analytic point of view, what is of interest is not so much the elements in themselves and how each of them is handled, but rather the general pattern emerging from the relations between the elements and the main principles governing this pattern. Such a pattern can give a general overview and establish a fundamental understanding of how it is ensured that the human resources are continuously in accordance with a firm's quantitative and qualitative needs. Obviously, the systems approach is appropriate in such an analysis. Employment systems are defined as coherent, integrated and dynamic patterns of recruitment, competence development, training, integration and mobility. The dynamic patterns are expected to be determined by business strategy, organization of work processes and job relations inside the firm, and institutions related to employment.

In a Danish context, when it comes to institutions related to employment in enterprises, the unemployment compensation system plays an important institutional role, together with the vocational training system. These systems establish the norms and rules governing labor market flexicurity (Kongshøj Madsen in Bredgaard and Larsen 2005), and they make it relatively easy for firms to adjust employment quantitatively and develop employment qualita-

tively. These institutional elements of flexicurity thus provide a very convenient framework for enterprises to continuously develop and adjust employment. Obviously this is important in relation to the business cycle, but equally so in situations of structural changes in the economy. Generally, these institutional elements are important in order to avoid bottlenecks in an economy dominated by small and medium-sized firms, as is the case in Denmark.

In the same way, Danish industrial relations, as they have been developing for more than a century, are very accommodating for enterprises in situations of change and development. There is a long tradition for cooperation between employers and employees when it comes to implementation of new technology, vocational training and new ways of organizing work processes. This tradition of cooperation has influenced the management principles in many Danish firms, too. The principles are less authoritarian and management is more inclined to listen to and involve the employees or their representatives in decision-making than Anglo-American management. Thus the high labor market flexicurity and the long tradition of cooperation between employers and employees provide an institutional context for employee commitment and involvement which is in most cases strong enough to last in situations of change, restructuring and personnel adjustments in enterprises. It rests on a highly developed social capital and social cohesion (Lundvall 2002).

This is important in situations where the business strategy is based on product innovation and the organization of work based on process flexibility and internal learning. In such situations, the focus is turned on employee qualifications and continuous competence development, situated in the job organization of the firm. It is the continuous development of knowledge, skills, influence and responsibility in relation to job assignments and context which is expected to be the governing normative principle in the employment system, in relation to flexible and learning organizations and product innovation business strategies. Competence and learning becomes the governing principle in integrating the employment system with the needs of the firm's innovation system. This means that job-situated demands of competence and continuous competence development is expected to be the principle determining also the selection of qualifications and the way employees are recruited to positions in

the firm. This principle relates to the training offered, as well as the pattern of integration and mobility.

In sum, the implication of this approach is that when we choose the employment system perspective, we approach personnel matters strategically and related to the organizational and institutional elements of the firm. This opens up for an empirical study of personnel strategies as behavioral patterns independent of "formulated" strategies. It also brings into focus relations between the characteristics of employees, types of jobs and organization of jobs in enterprises. Finally, it establishes a dynamic analytical relation between the internal labor market and the external labor market.

1.5 The integrated system of innovation and employment

Theoretical considerations about the relations between innovation and employment at the macro level date back to the classical economists Marx, Ricardo and later Schumpeter, and theoretical considerations still flourish (see Lundvall 2003). Product innovation and process innovation are considered as having very different employment effects. The immediate impact of product innovation on employment is positive, e.g. if a new business area or market is opened, prices lowered or extra profit gained. However, this again depends on the nature of the innovation. A radical innovation may for instance create a new market, destroying old markets, and for a period of time the innovating firm may find itself in a monopoly situation concerning the pricing of the product. Even local innovations may move market shares from one area to another (Edquist et al. 2001). In this way, product innovation is related to what Schumpeter calls "creative destruction". This means that innovation is related both to the creation of new jobs and the destruction of existing jobs. Besides, product innovations from one industry can be used as process innovation in another industry, which may counteract and complicate the employment effect further.

Generally speaking, process innovation has been related to negative employment effects. New technology increases productivity and substitutes capital for labor, which reduces employment at enterprise level. The labor saving effect of new technology was pointed out early by the classical economist

David Ricardo in his "Principles of Political Economy" (Lundvall 2003), and technological unemployment is a well-known term. On the other hand, there is no doubt that technological innovation is a main source of and has paramount influence on economic growth in the long run. This is mainly due to what has been called the compensation theory. The compensation theory relates back to Karl Marx. It points out certain compensation mechanisms in relation to the negative impacts of new technology on employment. Spiezia and Vivarelli (2000) mention six such compensation mechanisms:

- Compensation via employment creation in the industries producing the new technology
- Compensation via decreases in unit costs and prices, which leads to increase in demand and employment
- Compensation via extra profit, which is invested and generates new jobs
- Compensation via the market mechanisms, which in situations of unemployment decreases wages, resulting in increasing labor demand
- Compensation when increases in productivity is followed by increases in wages, which from a Keynesian point of view increases effective demand and employment
- Compensation via new products, when technical innovations give rise to new products and new markets.

An empirical analysis of the compensation mechanism effects in four OECD countries (Simonetti, Tailor and Vivarelli 2000) shows that compensation via increases in wages followed by increased productivity is significant in all the countries. Compensation via decreasing wages shows significance only when the labor market mechanism is efficient. Compensation via decreased unit costs and prices works only partially, and compensation via new machinery shows only modest significance. Compensation via new capital investments is significant in only one of the cases.

In the present "knowledge economy", ICT has an important innovative role as the "leading technology". This approach to economic development

has already been presented and discussed above. Spiezia and Vivarelli (op. cit. 2000) state that ICT has achieved faster diffusion and higher pervasiveness than previous leading technologies. It is certainly true that ICT can be implemented in a multitude of functions and phases of the business process. ICT has been accused of creating jobless growth, but it is also true that ICT has often boosted growth in employment and economic activity, especially in the business services sector. In that case, ICT compensation via new products also means compensation via new services.

One of the problems with economic analysis of the relationship between innovation and employment is that the relation is considered mainly in quantitative terms at the macro level, and the measures used tend to be rather crude. It is a fact that ICT has strong rationalization and labor saving functions; but recently ICT has developed other important functions such as furthering internal or external information and communication, which have no direct labor saving effects. We have already mentioned Solow's socalled productivity paradox related to ICT. The solution to the productivity paradox seems to have been development of new management and organization forms related to the ICT innovation in enterprises (Velfærds-kommisionen 1995). Such a solution is in harmony with Chris Freeman's techno-economic approach to development. It demonstrates how important it is to analyze the innovation-employment relation in a dynamic meso- and micro-level perspective focusing on the systemic aspects, as proposed in this context. Nominal differentiation of the innovation and employment concepts as well as the organizational and institutional aspects of the relations between the various dimensions of innovation and employment at the enterprise level is of paramount importance in forming propositions on and investigating empirically how the relationship between innovation and employment actually work, to uncover the quantitative and qualitative consequences of it. This means that the analysis must "descend" from the macro and start at the meso- and micro level, from where it can then be accumulated to consequences at the macro level and back to the meso- and micro level again (Lundvall op.cit. 2006).

As for process innovation, this means that the focus must be on the ICT innovations of individual firms in the nineties, and that the growing im-

portance of the information and communication functions should be taken into account when the employment effect of process innovation is considered at enterprise level. From this follows that any labor saving effects of ICT investments are expected to be overruled by the various employment compensation aspects active at the enterprise level. The proposition, which is to be considered in the empirical analysis, is that in the nineties ICT innovation resulted, not in decreasing, but in increasing employment at enterprise level. It is, however, not only the quantitative net employment effects over time that are interesting when analyzing ICT innovation and employment. Gross flows of jobs and employees in and out of firms are interesting and important to consider analytically in relation to ICT innovation, too. We will therefore also focus on the levels of job turnover and labor turnover in firms, in relation to various patterns of ICT innovation in firms up through the nineties.

Another aspect of process innovation is organizational changes and new forms of work organization. As was the case with ICT, organizational change is not only synonymous with labor saving with a main focus on rationalization. There are different kinds of organizational change, with different consequences for employment. Edquist et. al. (2001) points out two types of organizational change: the labor saving and the capital saving. An example of labor saving organization change is "lean production systems". An example of capital saving organization change is "just-in-time systems". This distinction between labor and capital rationalization effects of organizational change is analytically important; however, we can identify another potential effect as well.

This is the human and social capital enhancement effect of building new organizations which establish appropriate frames of learning and knowledge development. Such learning organizations must be expected to have positive effects on a firm's product innovation. As mentioned above, product innovation has positive effects on employment, and an important proposition is that learning organizations promote employment growth through realized ability of product innovation. This is a quantitative effect, but the expected qualitative effects on the work processes and on employment profiles in the firms are

no less interesting, and just as important to analyze empirically in relation to the employment system perspective.

Consequently, the empirical analysis will focus on the demand for various types of employees in firms which have developed learning organization, compared to firms which have not developed learning organization. We are going to analyze and compare developments and changes in the recruitment of employees in relation to education, gender and age over the decade. Recruiting on the external labor market is one of the main channels of achieving and enhancing new knowledge for enterprises (Lundvall 2002). Another way to enhance human knowledge is by competence development within the firm and vocational training of employees.

As the governing principle for integrating the innovation and employment systems of the learning organization, it is important to uncover the frames and the dimensions of competence building which take place inside the firms. We expect to find that the organizational frames and management principles are used actively and deliberately in the process of developing employee competences. Further, we expect competence development to influence the level of job turnover and labor turnover of the firms. Development of firmspecific knowledge among employees is expected to reduce job turnover and employment turnover, because the firms need to retain the intangible knowledge developed among its employees as human capital. This tendency is expected to be strengthened by continuous vocational training activities, which complement the competence development with elements of new knowledge, thus increasing the human capital in the firms.

The need for human capital enhancement in the learning organizations is further expected to influence the personnel strategies of these firms. First of all, it is expected to influence the combination of flexibility measures applied by the firms. We are going to focus analytically on distinctions between internal and external flexibility in the different types of firms. Related to this distinction between internal and external flexibility and the use of the various measures, we will analyze empirically the core-peripheral pattern of employment relations inside firms, and observe how the pattern develops over the decade for various educational groups of employees in the different types of firms. An

interesting point is the integration and mobility of various employee groups. For exits and lay-offs, the empirical destinations of the employees over the ten-year period will be considered. In this way, the dynamic systems perspective of the relations between innovation, organization and employment will include the aspect of personnel politics and strategies of the individual firms in explaining the developments in the human side of the innovation system over the decade.

Chapter 2

The firms in focus and their context

As an introduction to the analysis of innovation and employment systems in Danish private sector firms, we are first going to "set the analytical scene" by giving a description of the structural location and characteristics of the firms. This description will provide an overview of how the panel firms are distributed by size and industry and by age, ownership and export share. The aim of the description is to characterize the conditions or "fields" that the firms operate in. These conditions or "fields" set the structural frames, and are expected to influence the behaviour of the firms, both in relation to innovation and to employment relations. Most of the information on the structural characteristics is cross-section, collected in the 2001 survey, but some of it stems from register data.

One characteristic of the Danish industrial structure is a large share of small enterprises and relatively few large firms. The design of this study ensures that most of the firms with less than 20 employees are excluded. However, due to high employee turnover and the business cycle, firms with less than 20 employees have in some cases been included in the study.

Firm size is considered an important structural factor. We thus expect size to be important in understanding differences in innovation behaviour, organizational flexibility and the ability to adapt to changing external conditions.

Table 2.1 Size of employment in firms in late 2000

Less than 50 employees	50-99 employees	100 + employees	(N)
54.3	15.3	30.4	516

The size of a firm is determined by asking its management representative how many employees the firm had at the end of November 2000. Even with the design excluding firms with less than 20 employees, we get a distribution which is highly skewed. More than 50% of the firms in the panel have less than 50 employees. At the other end, 30% of the firms have 100 or more employees. The middle group with 50-99 employees is the smallest, embracing only 15% of the firms. Though the distribution is skewed in favour of the small firms, the opposite is the case when it comes to employment distribution. Here the big firms with 100 or more in total have the largest number of people employed and thus the largest employee coverage.

Table 2.2 Industry of the firms in late 2000

Manu-facturing	Con-struction	Trade	Other services	Business services	(N)
41.0	16.8	29.0	6.9	6.3	524

Industry is another important factor used to categorize the structural background of a firm. For many reasons, industrial belonging is expected to be the most important structural determinant of the behaviour and organization of firms. In relation to innovation forms and innovative behaviour, we can expect significant differences between firms in manufacturing, construction and services. With its five main industries, the category distribution in table 2.2 represents this perspective of fundamental structural differences.

Manufacturing is the largest industry, including two fifths of the firms. It is an industry spanning many different sub-industries, such as food and beverages, iron and metal and pharmaceuticals. The construction industry is more homogenous, and the organization of work processes in this industry has long traditions which are fundamentally different from what is found in other industries. The service sector is rather heterogeneous, especially business services, which include both low-tech traditional services and high-tech information and communication services. Trade is the largest of the service industries with 29% of the firms. Business services is the smallest with 6%.

The small number of firms in business services may be due to the relative "newness" of major parts of this industry, with many firms founded in the nineties.

Table 2.3 Size of employment and industry of the firms in late 2000

	Manu-facturing	Con-struction	Trade	Other services	Business services	All firms
Empl. < 50	30.3	73.9	70.5	72.2	62.5	54.3
50-99 empl.	17.5	13.6	13.4	16.7	12.5	15.3
100 + empl.	52.1	12.5	16.1	11.1	25.0	30.4
(N)	211	88	149	36	32	516

Table 2.3 shows the size distribution of firms within each industry. It is evident, but also to be expected, that construction has the largest share of small firms. Many of them are probably sole proprietor craftsmen. Manufacturing, on the other hand, has the largest share of big firms. More than half of them have 100 or more employees. Business services, too, have a relatively high share of large firms, but also, as expected, a high share of small firms. This may be an indicator of the heterogeneity of this industry. Trade and other services show similar size distribution, however with a higher share of large firms in trade. In sum, the size distribution shows important differences among industries, which may influence their innovation and employment behavior.

Table 2.4 Year of establishment and industry of the firm

	Manu-facturing	Con-struction	Trade	Other services	Business services	All firms
Before 1960	49.8	35.4	39.3	28.6	9.1	40.3
1960 - 1980	37.0	40.2	43.6	48.6	51.5	41.1
After 1980	13.3	24.4	17.1	22.9	39.4	18.6
(N)	211	82	140	35	33	501

The distribution on year of establishment is interesting, first of all because it mirrors the growth patterns and industrial cycles since the early sixties. It gives some indication, too, of firm ecology and phases from start over maturity towards decline (Hendry 1995). The table shows that among all firms, three fifths were established in 1960 or later. Not surprisingly, business services has the largest share of firms established in 1980 and after. Manufacturing has the largest share, almost 50%, established before 1960. This is an indication of the industrial development from the sixties onward from manufacturing towards service industries. Especially the period between 1960 and 1980 represents a "boom" in establishment of firms in all the industries.

In the period from 1980 onwards, foreign ownership became more and more common, and especially in the nineties many firms became owned by foreign multinational groups. In the tables below, the firms are distributed according to ownership. First in 1996 (table 2.5), and in table 2.6, in late 2000.

Table 2.5 Ownership of the firms in 1996

Part of a group	Single firm	Don't know	(N)
40.9	58.7	0.4	521

In 1996, almost three fifths of the firms in the panel were single, privately owned firms, and two fifths were part of a group. Over a period of five years this structure has changed, so that by the end of 2000, only 45% of the firms in the panel were single, privately owned firms.

Table 2.6 Ownership of the firms in late 2000

Danish group	Foreign group	Single firm	(N)
34.0	20.6	45.4	520

The share of firms owned by foreign groups was more than one fifth by the end of 2000, and Danish groups owned a little more than one third of the firms. The share of foreign-owned firms is one indicator of globalization and the growing internationalization of capital ownership. Of all employment in the firms, foreign group firms employ 27%, Danish group firms employ 52% and single, privately owned firms employ 21%. In the table below, the distribution of ownership on industry is shown.

Table 2.7 Ownership and industry of the firm in late 2000

	Manufacturing	Construction	Trade	Other services	Business services	All firms
Danish group	44.4	29.9	22.0	41.7	24.2	34.0
Foreign group	26.6	1.2	26.0	13.9	15.2	20.6
Single firm	29.0	69.0	52.0	44.4	60.6	45.4
(N)	214	87	150	36	33	520

Among manufacturing firms, we find the largest share owned by a foreign group. Trade, however, has a large proportion as well. It is interesting, and contrary to what might be expected, that business services has a proportion of foreign-owned firms smaller than average. Business services has, on the other hand, one of the largest proportions of privately owned single firms, i.e. not belonging to a group. The largest proportion of single firms is found in construction. This industry has only a very small proportion of firms owned by foreign groups. Here, the ownership structure is approximately 30% Danish groups and 70% single firms. The most even distribution is found among manufacturing firms, but even here Danish groups own 44%, foreign groups own 27%, and 29% are single firms. Apart from construction, the impression from the table is that foreign groups are present and own a fair share of the firms in most industries.

Ownership is one indicator of the increasingly important global orientation and internationalization. Another important indicator is export as a share of turnover. The export share tells us to what extent the firms are oriented

towards the world market and the global economy. Among all panel firms, more than two thirds are on the world market, and almost two fifths have export shares of more than 10% of turnover.

Table 2.8 Export as share of turnover and size of employment in firm in late 2000

	No export	0 – 10% of turnover	More than 10% of turnover	(N)
Employees < 50	43.9	32.9	23.2	280
50–99 employees	27.9	34.2	38.0	79
100+ employees	11.5	22.4	66.0	156
All firms	31.7	29.9	38.5	515

The export orientation is size dependent. In the group of firms with 100 or more employees, only 12% have no export, and 66% have an export share of more than 10% of turnover. In the group of firms with less than 50 employees, we find 44% of firms with no export and 23% with an export share of more than 10% of turnover, or less than half the share of what we find among the large firms.

Table 2.9 Export as share of turnover and industry of firm in late 2000

	No export	0 – 10% of turnover	More than 10% of turnover	(N)
Manufacturing	7.0	20.6	72.4	214
Construction	79.6	20.5	0.0	88
Trade	30.9	50.0	19.1	152
Other services	50.0	22.2	27.8	36
Business services	48.5	24.2	27.3	33
All firms	31.7	29.5	38.8	523

The table of export distribution by industry shows that almost all of the firms in manufacturing are world-market oriented. Only 7% have no export at all and 72% have an export share of more than 10% of turnover. Quite the opposite pattern we find in construction, where 80% of the firms have no export and no firm has an export share of more than 10% of turnover. Among trade firms 69% are export-oriented, but only a moderate number have export shares of more than 10% of turnover. Looking at other services and business services, it is interesting to note that even though this is within the service industry, more than 27% of the firms have export shares amounting to more than 10% of their turnover.

Also ownership obviously matters when it comes to world-market orientation. Among the firms owned by foreign groups, 60% have an export share of more than 10% of turnover, and only 12% have no export at all. The firms owned by Danish groups are also export-oriented, but to a lesser extent than the foreign-owned. 44% have an export share of more than 10% of turnover, and 27% have no export.

Table 2.10 Export as share of turnover and size of employment in firm in late 2000

	No export	0 – 10% of of turnover	More than 10% of of turnover	(N)
Danish group	27.3	29.0	43.8	176
Foreign group	12.2	28.0	59.8	107
Single firm	44.1	30.1	25.9	236
All firms	31.8	29.3	38.9	519

It is interesting, though, that 56% of the single firms are on the export market. Export shares combined with group distribution prove that the panel firms to a large extent are oriented towards the world market and are thus part of the world economy. From this general description of the context of the panel firms, we will proceed in the next chapter to look into the system of innovation and its relations to the system of employment from an

enterprise perspective. We are going to start by studying product and service innovation.

Chapter 3

Product innovation and employment developments

Launching new products or services on the market is the fundamental goal and the ultimate result of a firm's innovative behaviour. Obviously, innovations vary substantially between individual firms, depending on their conditions and context. It may seem a daunting task to try to obtain a meaningful quantitative measure of product innovation and innovative behaviour based on empirical data including information collected from widely different firms, belonging to industries operating under very different conditions, using individually shaped production processes and producing products or services mostly incomparable. However, it is a common feature of innovation and innovative behaviour, as we understand the concept, that it is an expression of a learning process – a learning process and a knowledge production taking place within the firm, in the interplay between different functional groups and various decision levels, and not least in relation to actors in the firm's environment. New products or services on the market are materializations of the firm's collective and dynamic ability to learn and generate knowledge in the face of often turbulent and changing market conditions. It shows willingness to mobilize internal and external resources and move along unknown paths towards more risky fields of business.

It is in this perspective that this chapter intends to set the focus, first on the 524 panel firms' behaviour in relation to product innovation over the ten-year period in the nineties, and then relate this behaviour to employment developments in the firms. In the 1996 and the 2001 surveys, we asked the firms whether they had introduced new products or services on the market, excluding minor improvements of existing products, in a period of two years (1993-1995) and/or (1998-2000).

Table 3.1 Product or service innovation in 1993-95 and/or 1998-2000

	Frequency	Per cent
Product or service innovation 1995+2000	157	32.1
Product or service innovation 1995/2000	166	34.0
No product or service innovation	166	34.0

Based on the responses in 1996 and in 2001 we have classified the firms in three groups, and the result is shown in table 3.1. One group of firms was product innovative both in the first period 1993-1995 and in the second period 1998-2000. This group of firms, embracing 32% of the firms, shows product innovation in two periods, and the probability of their continuous product innovation activities seems high. Another group of firms had been product innovative in the first period 1993-1995 or in the second period 1998-2000. Being product innovative in only one of the two periods means lower probability of continuous product innovation. This group of one-time innovators includes 34% of the firms. The last group had neither been product innovative in the period 1993-1995 nor in the period 1998-2000. This group, covering 32% of the firms, thus has the lowest probability of continuous product innovation. These three groups of firms, almost equal in size, show very different innovation behaviour in the nineties.

In addition to the varying intensity of product innovation behaviour over the period, the resulting innovations can be of varying radicalism. When we ask whether the firm has introduced new products or services on the market as a result of innovation processes in the firm, it is not necessarily new products or services in the sense "new to the market". What matters in the way we define product innovation is that the product or service is new in relation to the production of the individual firm. This is a central point in our learning and knowledge production perspective on innovation. From this angle, it is obvious that a product or service innovation new to the individual firm's production context is not necessarily a new product or service in the market context. In order to uncover the various degrees of radical innovation in relation to the market context, we asked the firms both in 1996 and 2001

whether their innovations already existed on the national market or existed on the world market. By combining this information, we can explore developments in the radicalism of innovations.

Table 3.2 Product or service innovation type in 1993-95 and 1998-2000

	Local (98 – 00)	National (98 – 00)	Radical (98 – 00)	(N)
Local (93 – 95)	86.9	9.5	3.6	84
National (93 – 95)	31.6	42.1	26.3	19
Radical (93 – 95)	53.3	33.3	13.3	15
All (93 – 95)	73.7	17.8	8.5	118

Firms introducing product innovations already known on the national as well as the international market in the first period 1993-1995 can be termed "*local*" innovators. If we focus on innovations in the period 1998-2000 for this group of firms, it is obvious that a large part of the firms are "*local*" innovators in the second period as well. Being a "*local*" innovator in 1993-1995 means a high probability of being a "*local*" innovator, and a low probability of being a "*radical*" innovator in 1998-2000. The next group of firms have introduced product innovations which are new on the national, although known on the international market. This group can be termed "*national*" innovators. The probability that this group of firms are "*national*" innovators in 1998-2000 is also high, but what is more interesting, among all three groups the probability of being a "*radical*" innovator is the highest here. So, being a "*national*" innovator seems to be a good platform for jumping to the next step on the innovation ladder: "*radical*" product innovation.

On the highest step we find the group of firms which have produced innovations new both on the national and the world market; they are the "*radical*" innovators. The group of "*radical*" innovators in 1993-1995 also had a high probability of being "*radical*" innovators in the next period. However, not as high as the "*national*" innovators. In fact, they are frequently "*local*" innovators in the period after. Being a "*radical*" innovator in one period, then, does

not necessarily mean that the firm stays a "*radical*" innovator. However, the propensity for learning and experiences of knowledge development become part of the firm's internal relations and organizational practice, and this is of course important.

In order to go deeper into the question of the relations between management and employees, we have asked the employee representatives in 2001 whether the management is open and sympathetic to new ideas on organizational changes brought forward by the employees, and how responsive employees are to the management concerning ideas for and implementation of product innovations.

Table 3.3 Management–employee relations concerning product or service innovation in the firm

	To a large extent	Some extent	Less extent	Not at all	(N)
Management is open and sympathetic to new ideas from employees concerning new products or services	35.1	50.0	12.8	2.0	148
Employees respond well to management concerning implementation of product development projects	16.2	55.6	23.9	4.2	142
Employees respond well to management concerning ideas for product development projects	14.1	57.8	24.7	3.5	142

Whether the management is open and sympathetic to new ideas from employees concerning new products and services is one indicator of dialog and support from the management for a learning culture among the employees in a firm. The response from the employee representatives to the first question divides the firms into three main groups. One group of 35% of the firms where the management to a large extent is open and sympathetic to new ideas from employees. They are the firms most open to learning dialogs. Another group of 50% of the firms where the management to some extent is open

and sympathetic to new ideas from employees, and finally the group of 15% where the management to a lesser extent or not at all is open and sympathetic to new ideas from employees. Admittedly, this first question is very general and rather abstract. When it comes to ideas and implementation of product development projects, as in the next two questions, the group most open to learning dialogs shrinks to less than half the size, and the group least open to learning dialogs grows considerably. But still, the group "to some extent" in between is the largest with more than 50% of the firms.

The propensity to innovate may vary according to the structural conditions of the firms. In the following, we are going to investigate variations in continuous product innovation in the nineties according to firms' size, industry, ownership and export share.

Table 3.4 Product or service innovation in 1993-95 and/or 1998-2000 by size of employment in firm end-November 2000

	P/S innovation 93-95 and 98-00	P/S innovation 93-95 or 98-00	Not P/S innovative	(N)
Employees < 50	22.3	32.8	44.9	256
50-99 employees	28.6	42.9	28.6	77
100+ employees	52.0	29.7	18.2	148
All firms	32.4	33.5	34.1	481

The group of small firms, with less than 50 employees, is the largest, but also the group that shows the lowest propensity to innovate over the decade. 45% of the firms in this group have not been product innovative in either of the periods surveyed, and only half this proportion was product innovative in both 1993-1995 and 1998-2000. The group of firms with 50-99 employees also has a low propensity to be continuously product innovative in the decade; however, in this group there is a remarkably high proportion which have been innovative in one of the two survey periods. This is interesting because it shows that the medium-sized group contains more innovators, but that lim-

ited resources may hamper continuous initiatives. For medium-sized firms it can be "risky business" to be innovative, because a larger share of the firm's resources is at stake in the innovation process than in big firms. This argument is also in harmony with our findings that the group of 100+ employee firms has the highest probability of being continuously innovative. More than half of these firms have been product innovative in 1993-1995 as well as in 1998-2000. Thus the general pattern of product innovation related to firm size is that the smallest firms have the lowest propensity to innovate. The medium-sized firms have the highest propensity to be "one-time" innovators in the decade, and the biggest firms are most likely to be continuous innovators.

Table 3.5 Product or service innovation in 1993-95 and/or 1998-2000 by industry of firm 2000

	P/S innovation 93-95 and 98-00	P/S innovation 93-95 or 98-00	Not P/ S innovative	(N)
Manufacturing	42.6	37.8	19.6	209
Construction	6.2	27.2	66.7	81
Trade	31.9	31.9	36.2	138
Other services	18.8	34.4	46.6	32
Business services	44.8	34.5	20.7	29
All firms	32.1	34.0	34.0	489

The firms in the manufacturing industry are the strong product innovators. 43% of the manufacturing firms are continuous innovators, and 38% of the firms are one-time innovators over the decade. Only one fifth of the firms did not innovate in either of the periods. Among construction firms we find almost the opposite distribution. Only 6% are continuous innovators and two thirds of the firms do not innovate at all in either period. The construction industry is to a large degree protected from globalization and world market

competition,[5] which may explain the low propensity to innovate. Trade has a pattern of product innovation close to the overall average for all firms, whereas other services is below average on continuous innovators and above average concerning the group of firms with no innovations in the survey periods. It is, on the other hand, in business services we find the largest group of continuous innovators and a below-average group with no innovations in the two periods. In sum, the distributions of product innovation on industry show that two industries stand out in relation to product innovators. It is manufacturing, with high proportions of continuous as well as one-time innovators, and business services, with a high proportion of continuous innovators.

The age of a firm may influence the propensity to innovate, as we expect younger firms to be more innovative, mature firms to be less and old firms to be the least innovative.

Table 3.6 Product or service innovation in 1993-95 and/or 1998-2000 by establishment year of firm

	P/S innovation 93-95 and 98-00	P/S innovation 93-95 or 98-00	Not P/S innovative	(N)
Before 1960	35.4	30.2	34.4	192
1960 – 1980	32.6	37.4	30.0	190
After 1980	28.2	36.5	35.3	85
All firms	33.0	34.3	32.8	467

This expectation would be well in line with the ecology theories of enterprises. However, table 3.6 proves the expectation wrong. The table shows that the oldest firms have the largest group of continuous innovators. The group established between 1960 and 1980 have the largest group of one-time innovators, and the youngest group of firms has the largest group of firms with no innovations in the survey periods. This could have something to do with transformation pressures, which could be most intensive in the oldest of the

[5] A new EU directive on service may change this situation.

firms. Any interpretation of these findings should be cautious, though, because the difference between the groups is not very large.

Table 3.7 Product or service innovation in 1993-95 and/or 1998-2000 by ownership of firm 2000

	P/S innovation 93-95 and 98-00	P/S innovation 93-95 or 98-00	Not P/S innovative	(N)
Danish group	33.1	39.6	27.2	169
Foreign group	51.0	27.5	21.6	102
Single firm	22.2	32.9	44.9	216
All firms	32.0	34.1	33.9	487

An interesting dimension in relation to innovation behaviour is ownership of the firm. Table 3.7 shows that single firms have the largest group of firms with no product innovation in the periods surveyed. Danish group firms have the largest share of one-time innovators and foreign group firms have the largest proportion of firms with innovation in both the periods. This distribution may be an indication of the importance of economic resources or international influence, and not least of the importance of the international or global dimension, on the propensity to innovate among firms.

Table 3.8 Product or service innovation in 1993-95 and/or 1998-2000 by share of export of turnover in 2000

	P/S innovation 93-95 and 98-00	P/S innovation 93-95 or 98-00	Not P/S innovative	(N)
No export	14.7	27.0	58.1	148
0 – 10% of turnover	32.2	36.3	31.5	146
More than 10% of turnover	45.4	37.1	17.5	194
All firms	32.2	33.8	34.0	488

Table 3.8 follows up and further supports the argument on the importance of the international or global dimension for a firm's propensity to innovate. The table shows that among firms with an export share of more than 10% of turnover, 45% have performed product innovation in both periods, and 37% in either 1993-1995 or 1998-2000. In this group of firms operating on the world market, we find the smallest share of firms with no product innovation in the survey periods. In the group of firms with export shares from 0-10% of turnover, we find a slightly higher than average proportion of firms with innovations either in 1993-1995 or in 1998-2000. The group of firms with no export – home-market firms – has below average proportions of continuously innovative as well as one-time product innovative firms in the decade.

Up till now, analyzing the firms' propensity to innovate has shown that size matters. Obviously, bigger firms are more inclined to be continuous product innovators. Among the various industries, manufacturing and business services are outstanding product innovators compared to the rest. Lastly, a global orientation, both on input and output, matters for the propensity for innovation. In the last section of this chapter we are going to investigate the relationship between propensity to innovate and employment developments in the firms. The firms will be classified according to whether they have been continuous innovators (P/S95+00), one-time innovators (P/S95/00), or not innovators (Not P/S) in the decade.

The table on the next page shows that the group of continuously innovating firms (P/S 95+00) consists of large firms. They employ more than twice as many employees as the one-time innovators. If we observe the net employment trend for this group, given by the index values over the period, we can see a slight decline in the early years of the decade. After 1993 an increase in the index can be observed. However, this higher employment level decreases after 1997 and the final value of the index for this group is 101. The group of firms with product innovations either in 1993-1995 or in 1998-2000 (P/S 95/00) generally has higher index values of employment. Even though the index value of 1993 is low, this group of firms ends up with the highest index value in 1999.

Table 3.9 Employment in panel firms by product or service innovation in 1993-95 and/or 1998-2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
P/S 95+00	27992 = 100	98.6	97.2	97.5	105.3	109.6	105.3	108.3	102.5	101.1
P/S 95/00	12921 = 100	103.5	101.1	96.1	101.0	105.4	104.8	114.0	106.6	105.7
Not P/S in	8985 = 100	98.9	96.9	93.3	99.7	95.7	89.7	88.5	89.0	88.7
All firms	49898 = 100	100.0	98.1	96.4	103.2	106.0	102.3	106.2	101.1	100.1

It seems as if this group of firms has the strongest growth pattern of employment, compared both to the group of continuous innovators and the group with product innovation neither in 1993-1995 nor in 1998-2000. We could be dealing with a group of firms which are product innovative, but have longer product cycles. This might be one explanation of the difference related to the group with product innovation in both 1993-1995 and 1998-2000. The group of firms with no product innovation in the periods surveyed has the lowest index numbers of employment over the period, and a decline in the last part of the decade. Generally, the pattern of employment developments shows that firms which are product innovative in the decade increase their employment. Firms which do not innovate in the periods lose jobs. But even among firms in the groups with net employment growth, we may find some job losses. In the table on the next page, job creation and job destruction is shown for the different groups of firms. The calculation of job creation and job destruction is performed at enterprise level. The amount of jobs in the individual firm is summed up at the end of November and this sum is compared to the sum of jobs in the same firm at the end of November the year after. If the sum of jobs after one year is larger, job creation has taken place. If the sum of jobs is smaller, we have job destruction. This calculation is performed for each individual firm and then aggregated up to sums of job crea-

tions and sums of job destruction for the various groups of firms. The rates of job creation and job destruction are then calculated by dividing the sums of jobs created and the sums of jobs destroyed by the sum of end-November employment at the beginning of each one-year period for the various groups of firms.

Table 3.10.1 Job creation and job destruction in panel firms in 1990-91 to 1993-94 by product or service innovation in 1993-95 and/or 1998-2000

	Jobs 1990 – 91		Jobs 1991 – 92		Jobs 1992 – 93		Jobs 1993 – 94	
	Created	Destroyed	Created	Destroyed	Created	Destroyed	Created	Destroyed
PS 95+00	4.1	5.5	3.1	4.6	4.6	4.3	9.5	1.4
PS 95/00	7.6	4.1	4.9	7.2	3.9	8.8	9.4	4.3
No PS	7.4	8.5	5.5	7.6	6.2	9.9	12.0	5.1
All firms	5.6	5.6	4.0	5.8	4.7	6.5	9.9	2.8

Table 3.10.2 Job creation and job destruction in panel firms in 1994-95 to 1998-99 by product or service innovation in 1993-95 and/or 1998-2000

	Jobs 1994 – 95		Jobs 1995 – 96		Jobs 1996 – 97		Jobs 1997 – 98		Jobs 1998 – 99	
	Created	Destroy	Created	Destroy	Created	Destroy	Created	Destroy	Created	Destroy
PS 95+00	6.4	2.3	3.0	6.9	5.2	2.3	2.9	8.3	3.9	5.3
PS 95/00	7.7	3.3	4.4	5.1	12.3	3.5	4.6	11.1	4.8	5.6
No PS	8.5	12.5	3.9	10.2	5.2	6.6	5.9	5.3	6.1	6.4
All firms	7.1	4.3	3.5	7.0	7.1	3.3	3.8	8.6	4.5	5.6

In most of the period, the rate of job destruction is lowest for the group of firms with product innovations in 1993-1995 and in 1998-2000. The rate of job creation is comparatively low as well, and generally these firms have the lowest job turnover among the three groups. This may be due to a general propensity to retain employees because they represent firm-specific knowledge and learning competences in these firms. In this way, the employees

represent an important resource in the strategy of continuous innovation. The group of firms with product innovation in either 1993-1995 or 1998-2000 has higher rates of job destruction than the group of firms with continuous innovation over most of the decade. The rates of job creation increase for the one-time innovators and are higher in the last part of the decade, from 1994-1995 onwards, compared to the continuous innovators. The group of firms with no product innovation has the highest job turnover in the decade. The general pattern is that the most innovative firms have the lowest job turnover. Continuous innovation strategies may lead to the most balanced growth and to personnel strategies of retaining knowledge resources and learning competences, which these firms consider important. This may well have depressed their job turnover in the decade. Another reason could be that the continuously innovating firms are larger, and large firms tend to have lower job turnover (Davis, Haltiwanger & Shuh 1994). In order to investigate this explanation, we will now compare job turnover in smaller firms.

Table 3.11.1 Job creation and job destruction in panel firms in 1990-91 to 1993-94 with less than 50 employees by product or service innovation in 1993-95 and/or 1998-2000

	Jobs 1990 – 91		Jobs 1991 – 92		Jobs 1992 – 93		Jobs 1993 – 94	
	Created	Destroyed	Created	Destroyed	Created	Destroyed	Created	Destroyed
PS 95+00	9.6	6.0	4.3	6.6	5.8	7.7	7.1	2.9
PS 95/00	6.6	6.1	8.4	6.9	6.4	6.4	11.5	5.1
No PS	9.4	7.2	6.6	8.2	10.8	7.8	10.7	3.7
All firms	8.6	6.6	6.6	7.5	8.4	7.4	10.2	3.9

Table 3.11.2 Job creation and job destruction in panel firms in 1994-95 to 1998-99 with less than 50 employees by product or service innovation in 1993-95 and/or 1998-2000

	Jobs 1994 – 95		Jobs 1995 – 96		Jobs 1996 – 97		Jobs 1997 – 98		Jobs 1998 – 99	
	Created	Destroy	Created	Destroy	Created	Destroy	Created	Destroy	Created	Destroy
PS 95+00	8.8	4.6	6.9	3.1	8.1	3.6	7.4	4.7	5.8	6.0
PS 95/00	9.2	4.1	5.3	9.3	7.8	5.6	6.1	6.1	5.0	7.5
Not PS	10.0	21.8	5.5	10.5	7.3	6.4	7.0	6.9	3.8	8.8
All firms	9.5	13.1	5.7	8.5	7.7	5.5	6.8	6.1	4.7	7.7

Compared to the overall figures for job creation and job destruction in table 3.10, the figures for job creation and job destruction in firms with less than 50 employees are higher. This was to be expected. Small firms tend to grow faster and sometimes decline faster than large firms. The difference between the three groups in table 3.11 is not all that marked. The average among all firms is 7.6 for job creation and 7.4 for job destruction. For the group of firms with product innovation in 1993-1995 as well as 1998-2000, the average for job creation is 7.1 and for job destruction 5.0. This makes an average job turnover of 12.1, which is moderate. The group of firms with no product innovation in the periods has an average job creation of 7.9, which is 0.8 points higher than the innovative firms. The average job destruction for the firms with no product innovations is 9.0, which is 4.0 higher than the rate of job destruction for the innovative firms. The average job turnover is here 16.9. This is 4.8 higher than the average job turnover of the continuously innovative firms. We are thus allowed, in other words, to hold on to the conclusion we stated above that product innovative firms have more moderate job turnover than firms without product innovation. Later in this book we will investigate in more depth the explanations concerning personnel strategies for retaining knowledge resources and learning competences in the firms. Before that, however, we are going to look into other elements of

the innovation system, empirically from the enterprise perspective. First we will focus on the ICT innovations of the firms.

3.1 Concluding observations

The main results from this analysis of product innovation and employment developments are that:

- The propensity to innovate varies a good deal among the panel firms. 32% of them have a high probability of continuous product innovation, 34% show product innovation in one of the two periods, whereas 34% have no product innovations in either period.

- Local innovators in the first period have a high probability of also being local innovators in the next period. Being a national innovator in the first period means a high probability of being a national, or radical, innovator in the next period. However, radical innovators in the first period are less likely to be radical innovators in the second period.

- The smallest firms have the lowest propensity to innovate. The medium-sized firms have the highest propensity to be "one-time" innovators in the decade, and the biggest firms are most likely to be continuous innovators.

- Two industries stand out in relation to product innovation. It is manufacturing, with high proportions of continuous as well as one-time innovators, and business services, with a high proportion of continuous innovators.

- Among foreign group firms, there is a large proportion with innovation in both periods. Danish group firms have a large share of one-time innovators; single firms have a large group of firms with no product innovation in either of the periods surveyed.

- The firms that are product innovative in the decade increase their employment. The one-time innovators show the strongest growth pattern. Employment among continuous innovators grows as well, but more moderately. Firms that do not innovate in the periods lose jobs in the decade.

- The most innovative firms have the lowest job turnover. Continuous innovation strategies seem to imply the most balanced growth and personnel strategies of retaining knowledge resources and learning competences, which these firms consider important

Chapter 4

Process innovation: ICT and employment dynamics

A very important element of the innovation system, as it has been developing since the eighties, is ICT. We have already discussed the role of ICT as a leading technology in the knowledge economy, and the knowledge economy as a techno-economic paradigm. Since the mid-eighties, the use of ICT has increased dramatically in all aspects of business areas, and the functions of ICT have developed from a main emphasis on rationalization towards internal information and external communication. With shorter and shorter cycles, new "generations" of this technology create new possibilities for flexibility, instant adjustments and longer-term opportunities in various business and production functions. This means that ICT innovation can be seen as a continuous phenomenon, almost in the same way as product innovation can be continuous. In fact ICT innovations are basically product innovations, but when implemented as new technology in the firms, they become process innovations. Adopting new information and communication technology, i.e. not just upgrading systems already in use, always means change in work processes and communication inside the firm or in relation to the firm's environment. In both the 1996 and the 2001 surveys we asked the firms whether they had introduced new information and communication technology in the periods of two years (1993-1995) and (1998-2000), excluding mere upgradings of already existing systems.

Table 4.1 ICT innovation in 1993-95 and 1998-2000

	Yes (98 – 00)	No (98 – 00)	Don't know (98 – 00)	(N)
Yes (93-95)	67.5	31.3	1.2	323
No (93-95)	41.4	56.9	1.7	174
Don't know (93-95)	62.5	37.5	0.0	16
All (93-95)	58.5	40.2	1.4	513

Table 4.1 shows that among the group of firms introducing new ICT in the period 1993-1995, two thirds also introduced new ICT in the period 1998-2000. This proportion should be compared with the group of firms which did not introduce new ICT in the period 1993-1995; of them only 41% invested in new ICT in the period 1998-2000. This is much below the average for all firms, and it is even below the "don't know's" in 1993-1995, where 63% introduced new technology in 1998-2000. The group of firms introducing new ICT in 1993-1995 as well as in 1998-2000 has the highest probability of continuous cycles, and can be called the continuous ICT innovators. The group of firms introducing ICT either in 1993-1995 or in 1998-2000 is called the one-time ICT innovators, and the two ICT innovating groups will be compared to the third group of non-ICT innovating firms in the analysis. First, we are going to investigate the empirical relation between product innovation and process innovation as ICT investments in the nineties.

Table 4.2 P/S Innovation and ICT Innovation

	ICT Innovation 95+00	ICT Innovation 95/00	No ICT Innovation
P/S Innovation 95+00	65.3	32.0	2.7
P/S Innovation 95/00	47.2	35.9	17.0
No P/S Innovation	20.9	38.0	41.1

Among the group of firms product-innovative in 1993-1995 as well as 1998-2000, almost two thirds introduced new ICT in both periods. Nearly one third introduced ICT in one of the periods, and only 3% of the firms did not introduce new ICT in either period. This indicates a strong relation between probability of continuous product innovation and probability of continuous process innovation through ICT. If we take the group of firms which were product innovative in either 1993-1995 or in 1998-2000, 47% are process innovative in both periods, and 36% are process innovative in one of the two periods. Among these firms, 17% did not introduce ICT in either of the periods. The last group with no product innovation in the periods surveyed has a rather low probability of process innovation, too. 41% of the firms were not ICT innovative in either period, 38% were innovative in one of the two periods, and 21% of the firms were ICT innovative in 1993-1995 as well as 1998-2000. An obvious question following the exposed empirical relationship between the two innovation forms concerns the driving forces behind a firm's investment in ICT. We asked about the driving forces behind ICT investments in the firms for the period 1998-2000.

Theoretically, we have stated a proposition expecting developments in ICT purposes to shift from rationalization towards information and communication. This is in accordance with Zuboff (Zuboff 1985) and it seems to find support in the pattern of responses as to the driving forces behind ICT innovation. Among all firms, 43% mention "a more efficient exploitation of internal/external knowledge" and "faster communication with customers or subcontractors". 40% mention "faster internal communication within the firm" and only 13% mention "shorter production time", while 26% mention "labor cost reductions".

Table 4.3 Driving forces of ICT innovation in 1998-2000 (Per cent yes answers)

	Internal/ external know-ledge	Customer/ subcontrac-tor commu-nication	Inter-nal commu-nication	Flexi-bility in product	Conti-nuous develop-ment	Shorter produc-tion time	Labor cost reduc-tion
ICT 95+00	75.7	75.7	71.1	25.2	22.0	23.9	44.0
ICT 95/00	25.4	26.0	23.1	11.0	7.5	5.2	17.9
All firms	42.7	42.9	39.8	15.1	12.7	12.6	25.9

For the group of firms ICT innovative both in 1993-1995 and 1998-2000, the proportion answering "yes" to the first two "information and communication" driving forces is three fourths, and 71% for the third of these driving forces. However, the most interesting thing is that a third purpose seems to be emerging among the firms responding "greater flexibility of production" and "continuous development of products and services". This purpose may be named "innovative" in the sense that it intends to strengthen and further the innovative behavior in the firm. Between 25% and 22% of the firms in the group of continuously innovative firms (ICT 95+00) mention these two driving forces. That is more than double of what we find among firms in the group of one-time ICT innovators. This seems to be evidence that the firms investing most frequently in ICT in the decade also develop new purposes related to the internal innovation system, even though the rationalization purpose is still significantly present among these firms.

Table 4.4 ICT innovation in 1993-95 and/or 1998-2000 by size of employment in firm end-November 2000

	ICT innovation 93-95 and 98-00	ICT innovation 93-95 or 98-00	Not ICT innovative	(N)
Employment < 50	35.9	36.3	27.8	259
50-99 employees	46.1	36.8	17.1	76
100+ employees	58.5	33.3	8.2	147
All firms	44.4	35.5	20.1	482

Table 4.4 shows that the propensity for ICT innovation is size dependent. 28% of the small firms with less than 50 employees did not innovate in either of the periods surveyed, compared to 17% of the medium-sized firms with 50-99 employees, and 8% of the large firms with 100 or more employees. The big firms are very active indeed on the ICT innovation front. That size matters is obvious from the fact that a much higher proportion of the big firms are ICT innovative in 1993-1995 as well as in 1998-2000. Almost three fifths of the 100+ firms are continuously ICT innovative in the decade, and 46% of the medium-sized firms, compared to 36% of the small firms. If we look at the differences between the size groups concerning ICT innovation in either 1993-1995 or in 1998-2000, they are only marginal.

Table 4.5 ICT innovation in 1993-95 and/or 1998-2000 by industry of firm in 2000

	ICT innovation 93-95 and 98-00	ICT innovation 93-95 or 98-00	Not ICT innovative	(N)
Manufacturing	52.0	35.0	13.0	200
Construction	26.5	30.1	43.4	83
Trade	39.4	43.0	17.6	142
Other services	45.7	31.4	22.9	35
Business services	66.7	20.0	13.3	30
All firms	44.5	35.3	20.2	490

Of all the industries, it is business services firms which score highest on continuous ICT innovation in the nineties. Two thirds of the business services firms have invested in new ICT in 1993-1995 as well as in 1998-2000. This is a much higher proportion than the second-highest found, which is manufacturing firms with a proportion of 52%. It is interesting that business services score low on one-time ICT innovation as well as on not being ICT innovative. The reason for the intensive ICT innovation in business services is probably that ICT process innovation is often a necessary prerequisite for the service innovations in this industry. Manufacturing also has a high proportion of ICT innovation, but this is leveled out between continuous and one-time innovations. Together with business services, manufacturing has the lowest proportion of firms with no ICT innovation in the survey periods. The highest proportion of no ICT innovation is found among construction firms, where more than two fifths have no ICT innovation. Trade has a high frequency of one-time ICT innovators. Contrary to business services, they may not be as dependent on ICT innovation in their product or service innovation strategy.

Table 4.6 ICT innovation in 1993-95 and/or 1998-2000 by establishment year of firm

	ICT innovation 93-95 and 98-00	ICT innovation 93-95 or 98-00	Not ICT innovative	(N)
Before 1960	43.5	38.2	18.3	191
1960 – 1980	47.7	31.6	20.7	193
After 1980	44.7	35.3	20.0	85
All firms	45.4	35.0	19.6	469

It is interesting, and contrary to expectations, that there are only minor differences between the groups of firms of various ages in relation to the frequency of ICT innovation. Firms established between 1960 and 1980 have a slightly higher proportion of continuous ICT innovators and a lower proportion of one-time ICT innovators. Firms established before 1960 have almost the same

pattern of ICT innovations as firms established after 1980. In other words, it is not possible to identify any "generation" effect on ICT innovation.

Table 4.7 ICT innovation in 1993-95 and/or 1998-2000 by ownership of firm in 2000

	ICT innovation 93-95 and 98-00	ICT innovation 93-95 or 98-00	Not ICT innovative	(N)
Danish group	45.9	37.8	16.3	172
Foreign group	53.1	36.7	10.2	98
Single firm	39.5	32.6	28.0	218
All firms	44.5	35.3	20.3	488

Compared to age groups, ownership reveals a much more pronounced influence on ICT innovation. Single firms have a moderate proportion of continuous ICT innovators and a below average proportion of one-time innovators in the two periods. Firms owned by foreign groups, on the other hand, have markedly higher proportions of continuous ICT innovators and also an above average share of one-time ICT innovative firms. Danish group firms are close to the average of continuously ICT innovative firms and well above average in relation to one-time ICT firms. It seems that the globalization dimension is important in relation to process innovation, just as it is in relation to product innovation.

The importance of the globalization dimension is confirmed by the fact that firms with an export share of more than 10% of turnover have a proportion of 56% who are ICT innovative in 1993-1995 as well as in 1998-2000. The firms most export-oriented are a little less inclined to be one-time ICT innovative, and they have the lowest proportion of not-ICT innovative firms.

Table 4.8 Product or service innovation in 1993-95 and/or 1998-2000 by share of export of turnover in 2000

	ICT innovation 93-95 and 98-00	ICT innovation 93-95 or 98-00	Not ICT innovative	(N)
No export	33.3	32.7	34.0	156
0 – 10% of turnover	41.8	41.1	17.1	146
More than 10% of turnover	55.6	33.2	11.2	187
All firms	44.4	35.4	20.3	489

Firms with export shares less than 10% of turnover are a little below average of the continuously ICT innovative, and somewhat above average of the one-time ICT innovative. No-export firms have a high proportion of not-ICT innovative firms. They are far below the average of continuously innovative firms and slightly below average of the one-time ICT innovative firms. This general pattern could be said to support the proposition that the function of ICT has developed from rationalization towards internal information and external communication. It may also give support to the proposition that ICT has developed important functions related to innovation. Next, we are going to investigate the extent to which the rationalization and labor cost reduction functions overrule the information, innovation and communication functions.

Table 4.9 Employment in panel firms by ICT innovation in 1993-95 and/or 1998-2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
ICT 95+00	29664 = 100	100.6	98.5	97.1	104.3	108.5	103.7	106.0	102.1	102.3
ICT 95/00	15774 = 100	99.4	96.1	91.6	96.2	98.9	97.5	107.0	99.3	96.6
Not ICT	4137 = 100	95.9	100.3	101.2	110.9	101.1	102.2	95.2	94.9	94.1
All firms	49575 = 100	99.8	97.9	95.7	102.3	104.8	101.6	105.4	100.6	99.8

If we compare the group of firms which have innovated in both periods, 1993-1995 as well as 1998-2000, with the group of firms which did not innovate in either period, it is obvious that the firms with a high probability of continuous ICT innovations, i.e. having innovated in both periods, perform better on employment growth than the non-innovators. Both groups show a cycle peaking in the mid-nineties, but the continuous ICT innovators continue with index numbers above 100, and end up with the highest index number among the three groups. This means a job gain of 679 jobs over the decade. On the other hand, the group of firms with no ICT innovation loses 244 jobs in the period. The group of firms with either ICT innovation in 1993-1995 or in 1998-2000 loses 539 jobs in the decade. This is indeed a surprising result. Even though the group of continuous ICT innovators frequently mentioned "more efficient exploitation of internal/external knowledge", "faster communication with customers or subcontractors" and "faster internal communication within the firm" as driving forces of their ICT innovation, almost one fourth mentioned "shorter production time", while 44% mention "labor cost reductions" as driving forces. Nevertheless, the net employment development is positive, which means that the indirect compensation effect of strengthened competition does in fact dominate. Still, new technology and demands for qualifications may have influenced employee turnover. In the table below,

the rates of hiring and separations are shown for the three groups of firms. The hiring rate is calculated as the aggregated number of hirings for a year in each firm relative to the number of employees in the firm at the end of the year. The separation rate is calculated as the aggregated number of separations in each firm for a year relative to the number of employees in the firm at the beginning of the year.

Table 4.10.1 Hiring and separations in panel firms in 1990-91 to 1993-94 by ICT innovation in 1993-95 and/or 1998-2000

	1990 – 91		1991 – 92		1992 – 93		1993 – 94	
	Hiring	Separation	Hiring	Separation	Hiring	Separation	Hiring	Separation
IT 95+00	18.2	16.0	16.7	16.6	14.8	16.1	13.7	15.6
IT 95/00	21.7	19.1	18.5	19.1	16.2	21.3	16.3	18.9
Not ICT	29.2	24.0	19.0	21.5	24.2	22.6	20.8	22.8
All firms	20.2	17.7	17.4	17.8	16.1	18.3	15.1	17.2

Table 4.10.2 Hiring and separations in panel firms in 1994-95 to 1998-99 by product or service innovation in 1993-95 and/or 1998-2000

	1994 – 95		1995 – 96		1996 – 97		1997 – 98		1998 – 99	
	Hiring	Sepn.	Hiring	Sepn.	Hiring	Sepn.	Hiring	Sepn.	Hiring	Sepn.
IT 95+00	20.4	-	20.5	18.2	14.3	15.6	17.8	-	17.5	17.5
IT 95/00	21.9	-	21.1	20.3	17.4	17.6	26.5	-	18.8	18.0
Not ICT	31.9	-	27.8	24.0	26.4	27.1	22.2	-	22.5	21.2
All firms	21.8	-	21.3	19.3	16.2	17.1	20.9	-	18.3	18.0

Due to missing data the separation rates for 1994-95 and 1997-98 are not calculated and presented in the table.

ICT innovation in the nineties does not seem to have influenced the level of hiring and separation rates profoundly. The group of firms which innovated in 1993-1995 as well as 1998-2000 has an average hiring rate of 17.1 with a standard deviation (s.d.) of 2.48 and an average separation rate of 16.5, and

an s.d. of 0.99. This average separation rate is the lowest among all groups and the dispersion is small. The level of averages should be compared to the group of firms which did not innovate in either of the periods. This group of firms has an average hiring rate of 24.9 with an s.d. of 4.23, and an average separation rate of 23.3 and an s.d. of 1.99. Those are the highest turnover figures among the three groups of firms. The analysis first of all lends evidence to the conclusion that ICT innovation does not mean jobless growth, provided that the new technology sharpens and deploys the internal information and external communication processes, which are of utmost importance for flexibility and instant response, as well as for product and service innovation.

4.1 Concluding observations

New information and communication technology means changes in work processes inside the firm or in relation to the firm's environment. The main results from the analysis of new ICT as process innovation are that:

- Among the group of firms introducing new ICT in the period 1993-1995, two thirds also introduced new ICT in the period 1998-2000. This group is called the continuous ICT innovators.

- There is a strong relation between probability of continuous product innovation and probability of continuous process innovation through ICT.

- Firms investing most frequently in ICT also give high priority to new purposes related to the internal innovation system, though the rationalization purpose is still significantly present.

- Large firms are very active on the ICT innovation front. Almost three fifths of the 100+ firms are continuously ICT innovative in the decade.

- Among industries, it is business services which score highest on continuous ICT innovation. Manufacturing is second highest with a score well below business services.

- Firms owned by foreign groups and firms with an export share of more than 10% of turnover have a higher than average proportion of continuous ICT innovators.

- High probability of continuous ICT innovations means better performance on employment growth. The continuous ICT innovators gain 679 jobs over the decade, while the group of firms with no ICT innovation loses 244 jobs in the same period.

- Continuous ICT innovation does not influence the level of hiring and separation rates profoundly. The continuous ICT innovator's average separation rate is the lowest among all groups and the dispersion is small.

Chapter 5

Process innovation: Organizational change, employment and training

New information and communication technology has been an important element of process innovation, and thus of the innovation system in Danish firms. This technology has an impact on productivity, directly as well as indirectly, in combination with organizational change. The importance of the so-called total factor productivity (TFP) has been on the increase in the nineties. TFP represents new creative combinations of the productivity factors capital and labor. In this connection, organization of production processes is an important element. Many new organizational solutions and devices emerged in the eighties and nineties. Parallel to the technology wave, organizational concepts such as quality, empowerment, diversification and flexibility came to constitute global, so-called "institutional standards": value systems related to areas of organization, offering ways of achieving competitive advantages in a turbulent and changing economic situation, with a new international division of labor etc. (Røvik 1992 & 1998). It was such global "institutional standards" which had to find their way, and often did, from external standards into operative dimensions in the practical configurations of individual work organizations all over the industrialized world. These considerations, which we discussed in relation to the innovation system in the first chapter, and not least their economic implications, are important reasons why empirical research into new organization forms gathered momentum worldwide in the nineties (OECD 2001).

5.1 Important organizational changes in the nineties

In order to get an impression of the scope of organizational change in Danish firms up through the nineties, we will start by investigating the empirical

pattern of important organizational changes implemented by the firms in the period 1993-1995 and/or 1998 - 2000.

Table 5.1 Important organizational change in 1993-95 and 1998-2000

	Yes (98 – 00)	No (98 – 00)	Don't know (98-00)	(N)
Yes (93 - 95)	67.2	31.4	1.5	274
No (93 - 95)	29.3	69.9	0.8	239
Don't know (93 - 95)	20.0	80.0	0.0	5
All (93 – 95)	49.2	49.6	1.2	518

Table 5.1 shows that that the propensity to implement important organizational change in the period 1998-2000 among all firms in the panel is almost fifty-fifty. Among the firms having implemented important organizational change in the period 1993-1995, two thirds also performed important organizational change in the period 1998-2000. Recalling table 4.1, it is interesting to note that we found almost exactly the same distribution for firms introducing new ICT in the two periods. On the other hand, the propensity of firms, which did not engage in organizational change in 1993-1995, to perform important organizational change in 1998-2000 is much lower than it was in relation to new ICT. In fact, less than 30% of the not-innovative firms in 1993-1995 are organizationally innovative in 1998-2000. Given that a firm was not organizational innovative in 1993-1995, the chance of conformity is high. The firm stays in the same mode in the next period 1998-2000. However, we need to dig somewhat deeper into the question of organizational change and investigate the drivers behind the change processes. We asked the firms what the primary objective of the organizational change had been.

Table 5.2 Driving forces behind important organizational change in 1993-95 and/or 1998-2000 (Percent "to a large extent" answers)

	Effectiveness	Cooperation	Surroundings	P/S innovation	Knowledge	Quality
ORG 95+00	71.2	55.7	47.5	27.7	31.6	48.6
ORG 95/00	68.1	38.2	49.3	33.8	20.6	48.6
All firms	70.3	50.8	48.0	29.4	28.6	48.6

In table 5.2 the driving forces behind organizational change are compared between the group of firms which was organizationally innovative in 1993-1995 as well as 1998-2000 (ORG95+00), and the group of firms which was organizationally innovative in one or the other of the two periods (ORG95/00). The firms which have been continuously organizationally innovative in the two periods score higher on "effectiveness of daily work" (effectiveness), "cooperation and coordination across the organization" (cooperation) and "ability continuously to strengthen and renew knowledge and know how" (knowledge). The difference between the two groups is largest in relation to "cooperation" and "knowledge". It is obvious that for this group of firms, communication of useful knowledge is an important objective of organizational change, but "quality and customer service" (quality) is important, too. The firms which were organizationally innovative in either 1993-1995 or 1998-2000 score higher on "ability to adapt to more turbulent surroundings" (surroundings) and "ability to continuously develop new products or services" (P/S innovation); however, the difference between the groups is not very marked.

Table 5.3 Correlation between the driving forces behind important organizational change in the periods 1993-95 and 1998-2000.

	Efficiency 00	Co-operation 00	Surrounding 00	P/S innovation 00	Knowledge 00	Quality 00	Efficiency 95	Co-operation 95	Surrounding 95	P/S innovation 95	Knowledge 95
Efficien 00	1.00	0.10	0.15*	0.06	0.03	0.17*	0.24*	0.01	0.08	0.08	0.07
Cooper 00	0.10	1.00	0.22*	0.23*	0.32*	0.26*	0.13	0.16*	-0.03	0.08	0.05
Surroun 00	0.15*	0.22*	1.00	0.32*	0.30*	0.23*	0.14	0.11	0.18*	0.18*	0.06
P/Sinno 00	0.05	0.24*	0.32*	1.00	0.52*	0.27*	0.05	-0.00	0.10	0.17*	-0.01
Knowl 00	0.03	0.32*	0.30*	0.52*	1.00	0.36*	0.04	-0.04	0.16*	0.20*	0.08
Quality 00	0.18*	0.26*	0.23*	0.27*	0.36*	1.00	0.19*	0.12	0.21*	0.08	0.04
Efficien 95	0.24*	0.13	0.14	0.05	-0.04	0.19*	1.00	0.38*	0.29*	0.18*	0.30*
Cooper 95	0.01	0.16*	0.11	-0.00	-0.04	0.12	0.38*	1.00	0.28*	0.13*	0.23*
Surroun 95	0.08	-0.03	0.18*	0.10	0.16*	0.21*	0.29*	0.28*	1.00	0.34*	0.35*
P/Sinno 95	0.08	0.08	0.18*	0.17*	0.20*	0.08	0.18*	0.13*	0.34*	1.00	0.51*
Knowl 95	0.07	0.05	0.06	-0.01	0.08	0.04	0.30*	0.23*	0.35*	0.51*	1.00

* Correlation coefficients significant on at least 0.05 level

Table 5.3 shows a correlation matrix covering the objectives of organizational change stated by the firms in 1993-1995 and the objectives stated by the same firms in 1998-2000. Most interesting are the correlations across the two periods. Among the objectives stated in 1993-1995, "ability to continuously develop new products or services" and "ability to adapt to more turbulent surroundings" correlate with many of the objectives, such as cooperation and knowledge building in 1993-1995 as well as 1998-2000. Among the objectives stated in 1998-2000, it is "quality and customer service" together with

"ability continuously to strengthen and renew knowledge and know how" and "ability to adapt to more turbulent surroundings" which correlate with most other objectives across the periods. The correlation analysis is evidence of the importance attached to building new organizations in order to be able to adapt to the more turbulent surroundings. The internal and external adaptation is furthered by important measures, such as cooperation and coordination across the organization, the ability to continuously strengthen and renew knowledge and know-how, and quality as well as customer service.

Table 5.4 Organizational change in 1993-95 and/or 1998-2000 by size of employment in firm end-November 2000

	Org. change 93-95 and 98-00	Org. change 93-95 or 98-00	No org. change	(N)
Employment < 50	23.1	31.0	45.9	268
50-99 employees	42.3	24.4	33.3	78
100+ employees	55.6	34.6	9.8	153
All firms	36.1	31.1	32.9	499

First of all, table 5.4 shows that important organizational change is quite frequent among large firms. 90% of the firms with more than 100 employees have either performed organizational change in both the periods surveyed or in one of the two periods. 56% of the large firms have implemented organizational change in both periods. Among the small firms, we find a very different pattern. 46% of these firms have not implemented any organizational change. Less than one third have performed organizational change either in 1993-1995 or in 1998-2000, and less than one fourth of the firms implemented organizational change in both periods. The medium-sized firms have a proportion of 42% which have performed organizational change in both 1993-1995 and 1998-2000. This is closer to the proportion of the large firm than to the proportion of the small firms. But the medium-sized firms have a proportion of one-third which did not introduce any organizational change in either period surveyed. This proportion is closer to the small firms than

to the large firms. When we conclude that organizational change is mainly a large-firm phenomenon, it should be borne in mind that the probability of change must be expected to be higher in large firms. Large firms have a greater need for formal coordination and control; they are typically more organizationally sophisticated than smaller firms, and consequently their need for change must be greater.

Table 5.5 Organizational change in 1993-95 and/or 1998-2000 by industry of firm in 2000

	Org. change 93-95 and 98-00	Org. change 93-95 or 98-00	No org. change	(N)
Manufacturing	49.5	30.3	20.2	208
Construction	17.2	28.7	54.0	87
Trade	32.2	30.8	37.0	146
Other services	26.5	23.5	50.0	34
Business services	31.3	46.9	21.9	32
All firms	36.3	30.8	32.9	507

The two industries with the highest frequency of organizational change are manufacturing and business services. Among manufacturing firms, 50% implemented organizational change both in 1993-1995 and in 1998-2000, whereas 20% did not introduce organizational change in the periods. In business services, the frequency of organizational change in either 1993-1995 or 1998-2000 is 47%, which is the highest among all, and the frequency of organizational change in both survey periods is 31% in this industry. Trade has a little less than one third of the firms with organizational change either in both or in one of the two periods, and 37% of the firms have no organizational change. The lowest frequencies of organizational change are found among firms in other services and in construction. Other services have more than one fourth of the firms with organizational change in both periods, but 50% firms with no change in either period. Construction has less than one fifth of the firms with change in both periods, and 54% with no organiza-

tional change in either period. Generally, there is a high dispersion among the industries, with manufacturing at the front and construction the most static in relation to organizational change.

Table 5.6 Organizational change in 1993-95 and/or 1998-2000 by ownership of firm in 2000

	Org. change 93-95 and 98-00	Org. change 93-95 or 98-00	No org. change	(N)
Danish group	39.6	33.7	26.6	169
Foreign group	63.2	23.6	13.2	106
Single firm	21.5	32.0	46.5	228
All firms	36.4	30.8	32.8	503

Table 5.6 shows that ownership is important in relation to organizational change. Firms owned by foreign groups have a very high proportion, 63%, which have implemented organizational change in both 1993-1995 and 1998-2000. Among the foreign-owned firms, only 13% did not introduce organizational change in either of the periods surveyed. Firms owned by Danish groups have a proportion of 40% introducing organizational change in both periods, and one third of the firms performing organizational change in one of the two periods. This is the highest one-time innovator rate among the three ownership groups. Single firms have the lowest rate of organizational change in both periods, and a slightly above average rate of change in either 1993-1995 or 1998-2000. This group of firms has a proportion of 47% which did not perform any organizational change in either of the periods.

Table 5.7 Employment in panel firms by organizational change in 1993-95 and/or 1998-2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
ORG 95+00	33224 = 100	100.2	97.5	95.4	101.7	106.1	101.7	107.1	99.1	97.4
ORG 95/00	11632 = 100	98.7	96.1	94.5	102.8	100.7	99.0	99.1	101.4	98.2
Not ORGch	5666 = 100	98.8	100.8	99.3	106.7	111.5	110.8	114.2	114.0	115.6
All firms	50522 = 100	99.7	97.5	95.7	102.5	105.5	102.1	106.1	101.3	99.6

In table 5.7 the net employment developments are compared for the three groups of firms. Between the two groups having implemented important organizational change, we find a similar pattern, resulting in a lower net employment than the initial year. Surprisingly, the group of firms with organizational change either in 1993-1995 or in 1998-2000 shows the most stable development, while the group of firms with organizational change in both periods, contrary to expectations, has more fluctuations in their employment trend than the former group. But the most important observation is that the group of firms with no organizational change in the two periods ends up with the highest net-employment at the end of the decade. It is thus evident that labor saving must be part of the efficiency objective of organizational change, when between 68% of the firms with important changes in one of the two periods and 71% of the firms with important changes in both periods state efficiency of the daily work as a primary objective of organizational change. Declining employment is the general trend for firms that have implemented important organizational change. An interesting question is whether we find the same trend for firms with different ownership. First the foreign-owned firms are presented in table 5.8 below.

Table 5.8 Employment in foreign-group panel firms by organizational change in 1993-95 and/or 1998-2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
ORG 95+00	10566 = 100	100.8	96.2	95.4	100.3	103.2	101.8	102.7	101.3	100.2
ORG 95/00	2500 = 100	94.2	88.1	92.2	93.9	97.7	89.1	91.9	90.0	79.9
Not ORGch	603 = 100	103.2	88.2	81.6	81.1	92.4	95.4	93.0	85.1	90.4

As we saw before, firms owned by foreign groups had the highest proportion of firms with organizational change in both periods surveyed. Among these foreign-owned firms, we find a balanced employment development over the decade, ending up with almost the same number of employees as they started out with nine years before. A rather different trend we find among firms implementing organizational change in either 1993-1995 or in 1998-2000. Here the index shows a decline of 20 percent points, and it falls steeply the last year. The group of firms with no organizational change also has a declining employment trend, but only half the decline of what we observed for the firms with organizational change in one of the two periods. We can therefore establish the fact that, even though the foreign-owned firms frequently perform important organizational changes, they manage to maintain a balanced net employment development over the period.

Table 5.9 Employment in Danish-group panel firms by organizational change in 1993-95 and/or 1998-2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
ORG 95+00	18572 = 100	100.4	97.9	95.9	103.2	108.1	100.3	103.7	94.9	91.9
ORG 95/00	5591 = 100	96.2	97.0	96.5	104.9	95.7	97.3	100.6	104.3	102.2
Not ORGch	2117 = 100	91.4	100.9	99.9	110.5	111.5	109.9	114.9	113.5	116.2

In table 5.9 showing the employment development of firms owned by Danish groups we find a different pattern than that of foreign-owned firms. The group of firms with important organizational change in both 1993-1995 and 1998-2000 shows a development with a slightly higher trend than their foreign-owned counterparts up to 1997. After 1997, the trend drops down to a level below the foreign-owned status quo. Contrary to this trend, the firms with organizational changes in either 1993-1995 or in 1998-2000 have a much better employment development and end up with a net gain. The firms with no organizational change in either period have the most favourable employment development among the Danish-group firms.

Table 5.10 on the next page shows the employment development in single firms. Among the group of single firms implementing important organizational change in 1993-1995 and 1998-2000, we find a positive employment development over the decade, with a net growth in employment of 15 percent points. Among the firms with important organizational change in either 1993-1995 or in 1998-2000, we also find a positive net development, but only half the size of what we found for the first group of firms. The last group, without organizational change, has the most favorable employment development among the three groups.

Table 5.10 Employment in single panel firms by organizational change in 1993-95 and/or 1998-2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
ORG 95+00	3972 = 100	97.9	98.4	92.4	97.5	103.8	107.0	133.3	110.8	114.5
ORG 95/00	3470 = 100	106.1	102.2	94.9	108.0	112.9	110.6	103.8	106.9	106.7
Not ORGch	2908 = 100	103.4	103.0	102.3	108.9	115.1	114.4	117.8	119.9	119.8

Generally speaking, organizational change seems to squeeze employment over time, but it is only in Danish groups we find a negative trend for firms implementing organizational change in both periods and in foreign-owned firms implementing important organizational change in one of the periods surveyed. Surprisingly, the foreign-owned firms have a balanced employment development for the firms having performed important organizational changes in both periods, compared to the firms owned by Danish groups.

5.2 Employee training related to organizational change

Important organizational change means new processes of work and new tasks for employees, which in turn may require training. We asked the firms whether the employees had received courses or training in relation to the organizational changes implemented.

Table 5.11 Employee training in relation to organizational change in 1993-95 and 1998-2000

	Yes (98 – 00)	No (98 – 00)	Don't know (98 – 00)	(N)
Yes (93 – 95)	71.5	26.8	1.6	123
No (93 - 95)	50.9	45.8	3.4	59
All (93 – 95)	64.8	33.0	2.2	182

Among the firms which in 1993-1995 provided employee training in relation to organizational change, 72% also offered employee training in relation to organizational change in 1998-2000. The chances of firms without employee training in 1993-1995 offering training in 1998-2000 are lower; only 51% of these firms did so. We can thus observe that one group of firms is more likely to provide employee training in relation to organizational change than others, but even if training was not offered in the first survey period, the chance that it was in the second period is just above fifty-fifty.

Table 5.12 Employee training in relation to organizational changes in 1993-95 and 1998-2000 by size of employment in firm end-November 2000

	Emp. training 93-95 and 98-00	Emp. training 93-95 or 98-00	No emp. Training	(N)
Employment < 50	36.7	43.3	20.0	60
50-99 employees	43.8	37.5	18.8	32
100+ employees	61.0	29.3	9.8	82
All firms	49.4	35.6	14.9	174

Table 5.12 shows that among the large firms, with 100 or more employees, 90% provide employee training in relation to organizational change. The proportion for medium-sized and small firms is 80%. Evidently, the propensity to provide training is size dependent among these firms, which have implemented organizational change continuously. This also means that the larger firms are much more inclined to arrange training in relation to both organizational changes. 61% of these firms did so. Among the smaller firms, only 37% arranged employee training related to both organizational changes and the probability of employment training in only one of the two periods is much higher here.

Table 5.13 Employee training in relation to organizational change in 1993-95 and 1998-2000 by industry of firm in 2000

	Emp. training 93-95 and 98-00	Emp. training 93-95 or 98-00	No emp. Training	(N)
Manufacturing	52.0	33.3	14.7	102
Construction	35.7	42.9	21.4	14
Trade	51.1	35.6	13.3	45
Other services	28.6	57.1	14.3	7
Business services	50.0	30.0	20.0	10
All firms	49.4	35.4	15.2	178

Generally, a high proportion of manufacturing and trade firms provide employee training in relation to organizational change. Among the manufacturing and trade firms a deliberate policy of training in relation to organizational change is indicated by the high proportion of employee training both in 1993-1995 and in 1998-2000. Trade has a little fewer firms with training in both periods. Business service has the second lowest proportion of firms with employee training. However, the proportion of firms with employee training related to both periods with organizational change almost mach the trade firms as well as the manufacturing firms. The lowest rate of training is found among construction firms and here the share of employment training related to one of the two organizational changes is relatively high.

Table 5.14 Employee training in relation to organizational change in 1993-95 and 1998-2000 by ownership of firm in 2000

	Emp. training 93-95 and 98-00	Emp. training 93-95 or 98-00	No emp. training	(N)
Danish group	44.1	39.7	16.2	68
Foreign group	56.3	29.7	14.1	64
Single firm	48.9	35.6	15.6	45
All firms	49.7	35.0	15.3	177

It is among foreign-owned firms that we found the most balanced employment development in the decade, in the group of firms having implemented organizational change in both 1993-1995 and 1998-2000. Table 5.14 shows that it is also the foreign-owned firms which have the highest proportion offering employee training in relation to change. Also single firms have a high proportion offering training, and the single firms showed a positive employment development as well. Employment training in relation to organizational change means investment in human resources. This investment may influence the employment trend, so that firms strive to maintain their investments in the human resources.

Table 5.15 Employment in panel firms by employee training in relation to organizational change in 1993-95 and/or 1998-2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
EPT 95+00	18389 = 100	101.8	100.0	98.5	104.0	107.0	102.5	110.5	103.4	103.8
EPT 95/00	12033 = 100	97.2	94.5	90.7	97.7	103.6	97.5	98.4	87.5	83.3
Not EPTch	2457 = 100	104.8	95.0	95.3	107.5	111.2	108.5	118.3	112.4	105.0
All firms	32879 = 100	100.4	97.6	95.4	101.9	106.1	101.1	106.7	98.2	96.4

Table 5.15 shows that firms with employment training related to both organizational changes have a balanced employment growth during the decade. This balanced growth offsets the labor saving effect of organizational change, and presumably it is an effect of an active HRD investment in employees. The firms providing employment training in both periods are typically more aware of the value of the learning, competence and knowledge which their employees accumulate. In the next chapter we are going to focus more directly on the development of organizations which promote learning. Such organizations are expected, on the one hand, to be more product-innovative,

and on the other hand to develop employment systems which promote competence development.

5.3 Concluding observations

Complementary to ICT innovation, organizational change is of importance in order to realize the potentials of process innovation. The main results from the analysis of organizational change as process innovation are that:

- Among the firms performing organizational change in the first period surveyed, two thirds also performed important organizational change in the last period 1998-2000.

- For the firms which have been continuously organizationally innovative, communication of useful knowledge is an important objective of organizational change, but quality and customer service are important, too.

- Across the periods surveyed, correlations between objectives of change give evidence of the priority attached to building new organizations adaptable to the more turbulent surroundings.

- Organizational change is quite frequent among large firms. As many as 90% of the 100+ firms have either performed organizational change in both periods surveyed or in one of the two periods.

- There is a high dispersion of organizational change among industries, with manufacturing at the front and construction as the most static.

- In general, continuous organizational change seems to squeeze employment over time, but it is only in Danish groups that a negative trend is found. Foreign-owned firms have a balanced development and single firms have a positive employment development.

- Among the 100+ firms, 90% provide employee training in connection with organizational change and 61% do it in relation to both organizational changes.

- Firms with employment training related to both organizational changes have a balanced employment growth during the decade. This balanced growth offsets the general labor saving effect of organizational change.

Chapter 6

Organizations as learning systems

Throughout the nineties, cooperation and coordination across the organization, communication of useful knowledge and quality improvement have been important drivers for organizational change in enterprises. That is one of the important lessons of chapter 5. These motives for organizational change seem to point in one main direction: that utility of knowledge and learning has become important for many firms. We have already stated that innovation is an expression of a learning process taking place inside the firm. This learning process is facilitated and furthered by the interplay between different functional groups and the interaction of various decision levels, and not least by relations to actors in the firm's environment – between users and producers. Cooperation, coordination and communication thus become the key issues for the learning processes in enterprises.

In this chapter we will dig deeper into the anatomy of new organization forms promoting learning processes. The aim is to identify the characteristics of organizations as learning systems and test their impacts on innovation behavior. The globalization of competition and changes in consumer demands up through the nineties have, as mentioned, promoted development of universal values of organizational solutions, such as delegation of responsibility, decentralized internal and external communication, learning organizations, quality management and competence building. Research and experts have developed and/or confirmed these organizational devices to be what has been called "institutional standards" (Røvik, A. 1992, 1998), presenting themselves to firms as solutions to their problems or challenges in a global and competitive environment. In other words: the firms have been confronted with an array of organizational dimensions, which exist as specific value systems or "institutionalized standards" of problem solving. In the following we are going to investigate empirically how enterprises adopted these "institutional

standards" as organizational building blocks through the nineties; how they incorporated these new standards in the existing organization, and with what results. The answers will give us an understanding of the developments in the shape, content and effect of the new organizations as learning systems. This understanding is of theoretical interest as well as of empirical importance.

6.1 Organizational dimensions of learning

In both the 1996 and the 2001 surveys, the firms answered a number of questions concerning the organizational dimensions they had adopted. The organizational dimensions measured all, directly or indirectly, refer to classic and contemporary theories dealing with innovation in organizations: cross-occupational work groups, integration of functions, broader delegation of responsibility and planned job rotation are empirical indicators referring to Moss Kanter's theory of integrative organizations (Kanter 1983) and Burns & Stalker's organic organizations (Burns & Stalker 1961). Quality circles and proposal collection systems are indicators of quality management (TQM) and knowledge management. Tailored educational systems and educational planning indicating human resources development and cooperation with external actors refer to Lundvall et al's theory of innovation systems (Lundvall 1992). In the table below, the dimensions are classified in relation to the theoretical aspects they are indicators of.

Figure 6.1 Theoretical aspects and organizational dimensions in the learning organization

Theoretical aspects	Organizational dimensions
Organic and integrative organization	Cross-occupational working groups Integration of functions Delegation of responsibility Planned job rotation
Quality management	Quality circles/groups Systems for collection of employee proposals
HRD and compensation	Education activities tailored to the firm Long-term educational planning Performance-related pay
External relations	Closer cooperation with customers Closer cooperation with subcontractors Closer cooperation with knowledge institutions

In the following we are going to examine in which combinations and to what degree the firms have adopted the dimensions in figure 6.1. Furthermore we shall test the effect on innovation behavior of having adopted more than half of these dimensions. We are going to start the empirical investigation in the mid-nineties and follow up at the end of the decade. In order to examine whether the dimensions cover underlying or latent but more general variables, possibly in accordance with the above-mentioned theories, a factor analysis has been performed on the firms' use of the organizational dimensions in the work processes, first in 1995 (1996 survey). Besides the theoretical interest in how enterprises combine the dimensions, it has been demonstrated in empirical research that clusters of dimensions further innovation behavior and performance in enterprises (Dyer & Reeves 1995, Huselid 1995, Huselid et.al. 1996, Wood 1999, Osterman 2000, Lund Vinding 2000, Laursen 2001). Exploring clusters of dimensions should lead us forward in the analysis of the "anatomy" of learning organizations. The results of the factor analysis of the state of affairs as to the organizational dimensions in 1995 are shown in the table below.

Table 6.1 Factor analysis on organizational dimensions in the learning organization in 1995

	Factor 1: Organization, quality and pay	Factor 2: Human resource development	Factor 3: External relations
Cross-occupational working groups	**0.68**	0.26	0.02
Quality circles/groups	**0.67**	0.24	-0.00
Integration of functions	**0.67**	0.03	0.11
Planned job rotation	**0.62**	0.15	0.00
Performance-related pay	**0.59**	0.03	0.11
Systems for collection of employee proposals	**0.59**	0.25	0.05
Delegation of responsibility	**0.50**	0.01	0.16
Education activities tailored to the firm	0.12	**0.86**	-0.01
Long-term educational planning	0.12	**0.85**	0.11
Closer cooperation with knowledge institutions	0.18	0.30	0.12
Closer cooperation with subcontractors	0.06	0.08	**0.83**
Closer cooperation with customers	0.15	0.10	**0.81**

The twelve empirical dimensions included in the analysis load on three factors, after a varimax rotation. The first factor, which embraces seven dimensions concerning the internal organization and the pay system, is called "Organization, quality and pay". The dimensions included are: 'Cross-occupational working groups', 'Quality circles/groups', 'Integration of functions', 'Planned job rotation', 'Performance-related pay', 'System for collection of employee proposals', 'Delegation of responsibility'. It is interesting to note that the dimensions of cooperation, empowerment and quality all have high loadings on this factor. Most important seem to be variables concerning

cross-functional integration and quality in the organization. The second factor includes the "Human development" dimensions: 'Educational activities tailored to the firm' and 'Long-term educational planning'. High loadings of the two dimensions on the factor give evidence of long-term but individually shaped educational and training systems as the two sides of human development inside the firm. "External cooperation" is the common characteristic of the third factor, which includes the two dimensions: 'Closer cooperation with subcontractors' and 'Closer cooperation with customers'. This is the important user-producer relation. Interestingly, 'Closer cooperation with knowledge centers' does not load on this factor. It is more connected to the "Human development" factor. The factors emerging from this analysis give the impression of an interesting and "theory-consistent" application pattern of the organizational dimensions adopted by the firms in 1995.

The analytical question which follows from this first step is whether the factors or theoretical aspects, which complement each other empirically, increase the learning capability of the firms in such a way that the chances of P/S innovation increase. Fundamentally, the argument is that the more dimensions the firm implement in its organization, the higher the awareness it shows about the importance of learning and knowledge development among the various actors in the firm. This view is also in accordance with the empirical findings on "clustering" mentioned above. Building on such arguments and empirical results, an additive index has been constructed applying the twelve dimensions which cover the theoretical aspects of importance. The empirical distribution of observations (firms) in the additive index of organization, quality, human development and external relations of firms in the mid-nineties is shown in the table on the next page.

Empirically the index distribution shows that there is high variation among firms as to how many dimensions they have adopted. The distribution is slightly positively skewed and rather flat with short tails. If we classify the firms in two groups, according to the number of dimensions each firm had adopted in mid-nineties, built into their firm's organization and "bundled" to facilitate the knowledge production, the result is a group of firms with lowly developed learning organization, using zero to five of the various dimensions,

and a group of firms with highly developed learning organization, having adopted six to twelve of the various dimensions. Besides the quantitative bundling effect, the aim of the classification is to catch the qualitative aspect of organizational sophistication in relation to building a learning context.

Table 6.2 Index of organization, quality, human development, compensation and external relations in 1995

Index	Frequency	Per cent	Cumulative per cent
0	10	1.9	1.9
1	16	3.1	5.0
2	33	6.3	11.3
3	43	8.2	19.5
4	72	13.7	33.2
5	55	10.5	43.7
6	53	10.1	53.8
7	52	9.9	63.7
8	47	9.0	72.7
9	59	11.3	84.0
10	48	9.2	93.1
11	26	5.0	98.1
12	10	1.9	100.0

Applying many dimensions signals awareness of the aspects and channels of learning and knowledge development, and willingness to invest in and make practical use of different potentials. It indicates a culture of change and learning in the individual firm. In the table below results of this classification is shown.

Table 6.3 Development of learning organizations (LO) in 1995

Highly developed LO (6 – 12 dimensions)	Lowly developed LO (0 – 5 dimensions)
56.3	43.7

By classifying the index distribution in two groups, we get one group having adopted from six up to twelve of the dimensions, covering 56% of the firms, and another group having adopted up to six of the dimensions and comprising 44% of the firms. The two groups represent different orientations towards organizational development and learning, structurally as well as culturally. Analytically, the next step will be to test the importance of this different orientation towards learning, represented by high or low bundling of organizational dimensions in the firms in 1995. This importance of orientation will be tested in relation to the odds of the firms having performed product or service (P/S) innovation. It is tested in a logistic model with learning organization as independent and P/S innovation as dependent variable. The results are shown in the table below.

Table 6.4 Logistic regression of learning organization development on P/S innovation in 1995 (Odd ratio, 95% confidence interval, estimates, chi-square and P-value)

Variables	Effect	Lower 95%	Higher 95%	Estimate	Chi-sq	P-value
Dev 1 vs. 2	3.9	2.7	5.6	0.68	52.9	<.0001

Bundling many organizational dimensions obviously matters when it comes to the materialization of learning as product or service innovative behavior in a firm. Being in the category of highly developed firms increases the chances of P/S innovation four times compared to firms with less than half of the dimensions adopted. Thus the theoretical considerations and the empirical observations have proved the importance of developing the organization as to quality improvement, human resources and the firm's external relations, if the production strategy aims at product or service innovation. This is the important empirical result from the mid-nineties; but what happens if we observe exactly the same firms five years later? First, let us to take a look at how the firms tended to combine the dimensions in 2000 (2001 survey).

Table 6.5 Factor analysis on organizational dimensions in the learning organization in 2000

	Factor 1: Organization, quality and pay	Factor 2: Human resource development	Factor 3: External relations
Cross-occupational working groups	**0.65**	0.18	0.07
Systems for collection of employee proposals	**0.64**	0.01	0.09
Delegation of responsibility	**0.63**	0.09	0.15
Quality circles/groups	**0.62**	0.08	0.01
Planned job rotation	**0.52**	-0.09	0.10
Integration of functions	**0.45**	0.07	0.04
Performance-related pay	**0.43**	0.15	0.09
Closer cooperation with knowledge institution	0.29	0.19	0.16
Education activities tailored to the firm	0.10	**0.87**	0.00
Long-term educational planning	0.13	**0.86**	0.11
Closer cooperation with customers	0.11	0.05	**0.86**
Closer cooperation with subcontractors	0.17	0.07	**0.83**

The basic structure of factors emerging from the factor analysis has not changed after five years. Thus, the result of the analysis is still three factors embracing the same variables as in 1995. However, the loadings of the variables belonging to the first factor "Organization, quality and pay" have changed. Still, cross-occupational working groups has the highest loading on the factor, but systems for collection of employee proposals and delegation of responsibility have higher loadings on the factor in 2000. This could indicate that the importance of employee influence has increased over the period. Planned job rotation and performance-related pay also have higher loadings. The two other factors "Human resource development" and "External relations" are almost

identical with the 1995 analysis. This means that the combination and priorities of user-producer relations and employee training have remained the same in the firms. The question is whether the pattern of bundling has remained the same as well.

Table 6.6 Index of organization, quality, human development, compensation and external relations in 2000

Index	Frequency	Per cent	Cumulative per cent
0	17	3.2	3.2
1	22	4.2	7.4
2	36	6.9	14.3
3	46	8.8	23.1
4	69	13.2	36.3
5	60	11.5	47.7
6	79	15.1	62.8
7	60	11.5	74.2
8	69	13.2	87.4
9	30	5.7	93.1
10	21	4.0	97.1
11	12	2.3	99.4
12	3	0.6	100.0

If the pattern of table 6.6 is compared to the pattern of table 6.2, it is evident that the firms have not increased the cumulative use of dimensions in the period. On the contrary, table 6.6 shows that the use has decreased, though only marginally. Higher proportions of firms are concentrated in the low end and in the middle of the index, just as lower proportions are concentrated in the higher end, compared to the pattern of 1995. This is interesting, and contrary to what could be expected. The factor analysis does not give any clues to understanding this development, and it means that the classification of the index in lowly and highly developed learning organizations becomes slightly different in 2000, compared to the 1995 classification.

Table 6.7 Development of learning organizations (LO) in 2000

Highly developed LO (6 – 12 dimensions)	Lowly developed LO (0 – 5 dimensions)
52.3	47.7

Table 6.7 shows that the group with highly developed learning organization has shrunk from 56% in 1995 to 52% in 2000. Even though the decrease is only 4 percent points, we would have expected an increasing trend in the propensity to adopt the dimensions of the learning organization, considering the importance of the dimensions in furthering product innovation. Instead, we must accept that some of the firms have abandoned the use of some dimensions in the last part of the nineties. The question is whether this has had any influence on their propensity to innovate. Cross-section data show that the proportion of firms introducing new products or services in the period 1993-1995 was 52%, while the proportion in the period 1998-2000 was 45% (Nielsen 2004).

Table 6.8 Logistic regression of learning organization development on P/S innovation in 2000 (Odd ratio, 95% confidence interval, estimates, chi-square and P-value)

Variables	Effect	Lower 95%	Higher 95%	Estimate	Chi-sq	P-value
Dev 1 vs. 2	3.2	2.2	4.7	0.59	40.0	<.0001

Results from a logistic regression analysis are shown in table 6.8. Even though the estimate is still highly significant, the effect has shrunk from 3.9 in 1995 to 3.2 in 2000. The declining effect is mainly caused by the marginal tendency of the firms to abandon the dimensions of a learning organization. In this way, the results verify the theoretical arguments and the importance of the combination of dimensions in building a learning organization. Fundamentally, it is a verification of the importance of the learning perspective on organization for product innovation as the effect of learning in firms. The open question of course is why some of the firms have abandoned some of

the dimensions. Unfortunately, this question cannot be answered based on the questionnaire.

6.2 Learning organizations in the nineties

It is, however, important to proceed with the analysis of the implications of the highly developed learning organizations, both in relation to product innovation and in relation to employment. To do this, the firms which have maintained the adoption of 6-12 of the dimensions over the decade have been selected and compared to the firms which had adopted 6-12 dimensions either in 1995 or in 2000, and to firms with lowly developed learning organization in both periods. This classification of the firms is shown in the table below.

Table 6.9 Learning organization (LO) development in 1995 and/or 2000

		Frequency	Per cent
Highly dev. learning org. 1995+2000	(1)	190	36.3
Highly dev. learning org. 1995/2000	(2)	189	36.1
Not highly dev. learning org.	(3)	145	27.7

Even though it could be demonstrated that some of the firms had abandoned some dimensions of the learning organization in the decade in focus, table 6.9 shows that over a third of the firms have maintained the dimensions of the highly developed learning organization during the decade (1). A proportion almost as big had developed learning organizations in either 1995 or in 2000 (2). This group is rather heterogeneous because it contains firms with declining as well as increasing development in relation to highly developed learning organizations. The last group consists of firms with less than 6 dimensions adopted in both periods (3). This group without highly developed learning organization is the smallest, which in fact goes to show that organizational development did become a widespread phenomenon in the nineties. The result of this classification is three groups of firms with different practices in relation to the dimensions of organizational learning over

the decade, which makes them appropriate for a causal analysis of effects on product innovation.

Table 6.10 Logistic regression of learning organization development on P/S innovation in 2000 (Odd ratio, 95% confidence interval, estimates, chi-square and P-value)

Variables	Effect	Lower 95%	Higher 95%	Estimate	Chi-sq	P-value
Dev 1 vs. 3	5.9	3.6	9.7	0.91	49.1	<.0001
Dev 2 vs. 3	2.3	1.4	3.7	-0.05	0.1	0.7257

In the logistic regression model shown in table 6.10, the group of firms without learning organization is used as baseline. Compared to this group of firms (3), the firms with highly developed learning organization throughout the decade (1) has almost six times as high a chance of product innovation (1 vs. 3). This effect is highly significant, and it shows how important it is for the propensity to innovate that the organizational framework of learning is maintained over time. Thus, the group of firms with either highly developed learning organization in 1995 or in 2000 does not show significant effect on product innovation, although the effect is positive. This model shows both the importance of the theoretically derived dimensions in configuring the learning organization, and the importance of learning development over time.

Table 6.11 P/S Innovation and learning organization development

	LO high 95+00	LO high 95/00	Not LO high
P/S Innovation 95+00	58.0	29.9	12.1
P/S Innovation 95/00	40.4	38.0	21.7
No P/S Innovation	16.9	36.1	47.0

Table 6.11 shows the importance of the highly developed learning organization in relation to product innovation from another angle. The firms are grouped after product innovation, and we compare the proportions of lear-

ning organizations between these groups. Among the group of firms introducing new products or services in both 1993-1995 and 1998-2000, almost three fifths had highly developed learning organizations in both 1995 and 2000. 30% had highly developed learning organizations in either 1995 or in 2000, and only 12% did not have learning organizations in the decade. Among the firms introducing new products or services in either 1993-1995 or in 1998-2000, two fifths had highly developed learning organizations in both periods. Almost the same number of firms had learning organizations in either 1995 or 2000, and 22% did not develop learning organizations. Among the firms which did not introduce new products or services in the two periods, 17% had highly developed learning organizations in 1995 and 2000, and 47% did not have learning organizations in either of the periods. The result of this analysis is a confirmation of the linear causal relationship between development of learning organization and product innovation.

Table 6.12 ICT Innovation and learning organization development

	LO high 95+00	LO high 95/00	Not LO high
ICT Innovation 95+00	51.8	36.2	11.9
ICT Innovation 95/00	32.4	38.7	28.9
No ICT Innovation	14.1	31.3	54.6

In the systems approach to innovation, the dimensions of new ICT and of organizational change together constitute process innovation in firms. It is the creative relationship between the two elements which is important for productivity growth in a learning environment. This creative relationship is, as mentioned, one of the important drivers of TFP (Total Factor Productivity). The relationship between ICT innovation and development of learning organizations in firms is analyzed in table 6.12. We can observe a similar linear relationship between the two dimensions of process innovation as we observed for product innovation and development of learning organizations in table 6.11. This is evidence that new ICT is an important device in relation to furthering the internal and external communication in firms and

in relation to the processes of product innovation as well. It also confirms empirically the importance of the relations between the various dimensions of the innovation system. In this connection, the employment perspective is interesting and important as well. Does labor saving and rationalization play the most important role in the development of learning organizations, or does human capital enhancement prevail?

Table 6.13 Employment in panel firms by learning organization development in 1995 and/or 2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
LO 95+00	35175 = 100	100.7	98.5	96.6	103.2	108.3	104.3	106.9	102.6	102.3
LO 95/00	12309 = 100	98.7	95.7	91.9	98.6	96.3	94.6	102.9	95.7	92.7
Not LO	4391 = 100	97.4	97.2	100.9	108.4	107.6	104.0	105.1	104.9	102.1
All firms	51875 = 100	99.9	97.7	95.8	102.6	105.4	102.0	105.8	101.1	100.0

Table 6.13 shows that the 190 firms with highly developed learning organization in 1995 and in 2000 have a positive employment trend, and end up with a slightly higher figure than the firms which did not develop learning organizations. On average, the firms with highly developed learning organizations are the largest, which means that they create 794 jobs net in the decade, while the firms with no learning organization are the smallest, which means they create only 94 jobs in the decade. Even though the firms with no learning organization are the smallest, they have the highest s.d. in the employment trend (3.9), compared to the firms with learning organization in both periods (3.6). The firms with learning organization either in 1995 or in 2000 have a negative employment trend, and they lose 893 jobs in the period. These firms have below-average index figures throughout the decade. Employment peaks in 1997 with an index figure of 102.9, but after that peak

the decline in employment is marked. The development trends of the three different groups of firms show that the human capital enhancement factor is stronger than the labor saving factor in firms with highly developed learning organization in both 1995 and 2000. This means that moderate employment growth is related to highly developed learning organizations. In table 14 below we are going to analyze possible implications for job turnover in the different groups of firms.

Table 6.14.1 Job creation and job destruction in panel firms in 1990-91 to 1993-94 by learning organization development in 1993-95 and/or 1998-2000

	Jobs 1990 – 91		Jobs 1991 – 92		Jobs 1992 – 93		Jobs 1993 – 94	
	Created	Destroyed	Created	Destroyed	Created	Destroyed	Created	Destroyed
LO 95+00	5.6	4.9	3.6	5.8	3.7	5.7	9.7	2.7
LO 95/00	5.7	6.9	4.1	7.2	5.8	9.8	10.6	3.4
Not LO	6.2	8.8	7.3	7.5	9.8	6.1	10.8	3.3
All firms	5.7	5.7	4.0	6.3	4.7	6.7	10.0	2.9

Table 6.14.2 Job creation and job destruction in panel firms in 1994-95 to 1998-99 by learning organization development in 1993-95 and/or 1998-2000

	Jobs 1994 – 95		Jobs 1995 – 96		Jobs 1996 – 97		Jobs 1997 – 98		Jobs 1998 – 99	
	Create	Destroy	Create	Destroy	Create	Destroy	Create	Destroy	Create	Destroy
LO 95+00	6.9	1.9	3.1	6.9	5.1	2.6	3.3	7.3	4.4	4.7
LO 95/00	7.4	9.8	4.1	5.9	13.9	5.1	5.6	12.6	5.1	8.1
No LO	7.7	8.4	6.1	9.5	6.2	5.1	5.8	6.0	4.3	7.0
All firms	7.1	4.3	3.6	6.9	7.1	3.4	4.0	8.4	4.5	5.6

Among all firms, the job creation rate varies between 10% in 93-94 and 3.6% in 95-96, and the job destruction rate varies between 8.4 in 97-98 and 2.9 in 93-94. Adding the rates of creation and destruction gives a measure of the annual job turnover for the group of firms. The firms with highly developed

learning organization in 1995 as well as in 2000 have below-average job creation and job destruction rates. This means that these firms have more moderate job turnover rates than the other groups of firms. This is in harmony with considerations about the importance of human capital enhancement in such firms. Even though the turnover rates are moderate, more than 10% of the jobs are turned over each year. This opens up for changes in the personnel profile of the firms during the decade. In the next chapter we are going to analyze the propensity of the firms to recruit new competences or to retain the personnel profile over time. Fundamentally, in the short run it is a question of whether to use the market to recruit competences or develop the competences inside the firm. In the long run, it is the question of developing a personnel profile which supports the core competences and meets the strategic needs of the firms.

6.3 Concluding observations

The general view of innovation as learning processes makes it important to study the anatomy and effects of new organization forms promoting learning. The main results from the analysis of the organizational dimensions promoting learning are that:

- Theoretically, the organizational dimensions dealing with learning concern internal cooperation, coordination and transformation of knowledge, quality and continuous improvements, HRD and external relations to customers etc.

- Empirically, the analysis gives evidence of a "theory-consistent" application pattern of the organizational dimensions adopted by the firms.

- Adopting 6-12 of the organizational dimensions means awareness of the aspects of learning and knowledge development, and willingness to invest in the learning potentials of the firm. It means a highly developed learning organization.

- The group of firms with highly developed learning organization increases their chances of product or service innovation significantly compared to firms with less than half of the organizational learning dimensions adopted.

- Between 1995 and 2000 the firms decrease the cumulative use of learning dimensions. This means lower chances of product or service innovation. The empirical results verify the importance of combining the dimensions in building learning organizations.

- Nevertheless, more than a third of the firms have maintained the adoption of 6-12 of the learning dimensions during the decade, and an almost equally large proportion developed learning organizations in either 1995 or in 2000.

- The firms with highly developed learning organization throughout the decade (6-12 of the learning dimensions adopted) have almost six times as high a chance of product or service innovation, compared to firms with 0-5 of the dimensions adopted.

- ICT innovations are an important element of the highly developed learning organizations, furthering the internal and external communication in relation to product and service innovation.

- The firms with highly developed learning organization throughout the decade have a positive employment trend. This means that the human capital enhancement factor is stronger than the labor saving factor in firms with highly developed learning organization.

- The highly developed learning organizations have below-average job creation and job destruction rates. Generally, these firms have more moderate job turnover rates than the other groups of firms.

Chapter 7

Demand for qualifications

Learning organizations as stable phenomena over time are related to balanced employment growth and moderate job turnover. This is what the empirical findings show us and what we would expect based on theoretical and logical reasoning. A turbulent growth pattern might jeopardize the development of internal core competences and detailed knowledge related to the production, a development which is important in the experience-related learning process. On the other hand, we also expect qualifications demands to increase over time in a learning organization. Creativity and knowledge absorptive capacity are central resources in an organization striving for product or service innovation. Skills and formal training are, needless to say, important as preconditions, but what really matters is the ability to deploy qualifications in the job situation. This makes competence an important concept, especially when it relates to the qualities of social capital such as cooperation capacity and to communication skills internally between different functions, and externally towards various actors. What the learning organization requires is a triad of formal education, competence and social capital.

Besides this triad of qualifications, the ability of employees to continuously learn and supply new knowledge in the work process becomes an important resource in the learning organization. This may gradually change the demands, and bring into focus groups of employees who are trained in absorbing and making use of new knowledge. Complementary to the structure of dimensions configuring the learning organization we have identified in chapter 6, there needs to be an active learning culture among the employees as human resources in the learning organization. The structure of organizational dimensions and a learning culture are necessary conditions to bridge the system of innovation and the system of employment in the learning organization. This means that the demand for labor may gradually shift towards employees with

higher education who are trained in analytical skills and used to learning and acquiring knowledge continuously. That is what we expect, but we expect it to be a gradual process. The knowledge and competences of the skilled and unskilled employees as part of the core labor force are important as well, and enterprises may choose to develop a learning culture on the foundation of this. In this way the tacit knowledge is preserved in the firm and the core competences are developed continuously by internal means.

Fundamentally, it is a question of internal development or external recruitment of competences as the prevailing personnel strategy in enterprises. In this chapter we are going to deal thoroughly with external recruitment of competences in order to observe the developments in the nineties. In a later chapter, the internal development of competence and learning as a strategy will be investigated. It is important to note that the two strategies are not mutually exclusive. On the contrary, they are most often applied together in a systematic way. This is what the systems approach to employment in firms presumes logically, and what we expect to find empirically. But the weight put on internal development versus external recruitment in the individual personnel strategy is important. It determines whether the qualifications demands on employees in learning organizations lead to a "polarization" of labor, resulting in a marginal position of unskilled workers together with a colonization by the highly educated employees in the learning organizations; or whether the demands further a more balanced evolution of learning capabilities among all groups of employees.

7.1 External recruitment of qualifications

The analysis of external recruitment of qualifications will commence by exploring the developments in the hiring of highly educated, skilled and unskilled employees relative to all hiring in the firms. Related to the development of the hiring pattern, we then investigate developments in personnel profiles in firms with different developments in learning organization and product innovation. Finally, the hiring and separation rates of the various types of firms will be studied.

Table 7.1 Hiring of highly educated employees relative to all hiring in panel firms by learning organization development in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
LO 95+00	12.1	13.0	12.4	14.5	11.9	17.0	20.3	16.9	23.7	25.3
LO 95/00	8.9	10.8	9.3	13.8	10.8	13.9	15.3	9.3	18.7	19.4
Not LO	6.0	3.8	6.1	9.8	7.0	10.0	8.6	8.2	11.6	10.3
All firms	10.6	11.5	10.9	13.7	11.1	15.5	17.7	13.8	21.2	22.5

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-98 and 1998-00 figures.

Table 7.1 shows hiring of highly educated employees each year in the decade relative to all hiring in the panel firms. The hiring of highly educated employees is grouped by development of learning organization. Among the firms with learning organization in 1995 as well as in 2000 we find the largest proportion of highly educated employees hired. At the beginning of the period the proportion here is twice the proportion we find among firms without learning organization, and at the end of the period it is two and half times the size. The firms with learning organization in either 1995 or 2000 have a development in hiring patterns between the two other groups of firms. The relative figures conceal large differences in absolute values. The 190 firms with continuous highly developed learning organization over the decade recruit 809 highly educated employees in 1990-1991 and 1,532 in 1999-2000, compared to 71 highly educated hired in the 145 firms without learning organization in 1990-1991 and 85 hired in 1999-2000. The tendency of learning organizations to increase the proportion of highly educated employees relative to all hiring over the period is obvious.

Table 7.2 Hiring of highly educated employees relative to all hiring in panel firms by product or service innovation in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
PS 95+00	11.2	15.2	14.2	16.2	11.9	18.4	22.0	16.8	25.7	27.7
PS 95/00	12.3	10.7	8.7	14.5	11.6	14.4	17.2	12.1	20.8	22.0
Not PS	7.8	4.9	6.4	7.5	8.5	9.0	8.1	7.6	11.8	11.1
All firms	10.7	11.6	10.9	13.9	11.2	15.5	18.0	13.8	21.7	22.9

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-98 and 1998-00 figures.

In table 7.2 the hiring of highly educated employees is divided on firms with product or service innovation in 1993-95 and 1998-2000, or product and service innovation in either of the two periods, or no product innovation in the periods. Here the tendency of increasing recruitment of highly educated staff is even more pronounced. The group of firms which introduced new products or services in both periods shows a hiring proportion of 11% in 1990-1991 and 28% in 1999-2000. The group of firms which did not introduce new products or services also increases their proportion, but from 8% to 11%, which is in fact the start proportion of the continuous innovative firms. In absolute figures, the differences are even larger. The group of 157 firms with product innovation in both periods recruits 548 highly educated employees in 1990-91 and 1,252 in 1999-2000. The group of 166 firms with product innovation in either of the two periods recruits 364 in 1990-91 and 525 in 1999-2000, and the group of 166 firms with no product innovation in the periods recruits 174 in 1990-91 and 182 in 1999-2000. Generally, the de-cade saw an increase in demand for highly educated employees in all the types of firms. The difference lies in the proportions relative to all hiring and the absolute figures. The group of 190 firms with continuous learning organization have increased their hiring of highly educated employees by 723

in the decade, and the group of 157 firms with product innovation in both periods have increased their hiring by 704 in the decade.

Table 7.3 Hiring of skilled employees relative to all hiring in panel firms by learning organization development in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
LO 95+00	38.2	38.5	36.5	39.4	37.5	36.3	37.4	37.0	32.7	32.6
LO 95/00	35.9	36.9	34.5	35.3	39.0	35.4	37.2	27.7	33.9	36.0
Not LO	40.4	44.1	41.7	41.2	42.0	40.1	45.1	42.9	42.1	44.5
All firms	37.8	38.7	36.6	38.6	38.4	36.4	38.2	34.7	34.0	34.5

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-98 and 1998-00 figures.

Traditionally, skilled employees have played an important role as one of the main resources of industrial development. The trends in table 7.3 may give us an indication of how their role will develop in a learning or knowledge environment. Almost two fifths of the recruitments in 1990-91 among the firms with continuous learning organization in the decade are skilled employees. This is equal to 2,563 individuals. This proportion remains rather constant up until 1997-98, when 2,443 skilled employees are recruited. The last two years the proportion drops 4 percent points. This tendency is even more pronounced among firms with product or service innovation in 1993-95 and 1998-2000. The pattern is complementary to the increase in recruitment of highly educated employees in the last two years among the same firms. Whether this trend with lower demand for skilled employees will last is, of course, difficult to say. Especially when considering the trend among the firms with learning organization in either 1995 or 2000. Here we find a constant proportion of skilled hiring, though with fluctuations around 36%, ranging from 39% to 28%. Among the firms with no learning organization,

the trend of skilled hiring is slightly upward. These firms had the highest proportion at the outset of the decade, and end up with a proportion of 45% skilled employees hired. The trends in firms with different product or service innovation behaviors are very similar to the trends among firms with different developments in learning organization. As mentioned, the firms with product innovation in both periods experience a decline in skilled hiring. Firms with product innovation in one of the two periods show a constant trend, and firms without product or service innovation in either period experience an increase in the demand for skilled employees.

Table 7.4 Hiring of unskilled employees relative to all hiring in panel firms by learning organization development in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
LO 95+00	46.9	45.8	48.4	43.5	47.5	43.7	42.3	46.1	43.5	42.0
LO 95/00	52.2	49.9	53.1	48.6	47.5	47.3	47.5	62.9	47.4	44.6
Not LO	50.9	49.8	51.1	47.5	49.1	46.8	46.3	48.9	46.3	45.1
All firms	48.7	47.3	49.9	45.4	47.7	44.9	44.1	51.5	44.8	42.9

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-98 and 1998-00 figures.

Parallel to the importance of hiring highly educated employees, it is interesting and important to analyze the trend for hiring unskilled employees. Are there any sign of a polarization with declining trends of the hiring proportions for unskilled employees? Table 7.4 shows a pattern where we find the lowest proportion of unskilled employee hiring in the decade among firms with continuous highly developed learning organization. The proportion is declining in the middle of the decade, but with oscillations throughout the period. The same pattern is found among the firms with learning organization in either 1995 or in 2000. Among the firms with no learning organiza-

tion we also find a declining trend for unskilled hiring. This is interesting, and it indicates a generally rising trend in the educational level of the labor force rather than a polarization between the highly educated and unskilled groups, leaving the latter group in a marginal position.

Table 7.5 Hiring of unskilled employees relative to all hiring in panel firms by product or service innovation in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
PS 95+00	49.2	44.0	48.3	43.2	50.2	43.0	41.2	47.3	44.2	41.1
PS 95/00	49.2	50.2	52.5	45.9	55.8	46.1	46.2	59.6	43.1	42.0
Not PS	48.8	50.1	50.2	49.4	28.8	48.4	48.1	48.9	47.8	46.0
All firms	49.1	47.3	50.0	45.3	47.3	44.8	44.0	51.7	44.5	42.3

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-98 and 1998-00 figures.

Table 7.5 shows hiring of unskilled employees among firms with different innovation behaviors. The trend of declining hiring proportions is more pronounced here among the firms with product or service innovation in 1993-1995 and 1998-2000. 2,414 unskilled employees were hired in 1990-91 by these firms, and 1,860 in 1999-2000. Even though the trend is declining, there are large oscillations throughout the decade. It may indicate that the unskilled employees have a more peripheral position on the firms' internal labor market, a problem we are going to deal with in the following chapters. The firms with product or service innovation in one of the two periods show almost the same trend as the first-mentioned group. Firms with no innovations on the market in the two periods have a more stable trend throughout the decade, except for 1994-95, which obviously must be due to a technical data problem. Generally, there is no indication of a sharp polarization in the hiring patterns for highly educated and unskilled employees in innovative and

learning firms. On the other hand, it is evident that a large and increasing number of highly educated people are recruited in firms with continuous learning – and innovative – organizations, and a declining number of unskilled but also skilled employees are recruited by the same firms. We will return to the question of a possible influence on the personnel profile of the firms in the decade, but first we are going to look at the recruitment of women and employees 50 years old or older.

Table 7.6 Hiring of women relative to all hiring in panel firms by learning organization development in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
LO 95+00	34.2	31.7	35.2	35.4	33.8	34.3	33.7	35.4	35.5	37.5
LO 95/00	33.8	32.4	31.5	33.8	27.6	28.5	28.0	30.8	30.2	29.4
Not LO	23.9	24.7	20.8	23.2	20.2	26.4	20.2	21.3	20.9	19.3
All firms	33.0	31.2	32.5	33.3	30.8	32.1	30.7	32.7	32.6	33.9

The position of women on the labor market has often been characterized as segregated or segmented, mainly to various parts of the public sector. This makes it interesting to explore the hiring pattern for women empirically in private sector firms. Table 7.6 shows us that the proportion of women hired in the decade is highest in firms with continuous highly developed learning organization. 34% of their hiring is female in 1990-91, and this proportion is rising throughout the decade. At the end of the decade, 38% of the hiring is female. The firms with learning organization in one of the two periods have a declining trend of hiring women, starting out with almost the same proportion as the continuous learning organizations. At the end of the decade, the proportion is 4% percent points lower. Among the firms without learning organization we observe the lowest proportion of women hired. The proportion is more than

10 percent points lower than the proportion of firms with continuous learning organization. Even so, the proportion is declining throughout the period, and ends up with 19% women hired.

Table 7.7 Hiring of age 50+ employees relative to all hiring in panel firms by learning organization development in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
LO 95+00	7.3	7.1	6.7	7.9	5.6	7.0	7.2	7.3	7.7	8.5
LO 95/00	8.3	7.7	7.6	7.4	8.1	7.7	8.7	7.4	7.7	12.2
Not LO	7.2	7.0	8.7	10.2	8.4	6.6	9.6	9.8	10.4	11.2
All firms	7.5	7.2	7.1	8.1	6.5	7.1	7.9	7.6	8.2	9.7

Ever since the early nineties, the hiring of employees aged 50 and older has been debated from the point of view of whether employees in this age group are being discriminated against. Table 7.7 shows no sign of declining trends of hiring. On the contrary, there is a slightly increasing trend among all firms, and minor variations between the various groups of firms. Among the firms with continuous highly developed learning organization, we find a moderate hiring proportion, rising towards the end of the period. The firms with learning organization in either 1995 or in 2000 have the highest start proportion, but follow the group of continuous learning organizations throughout the period and end up with the highest hiring proportion. The firms with no learning organization also experience rising proportions of hiring up through the decade. So generally speaking, learning organizations show no evidence of declining demand for older employees.

Table 7.8 Hiring of age 50+ employees relative to all hiring in panel firms by product or service innovation in 1995 and/or 2000

	H90-91	H91-92	H92-93	H93-94	H94-95	H95-96	H96-97	H97-98	H98-99	H99-00
PS 95+00	6.1	5.8	7.4	7.4	4.6	6.6	7.4	7.4	6.7	7.8
PS 95/00	9.0	9.6	7.3	8.9	8.9	8.5	8.3	6.9	10.2	12.0
Not PS	8.6	6.3	6.4	8.5	8.2	6.7	8.1	10.3	8.9	10.5
All firms	7.5	7.1	7.2	8.0	6.4	7.1	7.8	7.7	8.1	9.5

Table 7.8 shows the hiring pattern for employees 50 years or older in groups of firms with different product or service innovation behaviors. Among the firms with product or service innovation in 1993-1995 and 1998-2000, we find the lowest proportion older employees hired. But the proportion is increasing up through the decade, although only slightly and it stays well below the average. A more marked increase is found among the firms with product or service innovation in either 1993-1995 or in 1998-2000. The firms in this group have the highest proportion in 1990-91 as well, but in figures they have recruited 68 persons fewer than the first-mentioned group at the end of the decade. The firms with no product or service innovation also have a rising proportion, though very moderately.

7.2 Developments in personnel profiles and dynamics

In the analyses of the demand for formal qualifications we could observe increasing hiring proportions of highly educated employees and decreasing hiring proportions of unskilled employees. We are going to follow up on this by analyzing developments in internal personnel profiles for the various groups of firms. The table below shows the development in shares of highly educated, skilled and unskilled employees for firms with highly developed learning organization in 1995 and 2000.

Table 7.9 Share of highly educated, skilled and unskilled employees in firms with learning organization development in 1995 and 2000 (LO95+00) (Percent vertical)

	Shr.90	Shr.91	Shr.92	Shr.93	Shr.94	Shr.95	Shr.96	Shr.97	Shr.98	Shr.99
Highly Educat	14.6	14.9	15.6	16.3	16.1	17.1	17.8	17.9	21.6	22.5
Skilled Empl.	42.1	43.3	43.4	43.9	43.5	43.1	42.8	42.7	39.8	39.9
Un-skilled	43.3	41.8	41.0	39.8	40.4	39.8	39.4	39.4	38.6	37.7
All Empl.	34,310	34,544	33,814	33,213	35,513	37,487	36,679	37,584	36,084	35,969

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

Table 7.9 shows that among the three groups of employees in the firms with learning organization in both 1995 and 2000, the share of unskilled employees was highest in 1990 and lowest in 1999. In 1990, 14,848 unskilled workers were employed in these firms, and in 1999 13,548 were employed in the same firms. That is, 300 jobs for unskilled employees were lost over the period, or rather, converted to other types of jobs. Aggregated employment in the group of firms with continuous learning organization throughout the decade increased by 1,659 jobs. The jobs have been generated among highly educated employees: they gained 3,077 jobs in the decade. From a starting point of 5,006 jobs, the firms end up with 8,083 jobs for highly educated employees, which is an increase of 62% over the period. The increase is highest from 1994 to 1995 and again from 1997-1998. For the skilled employees the number is almost status quo in the continuous learning organizations, from 14,456 jobs in 1990 to 14,338 jobs in 1999; however, their share drops from 42.1 to 39.9 due to the increasing total sum of jobs in the highly developed learning organizations. The result of the development is that the highly educated employees have gained 3,077 jobs, the skilled employees have lost 118 jobs, and the unskilled employees have lost 1,300 jobs over the decade. This

makes the term often used, "skills biased", true as a characteristic of our group of firms with highly developed learning organization throughout the decade.

Table 7.10 Share of highly educated, skilled and unskilled employees in firms with learning organization development in 1995 or 2000 (LO95/00) (Percent vertical)

	Shr.90	Shr.91	Shr.92	Shr.93	Shr.94	Shr.95	Shr.96	Shr.97	Shr.98	Shr.99
Highly Educat	10.4	11.1	11.5	12.8	12.8	13.7	14.3	13.7	17.7	18.3
Skilled Empl.	43.7	44.8	45.0	45.8	46.1	46.8	46.1	43.2	44.2	44.2
Un-skilled	45.9	44.1	43.5	41.3	41.2	39.5	39.6	43.1	38.0	37.5
All Empl.	11,997	11,887	11,524	11,072	11,882	11,615	11,625	12,650	11,768	11,416

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

The group of firms with learning organization in either 1995 or in 2000 shows a development in their personnel profile during the decade very similar to what we saw for the continuous learning organizations. The share of highly educated employees is lower in 1990 compared to the continuous highly developed learning organizations in table 7.9. In numbers, we find only one fourth of the size of jobs for highly educated employees in firms with learning organizations in either 1995 or 2000. The number of jobs for highly educated employees increases from 1,244 to 2,090, which is a development parallel to the continuous learning organizations. The skilled employees lose 195 jobs over the decade, even though their share of employment increases marginally. This means that the group of skilled employees has proved more robust in relation to the total job loss of 581 experienced by these firms in the decade. The job losers are the unskilled employees, who have lost 1,234 jobs from the start to the end of the decade. This job loss is caused by the general decrease in jobs in the firms. Unskilled jobs are

frequently used as a numerical regulator, which is clearly observable in the increase 1996-1997 and the decrease the following year 1997-1998 as well. We will come back to this issue later when we study the personnel turnover rates of the three employee groups.

Table 7.11 Share of highly educated, skilled and unskilled employees in firms with no learning organization development (Not LO) (Percent vertical)

	Shr.90	Shr.91	Shr.92	Shr.93	Shr.94	Shr.95	Shr.96	Hir.97	Hir.98	Hir.99
Highly Educat	6.4	6.2	6.8	8.3	8.2	9.1	8.7	8.7	11.2	10.7
Skilled Empl.	47.2	48.1	48.2	48.6	48.4	49.4	49.8	50.6	49.3	50.1
Un-skilled	46.4	45.7	44.9	43.1	43.4	41.5	41.5	40.7	39.5	39.2
All Empl.	4,271	4,167	4,180	4,318	4,660	4,617	4,535	4,589	4,594	4,485

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

The group of firms with no learning organization in the decade has the lowest share of highly educated employees. This share is less than half the share found among firms with continuous learning organization. The share increases to a level equal to the initial level found among firms with learning organization either in 1995 or in 2000. This means that the job development for highly educated employees is positive in the group of firms with no learning organization in the period. But the level from which the growth takes off is much lower than in the other two groups of firms; and in absolute terms it amounts to a gain of 205 jobs. The skilled employees also gain jobs in this group of firms; they gain 231 jobs, which is more than the highly educated employees. The unskilled employees, on the other hand, lose 222 jobs, i.e. almost equal to the number the skilled employees win. This may be a sign of a parallel upgrading of jobs from unskilled to skilled jobs. Besides shortterm numerical regulation, the unskilled jobs are lost by skills upgrading of jobs.

This means double pressure on unskilled jobs, which may be found in all groups of firms.

Table 7.12.1 Hiring and separation rates for highly educated employees in panel firms in 1990-91 to 1993-94 by development of learning organization in 1993-95 and/or 1998-2000

	1990 – 91		1991 – 92		1992 – 93		1993 – 94	
	Hiring	Separation	Hiring	Separation	Hiring	Separation	Hiring	Separation
LO 95+00	15.7	14.1	14.2	12.9	11.5	12.2	12.6	13.7
LO 95/00	19.4	16.2	18.6	16.8	13.6	15.5	18.9	17.2
Not LO	27.4	21.1	12.2	15.4	15.6	14.3	28.7	20.0
All firms	16.8	14.8	15.0	13.7	12.1	12.9	14.6	14.7

Table 7.12.2 Hiring and separation rates for highly educated employees in panel firms in 1994-95 to 1998-99 by development of learning organization in 1993-95 and/or 1998-2000

	1994 – 95		1995 – 96		1996 – 97		1997 – 98		1998 – 99	
	Hiring	Sepn.	Hiring	Sepn.	Hiring	Sepn.	Hiring	Sepn.	Hiring	Sepn.
LO 95+00	14.3	-	19.6	16.4	16.6	14.5	14.3	-	17.9	15.6
LO 95/00	20.0	-	23.0	18.6	20.8	16.7	15.1	-	21.9	19.6
Not LO	21.5	-	28.2	27.0	21.1	22.8	16.5	-	23.5	23.1
All firms	15.7	-	20.6	17.3	17.6	15.3	14.6	-	18.9	16.8

Due to missing data the separation rates for 1994-95 and 1997-98 are not calculated and presented in the table.

Table 7.12 shows the hiring and separation rates for highly educated employees in the three groups of firms with different degrees of learning organization. The group of firms with continuous learning organization has the lowest hiring and separation rates. The average rate of hiring is 15.2, with a standard deviation (s.d.) of 2.5, and the average rate of separation is 14.2, with an s.d. of 1.5. The gap between hiring and separation rates is largest in the last part of

the period. In general these rates are the lowest among all groups of employees and all groups of firms. The reason may be partly that the firms wish to retain the knowledge represented by this group and keep personnel turnover low, and partly that they are large firms, and large firms generally have lower job and personnel turnover. Nevertheless, in firms with continuous learning organization among employees with higher education, 15% of the employees are newly recruited each year and on average 14% leave the firm each year. Compared to the average for firms with learning organization in either 1995 or in 2000, the figure is moderate, even though it does represent more than one sixth of the employees turning over each year. In the firms with learning organization in either 1995 or in 2000, the average hiring rate is 19% and the average separation rate is 17.2%, with s.d. of 3 and 1.4 respectively. The highest turnover among the highly educated employees is found in the group of firms without learning organization. Here the average hiring rate is 21.6 and the average separation rate is 20.5, which makes a share of gross exchange of employees of more than two fifths on average each year.

Table 7.13.1 Hiring and separation rates for skilled employees in panel firms in 1990-91 to 1993-94 by development of learning organization 1993-95 and/or 1998-2000

	1990 – 91		1991 – 92		1992 – 93		1993 – 94	
	Hiring	Separation	Hiring	Separation	Hiring	Separation	Hiring	Separation
LO 95+00	17.1	13.1	15.1	15.0	12.5	15.4	12.6	14.8
LO 95/00	19.3	16.1	16.2	17.4	14.3	17.7	13.4	15.7
Not LO	23.7	21.7	20.4	20.3	18.5	19.6	20.5	19.1
All firms	18.2	17.7	15.8	16.1	13.5	16.3	13.6	15.5

Table 7.13.2 Hiring and separation rates for skilled employees in panel firms in 1994-95 to 1998-99 by development of learning organization 1993-95 and/or 1998-2000

	1994 – 95		1995 – 96		1996 – 97		1997 – 98		1998 – 99	
	Hiring	Sepr.	Hiring	Sepr.	Hiring	Sepr.	Hiring	Sepr.	Hiring	Sepr.
LO 95+00	17.9	-	17.4	16.1	12.8	14.4	17.0	-	13.9	15.0
LO 95/00	21.0	-	18.3	18.7	16.1	16.8	17.9	-	16.4	18.4
Not LO	23.6	-	19.7	21.5	19.1	18.7	19.6	-	18.4	18.6
All firms	19.2	-	17.9	17.2	14.1	15.4	17.5	-	15.0	16.2

Due to missing data the separation rates for 1994-95 and 1997-98 are not calculated and presented in the table.

The hiring and separation rates of skilled employees in the group of firms with continuous learning organization are comparable to the hiring rates for highly educated employees in the same firms, but the separation rates go up for the skilled employees in the last part of the decade. On average the hiring rates and separation rates are 15.1% and 14.8, but the s.d. is 2.2 for hiring and 0.9 for separation. This means that separations form a rather constant share of the oscillating yearly employment figures, which makes separation rates a structural phenomenon. This pattern is found for all three groups of firms, even though the averages are increasing. In firms with learning organization in 1995 or in 2000, the average of hiring and separation rates are 17% and 17.3%, but the s.d. of hiring is 2.4 and 1.1 for separation. In firms with no learning organization, the average hiring and separation rates are 20.4% and 19.9%, with an s.d. of 2.0 and 1.3. The last two groups of firms have lower hiring rates for skilled employees, but separation rates on level with those of highly educated employees in the same firms. This indicates that the structural element in the determination of the rates is important. Generally, separations act counter-cyclically and hiring acts pro-cyclically in relation to cyclical oscillations in the net job development. (Albæk & Sørensen 1995). This is a tendency found in this study, too.

Table 7.14.1 Hiring and separation rates for unskilled employees in panel firms in 1990-91 to 1993-94 by development of learning organization in 1993-95 and/or 1998-2000

	1990 – 91		1991 – 92		1992 – 93		1993 – 94	
	Hiring	Separation	Hiring	Separation	Hiring	Separation	Hiring	Separation
LO 95+00	21.8	19.1	19.0	19.0	18.3	18.9	15.0	18.2
LO 95/00	28.4	25.7	22.7	26.5	24.3	28.0	20.7	23.0
Not LO	31.4	27.9	24.7	26.5	25.6	28.8	26.4	25.8
All firms	24.3	21.5	20.4	21.5	20.4	22.0	17.4	20.0

Table 7.14.2 Hiring and separation rates for unskilled employees in firms in 1994-95 to 1998-99 by development of learning organization in 1993-95 and/or 1998-2000

	1994 – 95		1995 – 96		1996 – 97		1997 – 98		1998 – 99	
	Hiring	Sepr.	Hiring	Sepr.	Hiring	Sepr.	Hiring	Sepr.	Hiring	Sepr.
LO 95+00	24.6	-	22.9	20.5	15.7	17.8	21.8	-	19.6	20.0
LO 95/00	30.3	-	28.4	26.0	20.5	25.8	47.3	-	27.0	23.7
Not LO	32.8	-	27.6	26.4	24.3	25.2	27.8	-	25.7	22.8
All firms	26.6	-	24.5	22.2	17.6	20.2	28.0	-	21.8	21.1

Due to missing data the separation rates for 1994-95 and 1997-98 are not calculated and presented in the table.

The hiring and separation rates for unskilled employees in the three groups of firms are higher than those for skilled and highly educated employees in the same firms. This may be an effect of a more peripheral position of the unskilled workers in the firms, a phenomenon we are going to study more intensively in the next two chapters. Even so, we find much lower hiring and separation rates among the unskilled employees in firms with continuous learning organization compared to the other two groups of firms. In the firms with continuous learning organization, the average hiring rate is 19.9 and the average separation rate is 19.1, with s.d. of 3.2 and 0.9. In the group

of firms with learning organization in either 1995 or 2000, the average hiring rate is 25.3 (corrected) and the average separation rate is 25.5. This means a gross turnover one fourth of the staff of unskilled employees on average each year. Again we find the pattern of a higher s.d. for hiring rates of 3.8 (corrected) and lower for separation rates 1.7. Among the firms with no learning organization in the decade, we find the highest hiring and separation averages of 27.4 and 26.2, with s.d. of 2.9 and 1.9. Besides the dynamic relation between the firms and the labor market with large gross flows of employees in and out of the firms, it is interesting that the hiring rates (and the separation rates) are so high even though the number of jobs for unskilled employees is diminishing in the firms. This makes the process of external selection of skills and competences easier for the firms, but at the same time it puts a lot of pressure on the unskilled employees to stay "up to standard" in relation to qualifications demands.

7.3 Concluding observations

Learning organizations require a triad of formal education, competence building and social capital to thrive. This chapter deals with the external recruitment of qualifications and the change in personnel profiles during the decade. The main results from the analysis of demand for qualifications are that:

- Firms with continuous highly developed learning organization hire the largest proportion of highly educated employees. At the beginning of the decade, the proportion is twice the proportion we find among firms without learning organization, and at the end of the decade it is two and half times the size.

- The tendency of increase in recruitment of highly educated over the decade is even more pronounced among continuously product or service innovative firms.

- Firms with continuous learning organization experience a decline in hiring of skilled employees. Firms with learning organization in one of the two periods show a constant trend, and firms without learning organization experience a slight increase in the demand for skilled employees.

- The lowest hiring proportion of unskilled employees is found among the firms with continuous highly developed learning organization. This proportion is declining in the middle of the decade, but with oscillations throughout the period. Firms with no learning organization also show a declining trend for unskilled hiring.

- In innovative and learning firms no indication is found of sharp polarization in the hiring patterns for highly educated versus unskilled employees, though it is evident that an increasing number of highly educated employees are recruited in firms with continuous learning and innovation, and a declining number of unskilled are recruited by the same firms.

- The proportion of women hired is highest in firms with continuous learning organization. In 1990-91, 34% of their hiring is female, and this proportion rises to 38% at the end of the decade.

- The firms with continuous product or service innovation have the lowest hiring proportion of 50+ employees. Although the proportion is increasing slightly up through the decade, it stays well below the average.

- Developments in personnel profiles of the continuous learning organizations show an increasing share of highly educated, a relatively decreasing, but in absolute figures constant, share of skilled employees and a decreasing share of unskilled employees.

- The group of firms without learning organization has the lowest share of highly educated employees. This share is less than half the share found among firms with continuous learning organization.

- The group of firms with continuous highly developed learning organization has the lowest hiring and separation rates for highly educated. The average hiring rate is 6.5 point lower and the average separation rate is 6.3 point lower than the group of firms without learning organization.

- On average the rates of hiring and separation for skilled employees are on level with highly educated in the group of firms with continuous learning organizations and slightly lower in the group of firms without learning organization.

- For unskilled employees, the hiring and separation rates are higher in all three groups of firms than those for skilled and highly educated employees; but even so, we find much lower hiring and separation rates among the unskilled employees in the firms with continuous highly developed learning organization compared to the other two groups of firms.

Chapter 8

Competence development and continuous vocational training

Innovation and learning have to be closely and operationally related in the learning organization. The pivotal point is that this relationship between learning and innovation must be of a dynamic nature if continuous innovation is to prevail. In the continuously innovative firms, learning must at one and the same time be a result of and a driver of new products and services. Learning must be closely connected to the job situation and to job assignments in such a way that the internal and external work relations and experiences become the reflective fuel in the learning processes. This is a necessary, but not a sufficient, condition for innovative learning. To make learning complete and sufficient, with the innovative mode in focus, it is necessary to combine experience-based and reflective learning with new knowledge achieved from formal training and education (Tidemand & Lindstrøm 2003). Only in this way does learning become both knowledge-based and experience-based, and may evolve dynamically in the context of the organization.

Due to the contents of this learning concept and its importance for product and service innovation, competence development and continuous vocational training become crucially important for the firm. Competence development and continuous vocational training must form two sides of the same coin in the learning organization's employment system, and be complementary to its production strategies. In other words, competence development and continuous vocational training should establish the central basis of the employment system, be organizationally embedded and situated in or related to the firm's production and innovation strategies. The external recruitment of different qualifications was examined in chapter 7, and we have seen that the learning organizations create many jobs for highly educated people, whereas the net

trend for skilled, and especially for unskilled, employees is declining over the decade. But even though the personnel profiles are changing in favor of employees with higher education, this only provides an inflow of certain formal qualifications and of knowledge absorptive capacity into the firms. It is then the important function of the employment system to establish relations from recruitment to competence development and training, governing integration flows and mobility of employees, within the framework of the innovation system of the firm.

In this chapter we are going to investigate empirically this employment systems approach to competence development and continuous vocational training, with its relations to employment trends, job turnover and gross flows of employees. Competence development and continuous vocational training means firm-specific human capital enhancement. The experience- and reflection-based part of learning relates both directly and indirectly to the organization and its management of the work relations and processes in the firm. Thus the resulting knowledge will to a large extent be firm-specific and tacit, and will be valuable only provided the employee retains his or her employment in the firm. Should the employee leave the firm, it can be argued that both the employee and the employer lose the value represented by the utility of the firm-specific knowledge. However, in a more dynamic perspective, the employee may want to gain access to new frames of learning, in order to avoid ending up with too narrow and firm-specific qualifications and competences; and the firm may want to recruit employees with new or broader qualifications and competences. This, on the other hand, furthers mobility and makes it difficult to formulate any logical specific hypotheses about the relationship between competence development and employment dynamics. The institutional and organizational conditions of the sub-markets and the professions involved play an important role in the way the employment systems work and the resulting dynamics between enterprises and the labor market. Employment systems are the product of institutionally bounded rationality, often shaped by evolutionary track dependencies.

8.1 Continuous skill development and the competitiveness of enterprises

Empirically, we will commence the analysis of competence development and continuous vocational training by investigating the question of how important it is for a firm's competitiveness that its employees continuously develop their skills and competences. This is considered a general indicator of how the firm values the importance of learning in the above sense, directly related it to the firm's performance possibilities.

Table 8.1 Importance for the firm's competitiveness that its employees continuously develop their skills (Percent horizontal)

	Decisive	Great	Some	None	Don't know	(N)
1995	25.5	43.0	25.1	3.7	2.7	521
2000	25.2	45.6	24.5	3.9	0.8	515

We asked the firms both in 1996 and in 2001 how important it was for their competitiveness that their employees continuously develop their skills. Table 8.1 shows a remarkable uniformity in the firms' responses concerning the importance of continuous skill development. One fourth of the firms describe continuous skill development as of decisive importance in 1995 as well as in 2000, and between 43 and 46 % describe it as of great importance. This is an indication of awareness among a large number of the firms questioned about the centrality of competence development and vocational training of their human resources for the competitive performance of the enterprise. Especially the proportion of 25% of the firms which describe continuous skill development as of decisive importance is interesting in relation to the discussion of the competence-based employment system. First, we will examine whether the 25% constitute a stable group over time.

Table 8.2 Decisive importance for competitiveness of continuous skill development in 1995 and/or 2000 (Percent vertical)

Decisive importance for competitiveness of:		Frequency	Per cent
Continuous skill dev. 1995+2000	(1)	59	11.3
Continuous skill dev. 1995/2000	(2)	145	27.7
Not of decisive importance	(3)	320	61.1

Table 8.2 shows the proportion of firms describing continuous skill development as of decisive importance for competitiveness in 1995 and in 2000, in either 1995 or in 2000, or as not of decisive importance in either of the periods. First, it is important to note that the attitude of the 25% firms responding 'decisive importance for competitiveness' in each of the two surveys is not particularly stable over time, since a large replacement of firms has obviously taken place between the two measurements. The result of this replacement is that only 11% of the firms have been stable in their attitude and responded 'of decisive importance for competitiveness' in both periods, while 28% of the firms responded 'of decisive importance' in one of the two surveys. The largest part of the firms responded 'not of decisive importance' in either of the two periods. The 11%, or 59 firms, indicating decisive and stable priority of continuous skill development in both periods can be considered a core group of firms which give high priority to continuous learning and acknowledge its importance for competitive performance. Competitive performance is not necessarily related to innovative performance, and it is therefore of interest to examine empirically the relationship between the importance of continuous skill development and product innovation in the two periods.

Table 8.3 Continuous skill development (CS Dev.) and P/S innovation

	P/S Innovation 95+00	P/S Innovation 95/00	No P/S Innovation
CS Dev. 95+00 (1)	61.4	31.6	7.0
CS Dev. 95/00 (2)	34.1	41.7	24.2
Not CS Dev. (3)	25.7	31.0	43.3

Chisq p = <.0001 Gamma = 0.41

Among the group of firms ascribing decisive importance to continuous skill development in both periods, the probability of product or service innovation is remarkably high. 93% of this group of firms have been product or service innovative, either in both periods or in one of the two periods. The highest probability is product or service innovation in both periods (95+00). This is an indication of strong relations between the dynamics of skill development, competitive strengths and continuous product innovation. The group of firms responding of decisive importance to continuous skill development in one of the two periods has a lower probability of product or service innovation. Only one third of these firms are product innovative in both periods, and 42% of the firms are product innovative in one of the two periods. Among the firms that do not ascribe decisive importance to continuous skill development, the probability of product or service innovation in both periods is 26%. The strong relationship between the expressed importance of skill development and product innovation is confirmed by this linear relationship in table 8.3. In addition, a logistic regression of continuous skill development on P/S innovation in 2000 shows that the chances of product or service innovation is significantly 4.5 times higher for the group of firms expressing decisive importance of continuous skill development in both periods, compared to firms which do not prioritized continuous skill development.

Table 8.4 Continuous skill development and learning organization

		LO high 95+00	LO high 95/00	Not LO high
CS Dev. 95+00	(1)	54.2	35.6	10.2
CS Dev. 95/00	(2)	44.1	40.0	15.9
Not CS Dev.	(3)	29.4	34.4	36.3

Chisq p = <.0001 Gamma = 0.38

Among firms with learning organization we expect to find a prevalent opinion of the decisive importance of continuous skill development. Table 8.4 shows that within the group of firms ascribing decisive importance to continuous skill development in both periods, only 10% did not develop a learning organization. More than half the firms had highly developed learning organization in both periods, and more than one third had highly developed learning organization in one of the two periods. The group of firms describing skill development as of decisive importance in one of the two periods has a 10 percent-point lower share of continuous learning organizations, but a higher share of organizations with learning characteristics in one of the two periods compared to the former group. The lowest probability of learning organization is found among the firms that do not describe continuous skill development as of decisive influence. The result of the analysis is that our expectations have been confirmed about the empirical relationship between the attitude of ascribing decisive importance to continuous skill development and the behavior of building frameworks of learning. The importance ascribed to qualitative human capital enhancement in these firms makes it interesting to examine variations in employment trends among firms putting different weight on continuous skill development.

Table 8.5 Employment in panel firms by continuous skill development in 1995 and/or 2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
CS 95+00	8556 = 100	100.8	101.3	103.2	113.2	118.0	113.2	116.1	116.0	119.5
CS 95/00	18493 = 100	100.0	96.3	94.0	98.6	102.6	98.4	99.4	90.2	87.9
Not CS	24826 = 100	99.6	97.5	94.6	101.8	103.2	100.7	106.9	104.2	102.2
All firms	51875 = 100	99.9	97.7	95.8	102.6	105.4	102.0	105.8	101.1	100.0

Table 8.5 shows indexes of net employment development in firms ascribing decisive importance to continuous skill development in both 1995 and 2000, in either 1995 or in 2000, or in neither of the periods. First, we note that the first-mentioned group of firms is on average the largest, and the last-mentioned on average the smallest. Next, if we examine the net employment trend of the firms indicating decisive importance of continuous skill development in both periods, we see that their employment trend is increasing, and in 1995 it reaches the level that it ends up on at the end of the decade. The firms ascribing decisive importance to continuous skill development in one of the two periods have a decreasing employment trend starting as early as 1992 and lasting most of the decade, apart from a single peak in 1995. The firms that do not ascribe decisive importance to continuous skill development have a declining employment trend until 1994, and thereafter a rising trend towards the end of the decade. The difference between the net employment trends of the two groups of firms giving priority to continuous skill development is somewhat contradictory, which makes it all the more interesting to discuss and dig deeper into the material contents of the competence concept and try to identify the instruments used in competence development in the decade.

8.2 Competence development as situated and experience-based learning

While qualifications are individually adopted characteristics, built into and carried by a person, competence as a concept has to do with specific job situations and assignments, and concerns the capacity of an employee to use his or her qualifications in the job situation (Høyrup & Petersen 2002). Thus, Per-Erik Elström has defined competence as the potential possibilities to act in a specific assignment, situation or context. In line with this definition, competence development as a concept in this context will be defined as a continuous development of experiences, skills, influence, possibilities and responsibilities, related to the job situation, tasks and context of the employee. With this definition, competence development becomes closely connected to the experience-based and situated part of the learning concept and related to the organizational and the management context of the work situation.

Dealing with competence development implies special attention to the active use of the potentials in the organization and management principles, and how these principles can be configured in order to continuously develop the employees' capabilities. Besides the job situation and external relations, it is the mutual relations between the employees and towards the management which carry most of the potentials of competence development. Within this concept, the operational instruments of competence development are related to the way the organization and management of the work processes is used actively and deliberately as instruments to enhance the employees' experiences, skills etc. In order to go deeper into and examine empirically the instruments deployed and combined in competence development processes inside the firms and their implications for the job dynamics of the different employment groups, we will first consider conditions whereby competence is developed continuously in firms.

Table 8.6 Continuous development of employees' competences in 1995 and 2000 (Percent vertical)

	1		2		3		4		5		6	
	1995	2000	1995	2000	1995	2000	1995	2000	1995	2000	1995	2000
Great	44.9	64.8	24.4	20.1	6.2	6.6	13.6	21.8	25.6	20.8	12.9	9.6
Some	44.7	28.9	46.7	50.3	25.6	24.1	37.7	38.3	33.0	36.1	32.6	42.0
Small	3.3	1.2	17.8	15.3	24.2	23.5	13.9	14.0	11.1	15.6	25.2	24.9
None	1.8	2.6	5.3	8.2	28.1	33.5	15.8	17.6	18.9	16.8	19.1	16.9
D't k	5.3	2.6	5.7	6.2	16.0	12.4	9.0	8.4	11.5	10.8	10.2	6.6

1 = By solving the job assignments
2 = By giving time for sparring with management/other employees
3 = By planned job rotation
4 = By organizing the work in teams
5 = By promoting cooperation and networking across divisions and groups
6 = By standard courses/educational schemes

Table 8.6 shows the importance of different conditions or instruments used in the management's efforts to ensure that their employees continuously develop their skills, comparatively for the surveys of 1996 (1995) and 2001 (2000). Solving the job assignments (1), which is the first instrument considered, is described as of great importance by a large and increasing proportion of the firms. This is a signal of awareness about the potentials of organizing work processes in such a way that learning becomes part of solving the tasks. The next instrument concerns giving priority to the learning element in mutual relations between employees and management (2). Sparring is of great importance in almost a quarter of the firms in 1995 and a fifth of the firms in 2000. Planned job rotation (3) and team organization (4) concern learning in communities of practice (Lave & Wenger 1995). Obviously, team organization plays an increasing role in competence development. Cooperation and networking across divisions and groups (5), on the other hand, plays a decreasing role. In 1995 more than a quarter of the firms considered it of great importance, while only one fifth did in 2000. Standard courses or educational schemes (6) also have decreasing importance. Generally speaking, there seems to be a movement towards the informal and practice-oriented instruments,

and away from the deliberate use of inter-subjective instruments when we consider the instruments individually. To get a more precise and valid picture of the conditions of continuous competence development, it is interesting and important to uncover if and how the instruments are used together in the firms. The factor analysis in the table below presents the centrality and relations between the instruments.

Table 8.7 Factor analysis on competence development dimensions

1995 Dimension	Factor loadings 1995	2000 Dimension	Factor loadings 2000
5	**0.68**	5	**0.75**
4	**0.68**	4	**0.74**
2	**0.65**	3	**0.64**
1	**0.49**	2	**0.58**
3	**0.45**	1	**0.49**
6	**0.43**	6	**0.34**

1 = By solving the job assignments
2 = By giving time for sparring with management/other employees
3 = By planned job rotation
4 = By organizing the work in teams
5 = By promoting cooperation and networking across divisions and groups
6 = By standard courses/educational schemes

The six conditions or instruments all load on one factor both in 1995 and in 2000. This means that the conditions are used more or less simultaneously or interrelated as one dimension when practicing competence development in the firms. The most interesting observation is that cooperation and networking across divisions and groups and team-work have high factor loadings both in 1995 and in 2000. This is a signal of the importance of deliberate inter-subjectivity together with informal collective practices of learning in competence development. The individual and task-related instruments have loadings on a lower level, but except for "standard courses/educational schemes in 2000", high enough to be part of the latent variable of "applied continuous competence development instruments".

This makes it relevant and interesting to analyze the conditions of competence development as the use of a multitude of instruments applied more or less simultaneously in the firm. To perform such an analysis, an additive index has been constructed for 1995 and 2000. Each of the instruments counts one on the index when the firm has assigned "great" importance to the instrument. Having assigned great importance to 4 instruments means that the firm scores "4" on the index. 28 firms have assigned great importance to four instruments in 1995 and 25 did so in 2000. In this way, the indexes show the intensity of the bundling of instruments in the firms.

Table 8.8 Index of competence development conditions in firms in 1995 and 2000

Index 1995	Frequency 1995	Per cent 1995	Index 2000	Frequency 2000	Per cent 2000
0	197	37.6	0	152	29.0
1	133	25.4	1	178	34.0
2	95	18.1	2	102	19.5
3	62	11.8	3	50	9.5
4	28	5.3	4	25	4.8
5	4	0.8	5	9	1.7
6	5	1.0	6	8	1.5

The index of competence development conditions in table 8.8 shows that only between two fifths and one third of the firms both in 1995 and in 2000 have two or more instruments they assign great importance to simultaneously, in order to ensure that their employees continuously develop their competences. The distributions of 1995 and 2000 are similar, with minor variations. Very few firms have ascribed great importance to five or six instruments. 37% of the firms have ascribed great importance to between two and six instruments in 1995 and in 2000. When these firms consider two or more instruments of great importance for continuous competence development, we can expect them to have an active competence development policy towards their em-

ployees. What is interesting to find out next is whether the same firms score two or more on the index in both 1995 and 2000.

Table 8.9 Competence development in 1995 and/or 2000

		Frequency	Per cent
Competence development 1995+2000	(1)	91	17.4
Competence development 1995/2000	(2)	206	39.3
No competence development	(3)	227	43.3

Table 8.9 shows that 17% of the firms are in the group ascribing great importance to two or more instruments both in 1995 and in 2000. This means that less than half the firms which mention two or more instruments of great importance in 1995 still mention two or more instruments as of great importance in 2000. A much larger group of almost two fifths of the firms mention two or more instruments of great importance in either 1995 or in 2000. Less than half the firms do not consider two or more instruments as of great importance for competence development in either of the two periods. The first-mentioned group of firms, mentioning two or more instruments in 1995 as well as in 2000, shows the quality of a conscious and continuous competence development policy. This ought to promote learning in the firms and have an effect on their propensity to innovate. Whether this holds truth will be tested in the logistic regression below.

Table 8.10 Logistic regression of competence development on P/S innovation 2000 (Odd ratio, 95% confidence interval, estimates, chi-square and P-value)

Variables	Effect	Lower 95%	Higher 95%	Estimate	Chi-sq	P-value
Dev. 1 vs. 3	4.6	2.7	7.7	0.88	28.3	<.0001
Dev. 2 vs. 3	1.5	1.0	2.2	-0.24	3.5	0.0600

Results from the model shows that the group of firms mentioning two or more instruments as of great importance for continuous competence development both in 1995 and in 2000 have a significant 4.6 times higher chance of being product or service innovative, compared to the firms with no conscious or continuous competence development. The group of firms mentioning two or more instruments in either 1995 or in 2000 has a lower chance, and it is hardly significant. This means that continuous competence development with two or more instruments matters in relation to promoting organizational learning and the ability of product innovation. We must expect the framework of the learning organization, as defined and analyzed in chapter 6, to be closely related to the use of two or more instruments, because many of the competence development instruments are equivalent to the applied dimensions of the learning organization. It thus becomes a question of the conscious use of the attributes of the learning organization when the instruments are considered of great importance.

Table 8.11 Competence development and learning organization

	LO high 95+00	LO high 95/00	Not LO high
CO Dev. 95+00 (1)	64.8	28.6	6.6
CO Dev. 95/00 (2)	39.8	38.8	20.4
Not CO Dev. (3)	21.6	35.7	42.7

The probability of having a highly developed learning organization, either continuously in both periods or in one of the two periods, is very high in the group of firms with continuous competence development both in 1995 and in 2000. Only 7% of this group with high priority given to continuous competence development does not have a high-developed learning organization, and by far the largest proportion have developed learning organization in both periods. Among the firms with continuous competence development in one of the two periods, one fifth has not developed learning organizations, and the proportion with highly developed learning organizations in both periods shrinks to two fifths of the firms. Still, the relationship between com-

petence development and learning organization is evident. This means that among the group of firms without conscious competence development, only a little more than one fifth of the firms have a highly developed learning organization in both periods, and one third of the firms have highly developed learning organizations in one of two periods.

Table 8.12 Competence development and continuous skill development

		CS Dev 95+00	CS Dev 95/00	Not CS Dev.
CO Dev. 95+00	(1)	81.3	14.3	4.4
CO Dev. 95/00	(2)	59.2	34.3	6.5
Not CO Dev.	(3)	39.4	33.9	26.7

In order to test the internal validity of the two main indicators used to measure importance and awareness of continuous competence development inside the firms, table 8.12 shows the relationship between continuous competence development with two or more instruments of great importance and continuous skill development described as of decisive importance for the firm's competitiveness. The empirical relationship is obvious and strong. Especially among the firms with continuous competence development in both periods: 81% also describe continuous skill development as of decisive importance in both periods, and only 4% of the firms do not describe continuous competence development as of decisive importance. Among the group of firms which do not have continuous competence development we find large proportions ascribing decisive importance to continuous skill development. This may indicate that the index fails to catch a perfectly valid picture of the skill development policy practiced in the firms. However, the overall distribution shows that the index catches the core of continuous competence development in the sense that the probability of conscious and continuous competence development in the decade is very high in the group of firms which indicate two or more instruments as of great importance both in 1995 and in 2000.

Table 8.13 shows the relationship between continuous competence development as explained above and the firm's employment trends in the nineties. Among the firms with continuous competence development in both periods, a slight decline in index values can be observed in 1992 and 1993, followed by growth to a level above 100 until 1997, when a decline sets in resulting in index values of less than 100. The firms with continuous competence development in either 1995 or in 2000 seem to have a more balanced employment trend over the decade, and they do not experience any decline at the end of the period.

Table 8.13 Employment in panel firms by competence development in 1995 and/or 2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
CO 95+00	21128 = 100	101.0	98.5	97.2	104.7	109.2	104.0	105.8	97.8	96.5
CO 95/00	17887 = 100	101.2	98.1	96.2	101.5	102.6	100.0	101.7	102.7	102.7
Not CO	12860 = 100	96.5	95.8	93.0	100.5	103.1	101.5	111.5	104.5	101.9
All firms	51875 = 100	99.9	97.7	95.8	102.6	105.4	102.0	105.8	101.1	100.0

Actually a slight growth can be observed here, whereas the first-mentioned group experiences a fall. Thus the group of firms with continuous competence development in one of the two periods ends up with the highest index number. The firms with no continuous competence development experience a remarkable peak growth in 1997, which falls towards the end of the decade. Even though the group of firms with continuous competence development ends up with the lowest index number, this group has the highest average of 101.5 for index values among the three groups. The s.d. of 4.3 is high as well for this group of firms. The group of firms with continuous competence development in either 1995 or in 2000 has an average of 100.7 and an s.d. of

2.1. Firms with no continuous competence development have an average of 100.8 and the highest s.d. of 5.2. The general impression is that employment is more volatile than expected in the firms giving priority to continuous competence development in both periods. These firms would have been expected to retain and develop their employees rather than hire new qualifications, i.e. having a more stable personnel profile over time.

Table 8.14 Share of highly educated, skilled and unskilled employees in firms with competence development in 1995 and 2000 (CO95+00) (Percent vertical)

	Shr.90	Shr.91	Shr.92	Shr.93	Shr.94	Shr.95	Shr.96	Shr.97	Shr.98	Shr.99
Highly Educat	14.9	15.4	15.8	16.8	16.2	17.2	17.9	17.9	21.6	22.6
Skilled Empl.	41.0	42.6	42.6	42.7	42.5	42.2	42.1	42.1	39.2	39.3
Un-skilled	44.1	42.0	41.6	40.5	41.3	40.6	40.0	40.0	39.1	38.1
All Empl.	20694	20898	20410	20177	21711	22769	21957	22339	20662	20398

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

Contrary to expectations, the personnel profile in firms with continuous competence development in both 1995 and 2000 develops gradually, increasing the share of employees with higher education and decreasing the share of skilled and particularly unskilled employees, in a manner quite similar to what we observed for firms with learning organization in both 1995 and 2000. The share of highly educated employees increases by 54%, while the share of skilled employees decreases by only 5%, and the share of unskilled employees decreases by 13%. Skilled employees is the only group of employees which seems to confirm our expectations of stability. The net trends do not, however, present a true picture of stability vs. dynamics in the job situation of the firms. To get a more reliable picture, it is necessary to examine the job creations and job destructions for the various groups of employees.

Table 8.15.1 Job creation and job destruction for highly educated employees in panel firms in 1990-91 to 1993-94 by competence development in 1993-95 and/or 1998-2000

	Jobs 1990 – 91			Jobs 1991 – 92			Jobs 1992 – 93			Jobs 1993 – 94		
	Create	Destr.	D/C	Create	Destr.	D/C	Create	Destr.	D/C	Create	Destr.	D/C
CO 95+00	8.7	4.3	49	4.8	4.7	97	9.0	3.7	41	6.0	2.2	37
CO 95/00	9.4	5.4	58	6.5	4.4	67	8.8	4.8	54	9.8	3.6	36
Not CO	6.2	7.7	124	12.4	5.7	46	12.9	7.7	60	13.8	4.1	30
All firms	8.5	5.3	62	6.6	4.7	71	9.6	4.7	50	8.7	3.0	35

Table 8.15.2 Job creation and job destruction for highly educated employees in panel firms in 1994-95 to 1998-99 by competence development in 1993-95 and/or 1998-2000

	Jobs 1994 – 95			Jobs 1995 – 96			Jobs 1996 – 97			Jobs 1997 – 98			Jobs 1998 – 99		
	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C
95+00	12.3	1.4	11	4.9	3.9	81	4.9	3.7	75	15.4	3.4	22	6.0	2.7	45
95/00	15.0	4.6	31	8.6	5.8	68	8.6	4.1	47	21.3	2.6	12	8.6	5.4	63
Not	16.1	5.0	31	9.5	6.0	63	10.4	5.8	56	30.6	2.6	9	7.7	8.1	105
All	13.9	3.2	23	7.0	5.0	71	7.2	4.2	58	20.3	3.0	15	7.3	4.7	65

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

Among the group of firms with continuous competence development in 1995 and 2000, we find moderate job creation rates for the highly educated employees with an average of 8.0 in the decade and an s.d. of 3.7. The job destruction rate is on average 3.3, with an s.d. of 1.1, which is much lower than the average for job creations. While the job creation is volatile, the job destruction seems to be more stable and at a markedly lower level in this group of firms. The rate D/C is a measure of how many jobs are destroyed per 100 jobs created. The average for this group of firms is 51 jobs, but with a rather high s.d. of 28. The group of firms with continuous competence development either in 1995 or in 2000 has an average job creation for highly educated employees of 11.0, with an s.d. of 4.6. This is higher than the group

of firms with continuous competence development in both periods, but the job destruction is higher as well, with a mean of 4.5. The standard deviation of the job destruction is 1.0, which is on level with the former mentioned group of firms. Average D/C rate here is 48 with an s.d. of 19. The firms that did not give high priority to continuous competence development in either period have the highest average rate of job creation, 13.3, with an s.d. of 7.2, but also the highest average rate of job destruction, which is 5.9, with an s.d. of 1.8. The average D/C rate is 58, with an s.d. of 36. Even though the share of highly educated employees is growing throughout the decade in the firms with high priority attached to competence development, it is at moderate job creation and job destruction rates. On average 51 jobs are destroyed when 100 jobs are created in firms with continuous competence development in both periods, and a little less in firms with continuous competence development in one of the two periods. The firms that do not give high priority to continuous competence development have on average higher rates of job creation and job destruction and a higher D/C rate. All indicators show higher job dynamics for employees with higher education in this group of firms, and the high average rate of job creation means that these firms tend to recruit qualifications from the market rather than putting great weight on competence development.

Skilled employees have a comparatively stable share of jobs in the group of firms giving high priority to competence development in 1995 as well as in 2000. Table 8.16 on next page shows, in line with this observation, that on average they have a lower job creation rate and a higher job destruction rate than the highly educated employees in the same group of firms. The mean job creation for skilled employees in firms giving high priority to continuous competence development is 5, with an s.d. of 2.6 and the mean job destruction is 5.4, with a high s.d. of 4.3 (which is due to the high rate in 1997-98).

Table 8.16.1 Job creation and job destruction for skilled employees in panel firms in 1990-91 to 1993-94 by competence development in 1993-95 and/or 1998-2000

	Jobs 1990 – 91			Jobs 1991 – 92			Jobs 1992 – 93			Jobs 1993 – 94		
	Create	Destr.	D/C	Create	Destr.	D/C	Create	Destr.	D/C	Create	Destr.	D/C
CO 95+00	7.7	2.7	35	3.7	6.0	165	4.8	5.7	120	10.0	2.9	29
CO 95/00	7.6	4.4	58	4.9	7.2	148	4.6	7.4	115	10.4	4.7	46
Not CO	6.6	8.8	134	7.0	6.9	98	7.2	7.2	100	11.6	4.4	38
All firms	7.7	5.1	66	4.9	6.7	135	6.0	6.7	112	10.5	3.9	37

Table 8.16.2 Job creation and job destruction for skilled employees in panel firms in 1994-95 to 1998-99 by competence development in 1993-95 and/or 1998-2000

	Jobs 1994 – 95			Jobs 1995 – 96			Jobs 1996 – 97			Jobs 1997 – 98			Jobs 1998 – 99		
	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C
95+00	6.5	2.3	35	3.6	7.6	209	4.0	2.0	50	1.7	15.7	90.0	3.2	4.4	138
95/00	8.4	7.1	85	5.1	7.0	138	6.5	4.3	66	4.2	9.5	22.5	5.8	6.9	120
Not	9.7	6.1	63	5.3	5.6	107	7.4	4.7	64	4.9	9.0	18.6	5.9	6.4	108
All	8.0	4.9	62	4.5	6.9	151	5.7	3.5	61	3.4	11.8	34.7	4.9	5.8	120

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

Among the firms giving high priority to continuous competence building in one of the two periods, the average job creation rate is 6.4 with an s.d. of 2.1, and the average job destruction rate is 6.5 with an s.d. of 1.7. Even though the averages are higher here, the variation is smaller, which is interesting. In the group of firms that do not prioritize continuous competence development in either 1995 or 2000, the average job creation rate is 7.3 with an s.d. of 2.1, and the average job destruction rate is 6.6 and the s.d. is 1.6. Among the three groups, this is the only group of firms where average job creation is larger than average job destruction, and the higher job turnover is caused by higher average job creation. This also means that the average D/C rate is lowest here.

Table 8.17.1 Job creation and Job destruction for unskilled employees in panel firms 1990 – 91 to 1993 – 94 by competence development 1993 – 95 and/or 1998 –2000

	Jobs 1990 – 91			Jobs 1991 – 92			Jobs 1992 – 93			Jobs 1993 – 94		
	Create	Destr.	D/C	Create	Destr.	D/C	Create	Destr.	D/C	Create	Destr.	D/C
CO 95+00	3.8	7.7	203	3.3	6.5	198	2.7	6.5	240	11.8	2.1	18
CO 95/00	6.7	8.7	130	4.8	10.2	213	5.1	10.3	203	10.7	4.8	45
Not CO	5.5	10.0	181	6.2	8.8	142	6.0	13.6	227	14.0	5.4	39
All firms	5.2	8.6	166	4.5	8.3	184	4.3	9.6	221	12.0	3.8	32

Table 8.17.2 Job creation and Job destruction for unskilled employees in panel firms 1994 – 95 to 1998 – 99 by competence development 1993 – 95 and/or 1998 –2000

	Jobs 1994 – 95			Jobs 1995 – 96			Jobs 1996 – 97			Jobs 1997 – 98			Jobs 1998 – 99		
	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C	Crea	Dest	D/C
95+00	5.4	2.3	42	3.8	8.9	23.3	4.5	2.7	62	3.1	12.6	40.0	3.1	7.0	227
95/00	8.2	10.1	12.4	5.9	6.7	11	7.1	7.3	10.2	7.1	7.0	99	7.8	8.1	104
Not	9.6	9.7	10.0	7.8	7.3	94	26.3	6.7	26	6.1	22.6	37.1	4.9	10.2	207
All	7.4	6.7	91	5.5	7.8	14.2	11.0	5.2	48	5.2	13.8	26.6	5.1	8.2	160

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

Unskilled employees find themselves in a situation of declining shares of jobs in the group of firms giving high priority to continuous competence development. This depresses their average job creation rate to 4.6 with an s.d. of 2.8 The job destruction rate, on the other hand, is as high as 6.6, with an s.d. of 3.5, and the D/C's are generally very high throughout the decade. Almost the same structure is found for the firms giving high priority to continuous competence building in one of the two periods, but at a slightly higher level. Here the average job creation rate is 7.0, with an s.d. of 1.8, and the average job destruction rate is 8.1 with an s.d. of 1.8. The firms that do not give high priority to continuous competence development have an average job creation of 9.6, with an s.d. of 6.9 and the average job destruction is 10.5, with an

s.d. of 5.1. The D/C rates illustrate the difficult job situation for the unskilled employees.

8.3 Continuous vocational training as knowledge-based learning

The analysis has shown that continuous competence development plays an important role, especially in the firms with highly developed learning organization, and it has significant effects on product and service innovation. Prioritizing continuous competence development is related to changing personnel profiles as well, as we have observed increasing proportions of highly educated and decreasing proportions of unskilled employees. In a learning context, competence development is related to the reflective, situated and experience-based part of the concept. This part is in turn dependent on a knowledge-based part, to be complete in relation to innovative learning. Situated and experience-based learning encourages development of skills embedded in the firm. New theoretical and methodological knowledge is often of crucial importance if the firm faces development of new products or services. One strategy is to 'recruit' the new knowledge, but a more focused strategy is to combine the internal continuous competence development with internal and external courses and educational schemes. In order to examine the use of such formal continuous vocational training, we have asked the firms how many employees participated in internal or external courses or educational schemes, first from 1993 to 1995 and later during the period 1998-2000. In the last survey, we asked specifically about the employee groups.

Table 8.18 Continuous vocational training in 1993-1995 and 1998-2000 (per cent horizontal)

	50 - 100%	0 – 49%
1993-1995: All employees	38.2	61.8
1998-2000: Highly educated	38.8	61.2
1998-2000: Skilled	41.4	58.6
1998-2000: Unskilled	33.8	66.2

Referring to the period 1993-1995, almost two fifths of the firms responded that between 50 and 100% of all their employees had participated in internal or external courses or educational schemes. For the period 1998-2000 the question was specified on the three employee groups, but the responses were on level with the 1993-1995 observations. It is interesting to note that a higher proportion of firms have offered courses and educational schemes to the skilled employees, compared to highly educated and unskilled employees. It is even more interesting that the difference between the proportions of firms making extensive use of continuous vocational training for the various employee groups is so limited in 1998-2000. In order to examine empirically how extensive the use of continuous vocational training for all employee groups is in the firms, an additive index has been constructed. Firms responding '0-49%' for 1993-1995 get the value 3, and firms having responded 50-100% get the value 6. For the period 1998-2000, the response '0-49%' gets the value 1 and '50-100%' gets the value 2. In this way, the two periods are weighted equally and the minimum value of 6 in the index is given when the firm in both periods and for all employee groups had between '0-49%' of all their employees participating in internal or external courses or educational schemes. All values above 6 in the index had more extended vocational training, either in 1993-95 or in 1998-2000.

Table 8.19 Index of continuous vocational training

Index	Frequency	Per cent	Cumulative per cent
6	114	35.0	35.0
7	40	12.3	47.2
8	11	3.4	50.6
9	73	22.4	73.0
10	18	5.5	78.5
11	26	8.0	86.5
12	44	13.5	100.0

The additive index in table 8.19 shows that 35% of the firms have below 50% coverage of continuous vocational training for both periods and all employee groups. This, on the other hand, means that extensive continuous vocational training often seems to be part of the learning policy of the firms, for some or for all the employee groups. The peaks in the index distribution give the impression of a middle group of firms with vocational training for some, but not all employee groups and/or periods, and a group of firms with highly extensive use of internal or external courses or educational schemes. Scoring index values higher than '9' means that the firm makes extensive use of continuous vocational training in both periods, and for two or more employee groups. This group of firms uses continuous vocational training with high extensiveness. The group with index values higher than '6' and lower than '10' belongs to the medium group in extensive use of continuous vocational training. The table below shows this classification.

Table 8.20 Continuous vocational training for all employees

		Frequency	Per cent
VT High extensiveness	(1)	88	27.0
VT Medium extensiveness	(2)	124	38.0
VT Low extensiveness	(3)	114	35.0

A high extensity of continuous vocational training means that all or most of the firm's personnel groups participate in the knowledge-based learning part. This means that the necessary conditions are present for innovative learning to become something that concerns the entire organization. Here, innovative learning is not the preserve of an exclusive group in the firms. These necessary conditions for innovative learning are present in more than one fourth of the firms. The largest group of firms, though, is the firms where some of the employee groups have extensive vocational training; this group embraces 38% of the firms. The group with low vocational training extensiveness in both periods and for all employee groups includes 35% of the firms. Sufficient conditions for innovative learning, as mentioned, depend on the situated, reflective and experienced-based part as well, related to the priority given to continuous competence development in the firm. In order to examine the relationship between the two parts of innovative learning, the relationship between extensiveness of continuous vocational training and priority given to competence development is shown in the table below.

Table 8.21 Continuous vocational training and competence development (CO Dev.)

		CO Dev. 95+00	CO Dev. 95/00	Not CO Dev.
VT high extensiveness	(1)	77.3	20.5	2.3
VT medium extensiveness	(2)	55.7	32.3	12.1
VT low extensiveness	(3)	34.2	38.6	27.2

Among the group of firms with highly extensive continuous vocational training almost all have stated high priority given to competence development, using two or more organizational or management instruments in the continuous competence development. 77% have continuous competence development in both periods, and 21% have continuous competence development in one of the two periods. Only 2% do not give any priority to competence development. Among the group of firms with medium extensiveness of continuous vocational training, the share with continuous competence develop-

ment in one of the two periods is larger, and so is the share without continuous competence development compared to the former group. Learning may be more fragmented here, and not as pervasive as in the group with high extensiveness. The last group with low extensiveness of vocational training has the lowest proportion prioritizing continuous competence development and the highest proportion that does not prioritize competence development at all. Thus the analysis confirms the relationship between the two parts of innovative learning; but how is the vocational training situated in the learning organization framework? Table 8.22 answers this question.

Table 8.22 Continuous vocational training and learning organization

		LO high 95+00	LO high 95/00	Not LO high
VT high extensiveness	(1)	61.4	34.1	4.6
VT medium extensiveness	(2)	44.4	37.9	17.7
VT low extensiveness	(3)	22.8	36.8	40.4

Among the firms with high extensiveness of continuous vocational training, the probability of having a learning organizational framework is very high. Three fifths of the firms have highly developed learning organization in both periods and one third have high-developed learning organization in one of the two periods. This indicates a good fit between the conditions of situated learning and the possibilities of gaining new inspiration and knowledge. The firms with medium extensiveness of vocational training have the highest proportion of learning organization in one of the two periods, while the group of firms with low extensiveness of continuous vocational training has by far the largest proportion without learning organization in either period. This relationship between extensiveness of continuous vocational training and learning environments was to be expected, and is empirically confirmed. It will be interesting to investigate in more detail what consequences the learning policies of the firms have had on the composition of their workforce. First we are going to study the development of personnel profiles in firms with high extensiveness of continuous vocational training.

Table 8.23 Share of highly educated, skilled and unskilled employees in firms with high extensiveness of continuous vocational training (Percent vertical)

	Shr.90	Shr.91	Shr.92	Shr.93	Shr.94	Shr.95	Shr.96	Shr.97	Shr.98	Shr.99
Highly Educat	17.1	17.5	17.9	18.9	18.2	19.2	20.2	20.0	24.2	25.7
Skilled Empl.	37.8	39.1	39.4	40.2	40.2	40.5	40.1	39.9	37.4	37.5
Un-skilled	45.1	43.3	42.7	40.9	41.6	40.3	39.7	40.0	38.3	36.8
All Empl.	18943	18506	18141	18066	19736	20863	19786	20106	18466	18092

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

Compared to the share of highly educated employees in firms with learning organizations in 1993-95 and 1998-2000, the firms in this group have a 2.5 percent point larger share of highly educated employees and ends up with a 3.2 percent point larger share at the end of the decade. The share of highly educated employees increases by 50% over the period, corresponding to 1,419 employees. This prioritizing of recruitment of employees with higher education is frequently followed up by continuous competence development where extensive use of vocational training is part of the picture. The important point is that extensive continuous vocational training means that not only the highly educated employees get the training; the probability that all the employee groups take part in training here is high.

This means that the skilled and unskilled employees are part of the extensive training and development of employees in the employment system. The group of skilled employees has an almost constant share of employees over the decade, rising from 38% to 40% in the middle of the decade and falling back to 38%. From being the second largest employee group, the skilled employees move up to become the largest group of employees in these firms. It is the unskilled employees who lose jobs in the decade. From a share of 45% at the beginning, their share falls to 37% at the end of the decade. This is a decrease

in share of 18% and it means 1,892 fewer jobs for the unskilled. It is important to remember, though, that there is a high probability that the unskilled employees who stay on in the firms take part in the continuous competence development and vocational training policy (Nielsen 2004).

Table 8.24 Share of highly educated, skilled and unskilled employees in firms with low extensiveness of continuous vocational training (Percent vertical)

	Shr.90	Shr.91	Shr.92	Shr.93	Shr.94	Shr.95	Shr.96	Shr.97	Shr.98	Shr.99
Highly Educat	8.6	8.5	8.8	10.2	9.7	10.3	10.5	10.6	13.4	13.3
Skilled Empl.	47.9	49.0	48.5	49.5	49.1	49.2	48.9	49.1	47.6	47.4
Un-skilled	43.5	42.5	42.7	40.3	41.1	40.5	40.6	40.3	38.9	39.3
All Empl.	5964	6040	6171	6010	6620	7047	6962	7032	7152	7126

A change in educational codes between 1997 and 1998 causes a break and minor inaccuracy between 1990-97 and 1998-99 figures.

Table 8.24 shows the shares of highly educated, skilled and unskilled employees in firms with low extensiveness of continuous vocational training. This group of firms has only half the share of highly educated employees at the beginning of the period, but the share is growing proportionally with the group of firms with high extensiveness of vocational training, ending up with a share of 13%. This means an extra 439 jobs for the highly educated in these firms. The skilled employees start out with the highest proportion at the beginning of the period and they end with the highest proportion as well.

Also here, the unskilled employees lose proportions, but the present decrease is only half of what we observed among firms with high extensiveness of vocational training, and because of general growth the unskilled employees do not lose jobs in this group of firms. But even though the share of employees is constant or even rising, employee turnover indicates there are interactions between the market and the competence development and training

taking place inside the firms. This makes the study of hiring and separation important, to get a dynamic picture of the employment systems of the firms. First, we will examine the hiring and separation rates for the employees with higher education in the three groups of firms with different extensiveness of continuous vocational training.

Table 8.25.1 Hiring and separation rates for highly educated employees in panel firms in 1990-91 to 1993-94 by extensiveness of continuous vocational training

	Jobs 1990 – 91			Jobs 1991 – 92			Jobs 1992 – 93			Jobs 1993 – 94		
	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H
High	13.5	13.3	41	11.3	12.3	39	9.0	11.0	89	13.1	12.5	49
Med	22.4	16.1	49	20.1	15.5	30	13.1	12.1	73	15.8	16.2	54
Low	21.4	18.2	47	15.8	15.9	70	15.5	10.8	-	20.3	16.8	55
All	17.1	14.7	45	14.6	13.7	38	11.0	11.3	85	14.7	14.1	52

Table 8.25.2 Hiring and separation rates for highly educated employees in panel firms in 1994-95 to 1998-99 by extensiveness of continuous vocational training

	Jobs 1994 – 95			Jobs 1995 – 96			Jobs 1996 – 97			Jobs 1997 – 98			Jobs 1998 – 99		
	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H
High	13.5	-	84	18.7	15.7	24	14.9	14.5	26	13.4	-	-	17.8	14.6	35
Med	17.4	-	74	21.7	18.4	45	20.7	15.1	54	16.9	-	-	18.5	17.2	36
Low	17.4	-	84	22.6	17.7	34	17.4	15.8	45	12.7	-	-	21.8	20.8	39
All	15.2	-	80	20.1	16.7	33	17.2	14.9	40	14.6	-	-	18.5	16.3	36

Due to missing data the separation rates for 1994-95 and 1997-98 are not calculated and presented in the table.

The importance for enterprises of having employees with higher education is growing in the nineties. Formal qualifications and learning capacity are demanded by enterprises and many jobs are created in organizations where learning, continuous competence development and extensive vocational training is institutionalized. This investment in human resources can be expected to produce a lower employee turnover. For the highly educated employees the separation rates should be moderate in a situation where the firms have an

interest in retaining their human investments in jobs. On the other hand, the highly educated employees, and other groups as well, may have a career interest in being mobile on the labor market, to avoid ending up with too narrow and firm-specific qualifications.

Table 8.25 shows that the highly educated employees have lower than average hiring and separation rates in firms with extensive continuous vocational training. The average rate of separation is 13.4, with an s.d. of 1.6 in these firms. The average hiring rate of 13.9, with an s.d. of 3.0, is fairly close to the level of the separation rate. This means that in a situation of job growth, turnover and flows between the firms and the labor market is important. The C/H rate represents job creation relative to the hiring of the firms. The average C/H rate of 48 in the firms means that 48 jobs were created for every 100 employees hired in the group. A low figure means a high share of qualifications hiring in addition to the hiring which follows from the job creation. Among the firms with medium extensiveness of continuous vocational training, the average hiring rate is 18.5 with a 3.0 s.d., and the average separation rate is 15.8, with an s.d. of 2.0. The larger gap between hiring and separation rates means that the C/H rate is 52 in these firms. Hiring in excess of job creation is lower here. The firms with low extensiveness of continuous vocational training have average hiring and separation rates on level with the firms with medium extensiveness. Here the C/H rate is 53; the higher rate is, however, due to variations as the standard deviation is higher here. In general, the analysis shows that the hiring level is determined by the creation of new jobs, but also by the employee flows between the firms and the market. Even in a situation where firms invest extensively in training, there is a permanent need for recruiting qualifications on the market.

Table 8.26 on next page shows the hiring and separation rates for skilled employees. It is interesting that in firms with extensive continuous vocational training, the average hiring rate of 13.3 and separation rate of 13.1 is on level with those for the highly educated employees in the same firms. Due to the lower job creation in the firms for this group, the average C/H rate is 38. In general, on the market for skilled qualifications, a relatively high mobility between firms has been institutionalized (Sengenberger 1974).

Table 8.26.1 Hiring and separation rates for skilled employees in panel firms in 1990-91 to 1993-94 by extensiveness of continuous vocational training

	Jobs 1990 – 91			Jobs 1991 – 92			Jobs 1992 – 93			Jobs 1993 – 94		
	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H
High	15.2	11.8	32	11.5	12.3	32	10.3	11.8	45	10.5	12.5	96
Med	20.2	16.0	43	18.8	17.8	21	13.3	18.5	33	13.9	16.6	65
Low	20.9	17.7	49	19.1	18.3	39	18.1	19.6	47	16.3	16.1	66
All	18.2	14.5	41	15.7	15.5	29	12.9	15.8	44	12.8	14.7	77

Table 8.26.2 Hiring and separation rates for skilled employees in panel firms in 1994-95 to 1998-99 by extensiveness of continuous vocational training

	Jobs 1994 – 95			Jobs 1995 – 96			Jobs 1996 – 97			Jobs 1997 – 98			Jobs 1998 – 99		
	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H
High	17.5	-	43	17.4	16.3	19	9.8	13.3	36	15.3	-	13	12.2	13.6	25
Med	18.9	-	35	17.1	17.1	31	16.0	15.6	46	19.6	-	20	16.0	16.6	28
Low	21.0	-	54	20.4	20.0	26	17.1	18.2	32	17.9	-	30	16.7	19.8	37
All	18.7	-	42	17.9	17.3	25	13.5	15.1	40	17.5	-	19	14.6	16.0	29

Due to missing data the separation rates for 1994-95 and 1997-98 are not calculated and presented in the table.

This norm of mobility is part of an access to broader competence development for the skilled employees, and it may explain the comparatively low C/H rate. In the firms with medium-extensive continuous vocational training, the average hiring rate of 17.1 and separation rate of 16.9 are higher than in the firms with high extensiveness of training. This could indicate that the former group of firms, within the frames of a dynamic market, actively depress employee turnover in order to retain qualifications in the firms. This is supported by the fact that the firms with low extensiveness of training have the highest average hiring rate of 18.6, and an average separation rate of 18.5. This indicates a high employee turnover, but also that job turnover is high as well, which is reflected in a relatively high C/H rate of 42, with a standard deviation of 13.

Table 8.27.1 Hiring and separation rates for unskilled employees in panel firms in 1990-91 to 1993-94 by extensiveness of continuous vocational training

	Jobs 1990 – 91			Jobs 1991 – 92			Jobs 1992 – 93			Jobs 1993 – 94		
	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H
High	21.2	17.9	14	14.5	16.2	18	15.0	16.5	14	12.7	15.5	87
Med	25.7	24.8	25	26.1	25.9	17	22.2	25.1	25	20.2	22.2	50
Low	28.7	24.6	30	24.1	23.6	39	28.9	29.2	23	21.5	22.6	65
All	24.0	21.3	21	20.1	20.8	22	19.7	21.6	21	16.7	19.0	67

Table 8.27.2 Hiring and separation rates for unskilled employees in panel firms in 1994-95 to 1998-99 by extensiveness of continuous vocational training

	Jobs 1994 – 95			Jobs 1995 – 96			Jobs 1996 – 97			Jobs 1997 – 98			Jobs 1998 – 99		
	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H	Hire	Sep.	C/H
95+00	24.7	-	20	21.5	19.5	18	12.4	15.5	38	20.9	-	9	17.6	19.4	16
95/00	26.2	-	26	24.3	23.3	24	16.6	21.0	-	39.5	-	11	21.1	20.5	20
Not	29.6	-	40	30.0	26.3	26	19.4	24.5	28	27.4	-	24	26.2	23.4	28
All f.	26.0	-	26	23.9	21.9	22	15.3	19.0	67	28.8	-	13	20.5	20.5	21

Due to missing data the separation rates for 1994-95 and 1997-98 are not calculated and presented in the table.

Even though their shares of jobs are shrinking, the hiring and separation rates for unskilled employees are generally high. When adjustments are needed, it is often the unskilled employees who are the objects of short-term regulation. But even so, the average hiring rate of 17.8 with an s.d. of 4.4 and the average separation rate of 17.2 with an s.d. of 1.7 in the firms with highly extensive vocational training show that these firms have much lower employee turnover than the other groups of firms which do not use continuous vocational training as extensively. In firms with medium extensiveness of continuous vocational training, the average rate of hiring is 25.7, with an s.d. of 6.5, and the average rate of separation is 23.3 with an s.d. of 2.1. This is 6 to 8 percent points higher than the group of firms with high extensiveness of vocational training, but the average C/H rates are very similar, 26 and 25 re-

spectively. The firms with low extensiveness of continuous vocational training have slightly higher, and thus the highest averages of hiring and separation rates among the three groups of firms. The average hiring rate is 26.2 and the separation rate is 24.9. The C/H rate is 34, which is a result of a relatively high job turnover related to the high employee turnover.

The analysis of the employment implications of competence development and continuous vocational training has shown that, parallel to the human capital enhancement activities inside the firms, a gradual shift in personnel profiles is taking place in the firms, favoring the highly educated employees. In excess of the increasing number of jobs for highly educated employees, a parallel replacement is taking place as well, which means mobility, learning and career opportunities in other firms. The flows of employees in and out are lowest in firms with high extensiveness of training. In the same way, the job turnover is lowest in firms giving high priority to continuous competence development. The most important observation is that this is true for all groups of employees, and for the unskilled employees the gap is by far the largest. This means that the firms, though embedded in different market conditions, endeavor to retain their investments in human resources. In this process, the firms have to play together with the market forces, and not against them, in their human resources strategies.

8.4 Concluding observations

The main results from this analysis of competence development and continuous vocational training are that:

- Among the group of firms ascribing decisive importance to continuous skill development in both periods, the probability of product or service innovation is very high.

- More than half the firms ascribing decisive importance to continuous skill development in both periods have continuous highly developed learning organizations.

- The net employment trend is increasing for the firms ascribing decisive importance to continuous skill development in both periods.

- Competence development in firms is related to the way organization and management is used actively and deliberately in the work processes as instruments to enhance employees' capabilities.

- Cooperation and networking across divisions and groups as well as team-work are central when used among other instruments in competence building, both in 1995 and 2000.

- Firms ascribing great importance to two or more instruments both in 1995 and 2000 have almost five times higher chance of being continuously product or service innovative.

- The probability of having a highly developed learning organization is very high in the group of firms with continuous competence development.

- The group of firms with continuous competence development ends up with the lowest net employment, but the group has the highest average on the employment index.

- In firms with continuous competence development the personnel profile develops gradually, increasing the share of employees with higher education and decreasing the share of especially unskilled employees.

- Though the share of highly educated employees is growing throughout the decade in the firms with continuous competence development, it is at moderate job creation and job destruction rates.

- A high extensity of continuous vocational training means that all or most of the firm's personnel groups participate in the knowledge-based learning part.

- Among the group of firms with high extensity of continuous vocational training almost all give high priority to continuous competence development.

- The firms with high extensity of continuous vocational training are characterized by a high share of highly educated employees, but the skilled and unskilled employees take part in the extensive training and development in these firms, too.

- Hiring and separation rates for unskilled employees are generally the highest, even though their shares of jobs are shrinking. This indicates that it is often the unskilled employees who are the objects of short-term regulation as well as medium-term downsizing.

Chapter 9

Personnel policies and strategies: flexibility, integration and mobility

Investments in human capital through competence development and continuous vocational training act as an incentive for management to retain employees and keep turnover low. Similar incentives and behaviour are to be expected in cases where firms are dependent on knowledge and learning capacity. Still, even in firms with learning organization and competence development practices we see a fair amount of turnover. This leads to a need for strategic recruitment, resulting in gradual changes of personnel profiles in the firms over time. Deliberate considerations and the resulting behaviour in personnel matters therefore bring into focus the question of the personnel policies and strategies applied by the different groups of firms. Our approach to personnel policies and strategies will be to examine the carried-out behaviour rather than formal intentions and written documents. Consequently, we define personnel policies as the actual behaviour which ensures that the personnel resources are in accordance with the needs of the firm. Analytically, this definition brings the concept of flexibility on the agenda. Flexibility provides the means for regulating and adjusting the human resources in accordance with the short- and long-term needs of the individual firms. One of the important contributions on these issues is John Atkinson's theory on the flexible firm (Atkinson 1985). Essentially, this theory builds a model of horizontal segmentation in the firm. One segment constitutes the core group of employees, who are functionally flexible and mobile between different job assignments and functions inside the firm. Another segment is the peripheral group of employees, who are numerically flexible and mobile in and out of the firm.

9.1 Internal and external flexibility in enterprises

Atkinson's model of the flexible firm has been extended in a Danish study of personnel policies and staff planning in firms (Jørgensen, Lind & Nielsen 1990). In addition to Atkinson's use of functional and numerical flexibility, the Danish research group developed two new dimensions of flexibility. The first additional dimension is regulation of working time, and the second is regulation of working intensity. The analysis showed that the firms used these four dimensions of flexibility in combination to ensure that the personnel resources matched their needs. In the present context, we are going to go a step further and construct a taxonomy of personnel strategy on the flexibility dimensions. The taxonomy assumes that the firms need instruments suitable for longterm integration of core competences and knowledge sources in their labor force as well as short-time regulation and at times downsizing of the more peripheral labor. This means that the personnel strategy must include measures to ensure internal flexibility of the core labor force as well as external flexibility of the more peripheral groups.

Table 9.1 Taxonomy of flexibility

Internal flexibility	Functional flexibility Working time flexibility
External flexibility	Numerical flexibility Outsourcing

As measures of internal flexibility, the firms are expected to use functional flexibility as well as working time flexibility. These measures of regulation are appropriate in relation to long-time integration of core competences. Especially functional flexibility contributes to competence enhancement. As measures of external flexibility, the firms may use numerical flexibility as well as outsourcing of activities. Numerical flexibility is suitable for short-time regulation, and outsourcing is suitable for downsizing functions not important for the firm's knowledge base. We will start the analysis of personnel policies and strategies by investigating how the various groups of firms with different innovation and learning behaviour make use of the measures of internal and

external flexibility in their personnel policy. It is an important analytical point to bear in mind that the pattern of flexibility used by the different groups of firms can be expected to have consequences for employment over time. What these consequences will be depends on the strategies of integration and mobility applied in the firms.

We define personnel strategy in line with Atkinson (1985) as the long-term development of core competences in combination with the short-term regulation of peripheral employment in enterprises. This means that we are going to examine developments over time in the pattern of core and peripheral employment for different groups of firms, and among various educational groups of employees. In doing so, we are going to integrate the analysis of personnel policies and strategies in the firms, relating the use of flexibility measures to the strategic development in the mix between core labor and peripheral labor in the firms. Our analytical starting point will be the firms' use of flexibility measures. We asked the firms in 1996 (1995) and again in 2001 (2000) to what extent they used the four flexibility measures, and classified their responses according to use, into "a high or to some extent" vs. "a small extent or not at all." The result is shown in the table below. The column (1995+2000) shows proportions of firms using flexibility to a high or some extent in both periods. The column (1995/2000) shows proportions of firms using flexibility to a high or some extent in one of the two periods, and the column (Low) shows the proportion of firms using flexibility to a small extent or not at all in both periods.

Table 9.2 Flexibility measures in 1995 and/or 2000

Flexibility		(1995+2000)	(1995/2000)	Low	N=100%
Functional	(FF)	38.3	38.5	23.1	493
Working time	(WT)	34.4	41.4	24.3	503
Numerical	(NF)	30.5	44.5	25.1	499
Outsourcing	(OT)	17.6	36.8	45.6	494

Functional flexibility is the measure used most frequently to a high or some extent for both periods: 38% of the firms make continuous use of functional flexibility in their personnel policy. The same proportion makes use of the measure to a high or some extent in either 1995 or 2000, and less than one fourth of the firms have little or no experience with the measure in their personnel policy in either of the periods. Almost the same pattern is found in the use of working time flexibility, though the continuous use of this measure in both periods is relatively lower, and the use in one of the two periods higher. Numerical flexibility is used to a high or some extent in both periods by 31% of the firms, and by 45% of the firms in one of the two periods. This could indicate a shift in the use of numerical flexibility, either as a decrease or as an increase in the use over the decade. Outsourcing is used by 18% of the firms in both periods, and by 37% of the firms in one of the two periods. 46% of the firms have little or no experience with this measure. The general impression is that the firms use the flexibility measures frequently. The measures of internal flexibility are used most frequently in both periods, whereas the measures of external flexibility are more often used in only one of the two periods.

Table 9.3 on next page shows the use of flexibility measures in firms, grouped after product or service innovation (P/S Innovation). The firms with continuous product or service innovation are the most frequent users of functional flexibility in their personnel policy; 47% of these firms used functional flexibility in both periods and 43% used it in one of the two periods. Among the firms with no product or service innovation, only 30% used functional flexibility in both periods, and 34% of the firms did not make use of functional flexibility in their personnel policy.

Table 9.3 P/S Innovation and flexibility measures

Functional flexibility	**95+00**	**95/00**	**Low**
P/S Innovation 95+00	46.7	42.8	10.5
P/S Innovation 95/00	39.4	38.1	22.5
No P/S Innovation	30.3	35.5	34.2
Working time flexibility	**95+00**	**95/00**	**Low**
P/S Innovation 95+00	43.0	39.1	18.0
P/S Innovation 95/00	31.1	48.8	20.1
No P/S Innovation	29.3	35.7	35.0
Numerical flexibility	**95+00**	**95/00**	**Low**
P/S Innovation 95+00	33.1	37.0	29.9
P/S Innovation 95/00	32.9	47.2	19.9
No P/S Innovation	24.7	48.7	26.6
Outsourcing flexibility	**95+00**	**95/00**	**Low**
P/S Innovation 95+00	22.4	38.8	38.8
P/S Innovation 95/00	16.9	40.0	43.1
No P/S Innovation	15.3	31.2	53.5

The pattern is quite similar for working time flexibility as a measure. 43% of the continuously innovative firms made use of working time flexibility in both periods and 39% in one of the two periods. On the other hand, 29% of the not-innovating firms used this flexibility measure in both periods, and 35% did not make any use of the measure. Numerical flexibility was used by one third of the continuously P/S innovative firms in both periods and by 37% in one of the two periods. Although the innovative firms do make use of numerical flexibility, it is at a distinctly lower level than their use of functional and working time flexibility. The continuously innovative firms have the highest proportion of firms with low use of numerical flexibility. The non-P/S innovative firms use numerical flexibility most frequently in one of the two periods. Outsourcing is used in the personnel policy of the continuously innovative firms as well, but to a lesser extent. 22% of these firms have used outsourcing in both periods and 39% in one of the two periods.

This last figure could be interpreted as an increasing trend. We find the same pattern among the group of firms with P/S innovation in one of the two periods. The pattern is not so marked among the firms without product or service innovation. In general, the product and service innovative firms frequently make use of flexibility measures in their personnel policy, and it is evident from the table that a higher proportion of P/S innovative firms use internal flexibility. This may well have to do with the need to preserve the core competences. Numerical flexibility is also used by these firms, but to a lesser extent. Still, it is obvious that these firms also need the possibility of short-term and external regulation in their personnel policy.

Table 9.4 Learning organization and flexibility measures

Functional flexibility	**95+00**	**95/00**	**Low**
LO high 95+00	57.8	33.2	9.1
LO high. 95/00	32.2	42.4	25.4
Not LO	18.6	41.1	40.3
Working time flexibility	**95+00**	**95/00**	**Low**
LO high 95+00	43.9	41.8	14.3
LO high. 95/00	31.7	39.3	29.0
Not LO	24.4	43.5	32.1
Numerical flexibility	**95+00**	**95/00**	**Low**
LO high 95+00	35.1	44.7	20.2
LO high. 95/00	30.0	39.4	30.6
Not LO	24.4	51.2	24.4
Outsourcing flexibility	**95+00**	**95/00**	**Low**
LO high 95+00	26.1	38.8	35.1
LO high. 95/00	10.3	33.3	56.3
Not LO	15.2	38.6	46.2

Firms that have developed and maintained learning organizations over the decade can be expected to make more intensive use of the flexibility measures than firms without learning organization. In table 9.4 the relationship

between development of learning organization and use of flexibility measures is shown. 58% of the firms with continuous learning organization in 1995 and 2000 make use of functional flexibility in both periods, while only 9% did not use the measure in either period. Functional flexibility gets the highest score among the firms with continuous learning organization. Only 19% of the firms without learning organization use functional flexibility in both periods, and 40% of these firms do not use the measure at all. The firms with continuous learning organization also use working time flexibility, but at a lower level. This measure is frequently used among all groups of firms in one of the two periods. What is more interesting is that even though the internal flexibility measures are used intensively by the firms with learning organization, these firms use the external flexibility measures frequently as well. Numerical flexibility is used by 35% of the continuous learning organizations in both periods and by 45% of these firms in one of the two periods. Only 20% of the firms do not use numerical regulation of employees. These firms use outsourcing as well; almost two thirds of the firms used outsourcing in either both periods or in one of the two periods. To sum up, internal flexibility measures are used by a high proportion of firms with learning organization, but external flexibility is also frequently used. Firms which use internal and external flexibility simultaneously are flexible firms in Atkinson's original understanding. Here the long-term considerations of competence development and training go hand in hand with short-term regulation of employment.

Table 9.5 Competence development and flexibility measures

Functional flexibility	**95+00**	**95/00**	**Low**
CO high 95+00	61.4	31.8	6.8
CO high. 95/00	35.5	41.1	23.4
Low CO	31.3	38.9	29.8
Working time flexibility	**95+00**	**95/00**	**Low**
CO high 95+00	41.1	42.2	16.7
CO high. 95/00	36.0	41.6	22.3
Low CO	30.1	40.7	29.2
Numerical flexibility	**95+00**	**95/00**	**Low**
CO high 95+00	34.8	39.3	25.8
CO high. 95/00	29.7	47.7	22.6
Low CO	29.3	43.7	27.0
Outsourcing flexibility	**95+00**	**95/00**	**Low**
CO high 95+00	22.1	43.0	34.9
CO high. 95/00	19.8	37.6	42.6
Low CO	13.7	33.7	52.6

Table 9.5 shows the use of flexibility measures among firms with various degrees of competence development. Functional flexibility is the measure most often used by the firms with continuous competence development. Only 7% of these firms do not use the measure, and 61% of them use it in both periods. This is not surprising as functional flexibility can be considered an instrument naturally belonging in the organizational toolbox of competence development. Working time flexibility is also used, but at a lower level, among the firms with continuous competence development, and the difference between the three groups of firms is not so striking here. We would expect the use of numerical flexibility to be at a low level among the firms with continuous competence development. This is, however, not the case. Three fourths of the firms with highly developed competence development make use of the measure in one or both the periods, and more than a third of the firms in both periods. Outsourcing is used, but not as frequently among the competence

developing firms. 22% of the continuous competence developing firms use outsourcing in both periods, and 35% do not make use of the measure.

9.2 Flexibility and employment

The flexibility measures are applied in short-term regulations to ensure that the personnel resources are in accordance with the needs of the firms. Continuous use of the various measures in the personnel policy may have consequences for the medium-term employment trends. Firms using mainly functional flexibility can be expected to have more stable employment with fewer fluctuations than firms relying mainly on numerical flexibility. We are going to study the employment trends resulting from the various uses of flexibility forms. First we will observe the trends related to functional flexibility.

Table 9.6 Employment in panel firms by functional flexibility in 1995 and/or 2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
FF 95+00	30327 = 100	101.3	98.0	95.5	103.1	109.1	103.2	105.2	100.2	98.3
FF 95/00	13210 = 100	97.7	98.0	97.5	104.5	106.6	106.8	109.4	110.2	110.0
Not FF	5426 = 100	99.2	99.0	94.6	98.2	99.4	98.5	117.8	99.0	98.6
All firms	48963 = 100	100.1	98.1	95.9	102.9	107.3	103.6	107.7	102.8	101.5

Functional flexibility applied to a high and some extent in both periods indicates high chances of continuous use of this personnel policy instrument throughout the decade. This policy seems to be related to a moderate and slightly decreasing employment trend in the firms, oscillating around a mean index value of 101.4 for the decade, with an s.d. of 3.9. The group of firms with functional flexibility applied in one of the two periods has the highest employment growth among the three groups of firms, which brings the mean

index value up to 104.1, with an s.d. of 5.3. Firms not using functional flexibility as instrument have a mean index value in the decade of 100.4 and the highest s.d. of 6.3. Though the slightly decreasing employment trend is part of the picture, the most important result is that the continuously functionally flexible firms have the lowest employment variation (s.d.) in the decade among the three groups. The continuously functionally flexible firms and the firms without functional flexibility end up with almost the same index value by the end of the period, but the employment dispersion over the decade is much higher for the latter group of firms.

Table 9.7 Employment in panel firms by working time flexibility in 1995 and/or 2000 (Index 1990 = 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
WT 95+00	26339 = 100	100.1	97.9	96.1	103.2	105.9	99.8	101.7	95.2	94.0
WT 95/00	15935 = 100	100.2	97.6	96.8	105.2	107.3	105.6	109.9	111.9	109.7
Not WT	8656 = 100	99.3	98.4	94.1	96.9	101.3	102.7	112.3	100.4	100.7
All firms	50930 = 100	100.0	97.9	96.0	102.7	105.6	102.1	106.1	101.3	100.0

In table 9.6 we saw that use of functional flexibility was related to a slightly decreasing employment trend. This is even truer for continuous use of working time flexibility. The group of firms with working time flexibility in both periods has a mean index value of 99.4 for the decade and an s.d. of 3.7. On the other hand, working time flexibility in one of the two periods is associated with a net employment growth of almost ten percent points, and a mean index value of 104.4 with an s.d. of 5.4. This represents smooth growth up through the decade. The group of firms without working time flexibility applied has an employment development of almost status quo in the decade. But some oscillation is noticeable here. The standard deviation is 4.8, which

is larger than for the first-mentioned group of firms applying continuous working time flexibility in their personnel policy. Generally, continuous use of internal flexibility seems to be related to status quo or slightly decreasing employment, while the firms applying internal flexibility in one of the two periods experience marked employment growth over the decade. Next, we are going to examine relations between use of external flexibility measures and employment trends.

Table 9.8 Employment in panel firms by numerical flexibility in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
NF 95+00	25174 = 100	97.7	97.1	96.5	103.7	108.9	102.0	101.1	94.8	91.8
NF 95/00	17853 = 100	101.8	97.8	91.9	98.8	98.9	99.4	108.6	102.4	102.2
Not NF	7254 = 100	103.5	100.8	102.6	107.6	116.9	115.8	124.1	127.8	129.0
All firms	50281 = 100	100.0	97.9	95.7	102.5	106.5	103.0	107.1	102.2	100.9

Use of numerical flexibility makes it possible to regulate the need for personnel resources on a short-term basis, but there is an obvious trade-off between this personnel policy measure and developing competences and building long-term knowledge capacity among the human resources. The group of firms practicing numerical flexibility in both periods experiences a decrease in employment of eight percent points in the decade. Though personnel turnover may be high, the oscillations around the net employment figures are not particularly high, with an s.d. of 4.9. Firms practicing numerical flexibility in one of the two periods experience a slight growth in employment. The mean index value in the period is 100.2 and the dispersion is 4.2. The group of firms that do not regulate numerically have the highest employment growth, with an increase of 29 percent points. A possible explanation may be that this

group is composed of growth firms with no need for short-term numerical regulation of employees.

Table 9.9 Employment in panel firms by outsourcing flexibility in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
OT 95+00	13476 = 100	103.6	100.5	98.5	106.5	105.3	99.2	101.0	98.7	99.2
OT 95/00	22565 = 100	97.7	95.7	92.9	98.1	102.7	99.2	104.4	94.7	92.3
Not OT	14704 = 100	100.2	98.7	98.1	105.8	109.7	108.4	112.6	113.0	111.8
All firms	50745 = 100	100.0	97.8	95.9	102.6	105.4	101.9	105.9	101.1	99.8

Compared to numerical flexibility, outsourcing is a more radical instrument, because it moves jobs rather than employees. Easy hiring and firing rules is one of the characteristics of the Danish labor market, which means that it is possible to use numerical flexibility as a short-term measure; but jobs cannot be outsourced and insourced as a similar short-term practice. It is indeed interesting to note that the group of firms which outsourced in both periods reached the highest index number of employment at the end of the period, compared to the other groups of firms practicing a flexibility form continuously in both periods. The mean employment in the decade is 101.3 with an s.d. of 2.9. The group most similar to this is the group of functionally flexible firms with a mean employment of 101.4 and an s.d. of 3.9 in the decade. The group of firms practicing outsourcing in one of the two periods experienced a more moderate development with an 8 percent-point net loss of jobs by the end of the decade. Firms without outsourcing practice had a net gain in employment of 12 percent points. Together with the firms that do not practice numerical flexibility, they have the highest net growth in employment of the decade.

9.3 Core and peripheral employees

Presumably, the use of flexibility measures in personnel policy is related to the development of a core and a peripheral group of employees in the firms. We can expect that the moderate employment development among firms continuously practicing various flexibility policies throughout the decade relates to strategic considerations of building core groups and regulating on peripheral groups. In the following we are going to study the development of core and peripheral employee groups over the decade. The core group is defined as employees with full-time and continuous employment for more than one year in the individual firm and a maximum of one unemployment period. The peripheral group is defined as employees with more than one unemployment period in the year, or continuous part-timers. The table below shows the development of core groups of employees in the product or service innovative firms.

Table 9.10 Employment of core employees in panel firms by product innovation in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
P/S 95+00	16477 = 100	97.7	106.7	126.5	125.8	137.4	139.0	141.0	134.1	133.6
P/S 95/00	7980 = 100	104.0	104.2	111.5	113.5	117.4	119.8	125.2	124.4	129.1
No P/S	4531 = 100	101.9	103.8	118.3	124.2	118.1	115.4	122.2	116.1	117.3
All firms	28988 = 100	100.1	105.6	121.1	122.2	128.9	130.0	133.7	128.6	129.8

For the group of firms with product or service innovation in 1993-1995 as well as 1998-2000, the core group of employees has been growing up to the index value of 141 in 1997, but thereafter it shrinks somewhat towards the end of the decade. The result is that the group of firms with continuous product innovation has a growth in their core labor force of one third over the

decade. The group of firms with product or service innovation in one of the two periods shows more steady growth and ends up with an index value of 129. Also the group of firms without product or service innovation has a growing core labor force in the decade, but at a lower level than the two other groups. Among the three groups of firms, the group with continuous product or service innovation has the highest growth in core labor force and the group without product or service innovation the lowest growth. This may be taken as an indicator of the need for the former group to sustain a growing knowledge source among its employees.

Table 9.11 Employment of peripheral employees in panel firms by product innovation in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
P/S 95+00	11483 = 100	100.1	83.6	55.9	76.1	69.3	57.0	61.7	57.5	54.8
P/S 95/00	4932 = 100	102.8	96.0	71.2	80.7	86.1	80.6	96.0	77.8	67.9
No P/S	4450 = 100	95.9	89.7	67.8	74.7	72.8	63.5	54.0	61.3	59.5
All firms	20865 = 100	99.8	87.9	62.1	76.9	74.0	64.0	68.1	63.1	58.9

Table 9.11 shows the development for peripheral labor groups in the same three groups of firms as table 9.10 showed for core groups. The table comes out with a pattern almost complementary to the pattern found in table 9.10. For the firms with continuous product innovation, a decreasing trend in peripheral employees can be observed, ending up with almost halving the peripheral group and with the lowest index number among the three groups of firms at the end of the decade. The group with product or service innovation in one of the two periods also experiences a decrease in their peripheral labor force, but not as markedly as the former group. The same propensity can be observed for the firms with no product or service innovation in the

periods. To sum up, the development in core and peripheral labor among firms with various product or service innovation practices shows that the share of core employees is growing, and the share of peripheral employees is decreasing. This pattern is most manifest in firms with continuous product innovation.

Table 9.12 Employment of core employees in panel firms by learning organization in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
LO 95+00	21285 = 100	100.4	105.4	120.8	119.9	129.9	131.7	134.3	128.9	130.0
LO 95/00	6488 = 100	99.1	104.0	119.2	124.5	119.8	122.7	128.0	124.1	124.8
Not LO	2331 = 100	103.2	107.8	117.3	124.9	129.3	124.9	133.5	131.2	133.3
All firms	30104 = 100	100.4	105.3	120.2	121.3	127.7	129.2	132.9	128.0	129.2

Table 9.12 shows developments in core groups of employees in firms with various experiences of continuous learning organization. The group of firms with learning organization in both 1993-95 and 1998-2000 develops the core groups up to a peak in 1997 and ends up with an index value of 130 at the end of the decade. Firms with learning organization in one of the two periods show a similar growth, but at a lower level, ending up with an index value 5 points lower. Firms without learning organization experiences show growth similar to the continuous learning organizations and end up with a slightly higher index value. Compared to the continuous learning organizations, the latter group of firms shows a much more volatile growth in the core group from year to year.

Table 9.13 Employment of peripheral employees in panel firms by learning organization in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
LO 95+00	13881 = 100	101.1	87.8	59.3	77.5	74.7	62.3	64.7	62.3	59.6
LO 95/00	5806 = 100	98.2	86.4	61.5	69.7	70.0	63.3	75.0	64.0	57.0
Not LO	2030 = 100	91.5	85.7	82.6	90.1	83.7	81.0	73.5	75.8	67.7
All firms	21717 = 100	99.4	87.2	62.1	76.6	74.3	64.3	68.3	64.0	59.7

Employment of peripheral labor in learning organizations shows similar patterns to the ones we found for peripheral labor in product or service innovative firms. For the firms with continuous learning organizations, a marked oscillation from year to year can be observed. This is the result of the short-term regulations, which is the strategic raison d'etre for peripheral labor and what could be expected. However, the most important observation is the medium-term development in the use of core and peripheral labor. The growth in the use of core labor and the decrease in the use of peripheral labor must be analytically compared to net employment in the learning organizations over the decade. When only a moderate employment growth can be observed among the group of firms with learning organization, this is related to their decreasing use of peripheral labor, and it must be seen in relation to their increasing use of core labor. Later we are going to examine how this pattern between core and peripheral groups presents itself among the various educational levels of employees in the different groups of firms. But first we will examine the pattern of core and peripheral labor in groups of firms with different practices of competence development.

Table 9.14 Employment of core employees in panel firms by competence development in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
CO 95+00	12685 = 100	100.1	107.6	127.8	123.7	135.6	136.8	137.6	127.3	126.5
CO 95/00	10522 = 100	102.5	103.6	117.0	120.2	120.3	121.7	126.4	126.2	127.3
Not CO	6897 = 100	97.8	103.8	110.9	118.5	124.6	126.6	134.2	132.2	136.9
All firms	30104 = 100	100.4	105.3	120.2	121.3	127.7	129.2	132.9	128.0	129.2

Table 9.14 shows that the firms with continuous competence development experience a growth in core labor which is higher than the other groups of firms up until 1997. After 1997, the firms experience a steep decline of 7.5% in the core labor groups and end up with the lowest index value among the three groups, but on level with firms with competence development in one of the two periods. This latter group experiences a smoother and more balanced growth in their core labor force. The same can be said about the group of firms without competence development. This group ends up with the largest increase in core labor among the three groups of firms.

Table 9.15 Employment of peripheral employees in panel firms by competence development in 1995 and/or 2000 (Index 1990= 100)

	Emp.90	Emp.91	Emp.92	Emp.93	Emp.94	Emp.95	Emp.96	Emp.97	Emp.98	Emp.99
CO 95+00	8438 = 100	102.3	84.8	51.0	76.1	68.6	54.6	57.7	53.4	51.4
CO 95/00	7349 = 100	99.5	90.3	66.4	74.8	77.4	68.9	66.4	69.0	67.6
Not CO	5930 = 100	95.2	86.8	72.5	79.5	78.5	72.5	85.6	72.8	61.7
All firms	21717 = 100	99.4	87.2	62.1	76.6	74.3	64.3	68.3	64.0	59.7

As was to be expected, we find the same declining number of peripheral labor among the firms with continuous competence development. Actually, here we find the lowest index number of peripheral labor at the end of the decade among the various groups of firms. This is not really surprising, but what is surprising is the fact that we do not find the steep decrease from 1997 to 98 that we found in relation to core labor. The group of firms with competence development in one of the two periods does not experience as marked a decrease in their peripheral labor as the group of firms with continuous competence development, and they have the highest index value at the end of the decade. The index value is 6 points higher than the index value of the firms with no competence development. This latter group has an index value 10 points higher than the index value of the group of firms with continuous competence development.

Table 9.16.1 Core and peripheral status among highly educated employees in panel firms in 1990-94 by learning organization in 1993-95 and/or 1998-2000

	1990		1991		1992		1993		1994	
	Core	Peri	Core	Peri	Core	Peri	Core	Peri	Core	Peri
LO 95+00	83.6	16.4	82.2	17.8	83.8	16.2	85.4	14.6	81.5	18.5
LO 95/00	78.3	21.7	78.0	22.0	79.9	20.1	79.6	20.4	75.8	24.2
Not LO	72.5	27.5	80.3	19.7	75.1	24.9	73.8	26.2	71.7	28.3
All firms	82.2	17.8	81.3	18.7	82.7	17.3	83.7	16.3	79.9	20.1

Table 9.16.2 Core and peripheral status among highly educated employees in panel firms in 1995-99 by learning organization in 1993-95 and/or 1998-2000

	1995		1996		1997		1998		1999	
	Core	Peri	Core	Peri	Core	Peri	Core	Peri	Core	Peri
LO 95+00	78.9	21.1	81.4	18.6	81.5	18.5	78.5	21.5	79.8	20.2
LO 95/00	71.4	28.6	75.0	25.0	76.9	23.1	71.2	28.8	76.4	23.6
Not LO	69.8	30.2	75.2	24.8	73.1	26.9	69.1	30.9	74.3	25.6
All firms	77.0	23.0	79.8	20.2	80.2	19.8	76.5	23.5	78.9	21.1

In the analysis above we have uncovered a pattern of increasing core labor and decreasing peripheral labor among the various groups of firms, and most markedly among the firms with continuous product or service innovation practices, but also among firms with continuous learning organization. Now we intend to go a few analytical steps further and examine the pattern between core and peripheral labor for the various educational groups. In table 9.16 the development is shown for the employees with higher education in the three groups of firms with different levels of learning organization. At the beginning of the decade, in 1990, the share of core labor is 84% among the highly educated employees in firms with continuous learning organization. This rather high share is upheld until the mid-nineties, but it diminishes 2-3

percent points throughout the last part of the nineties, to end up on 80% core labor. In firms with learning organization in either 1993-95 or 1998-2000 we find a share of core labor of 78% at the beginning of the period, and a share of 76% at the end of the nineties. The firms without learning organization have the lowest share of core labor among the three groups of firms. From a share of 73%, their core labor increases marginally to 74% at the end of the decade. For the highly educated employees the pattern of core and peripheral labor is rather stable throughout the decade. The continuous learning organizations have the highest share at the beginning of the period, and it diminishes marginally through the last half of the decade, but is still the highest at the end of the decade. This pattern remains constant in a situation of growth in recruitment of employees with higher education and changes of the personnel profiles in favor of this group. The firms without learning organization have the lowest share of highly educated core labor throughout the period, and a share that is oscillating somewhat from year to year.

Table 9.17.1 Core and peripheral status among skilled employees in panel firms in 1990-94 by learning organization in 1993-95 and/or 1998-2000

	1990		1991		1992		1993		1994	
	Core	Peri	Core	Peri	Core	Peri	Core	Peri	Core	Peri
LO 95+00	65.0	35.0	63.4	36.6	67.6	32.4	77.6	22.4	72.2	27.8
LO 95/00	59.6	40.4	58.8	41.2	63.6	36.4	72.7	27.3	70.9	29.1
Not LO	58.2	41.8	59.6	40.4	64.3	35.7	65.8	34.2	67.8	32.2
All firms	63.1	36.9	61.9	38.1	66.3	33.7	75.2	24.8	71.5	28.5

Table 9.17.2 Core and peripheral status among skilled employees in panel firms in 1995-99 by learning organization in 1993-95 and/or 1998-2000

	1995		1996		1997		1998		1999	
	Core	Peri	Core	Peri	Core	Peri	Core	Peri	Core	Peri
LO95+00	76.0	24.0	79.0	21.0	78.7	21.3	79.7	20.3	80.4	19.5
LO 95/00	73.0	27.0	73.8	26.2	76.2	23.8	74.7	25.3	74.2	25.8
Not LO	69.8	30.2	69.3	30.7	74.0	26.0	71.3	28.7	72.9	27.1
All firms	74.7	25.3	76.8	23.2	77.6	22.4	77.7	22.3	78.2	21.8

Table 9.17 shows the development of core-peripheral patterns for skilled employees over the decade. Again, the continuous learning organizations have a higher share of core labor compared to the other two groups of firms. However, this share is 19 percent points lower than the share of highly educated core labor at the beginning of the period. The important point is that the share of skilled core labor is growing up through the decade and ends up on 80%, which is the same proportion we find among the employees with higher education. From the analysis of personnel profiles we have seen that the share of skilled employees is rather stable over the decade in the continuous learning organizations, and this situation seems to have consolidated their share of core labor. This means that the firm-specific experience-based knowledge is retained in the firms. It is interesting that we find the same development over the decade for the skilled core groups in the firms with learning organization in one of the two periods and in the firms with no learning organization. Still, the latter group of firms has a share of 27% of peripheral labor, which is 7 percent points more than the group of firms with continuous learning organization.

Table 9.18.1 Core and peripheral status among unskilled employees in panel firms in 1990-94 by learning organization 1993-95 and/or 1998-2000

	1990		1991		1992		1993		1994	
	Core	Peri	Core	Peri	Core	Peri	Core	Peri	Core	Peri
LO 95+00	48.1	51.9	48.9	51.1	53.1	46.9	67.7	32.3	63.5	36.5
LO 95/00	40.8	59.2	39.3	60.7	43.1	56.9	56.7	43.3	57.2	42.8
Not LO	46.9	53.1	48.3	51.7	52.2	47.8	53.9	46.1	55.8	44.2
All firms	46.2	53.8	46.5	53.5	50.6	49.4	63.8	36.2	61.3	38.7

Table 9.18.2 Core and peripheral status among unskilled employees in panel firms in 1995-99 by learning organization in 1993-95 and/or 1998-2000

	1995		1996		1997		1998		1999	
	Core	Peri	Core	Peri	Core	Peri	Core	Peri	Core	Peri
LO 95+00	66.0	34.0	69.4	30.6	69.9	30.1	69.9	30.1	71.6	28.4
LO 95/00	54.0	46.0	57.4	42.6	50.6	49.4	59.7	40.3	64.6	35.4
Not LO	57.0	43.0	55.2	44.8	58.5	41.5	59.9	40.1	63.4	36.6
All firms	62.6	37.4	65.5	34.5	64.2	35.8	66.8	33.2	69.3	30.7

The unskilled employees have the lowest group of core labor at the beginning of the decade. Even the firms with continuous learning organization have below fifty percent unskilled core labor, and the variations among the different groups of firms are smaller than for highly educated and skilled employees. It was to be expected that there would be a limited share of core labor among unskilled employees, so what is the most important observation from table 9.18 is that their share of core labor is growing at the highest rate among the three educational groups. From 48% core labor in 1990, the share of unskilled core labor in firms with continuous learning organization increases to 72%, which is a growth of 49%. In the firms with learning organization in one of the two periods, the unskilled core grows from 41% to 65%, which is an even stronger growth, albeit from a lower level. The firms with no lear-

ning organization start at 47% unskilled core employees and end up at 63%, which is a growth of 35%.

The patterns of development in the core and peripheral groups of the different educational groups in the decade help us understand the personnel policy in relation to the moderate net employment growth we have observed for the group of firms with continuous learning organization. Behind this moderate overall net growth in employment, a changing personnel profile has emerged, showing a higher share of employees with higher education and a lower share of unskilled employees. This development has taken place mainly at the expense of the peripheral labor groups among the skilled and particularly the unskilled employees. The share of peripheral labor among these groups has been reduced throughout the decade, while the balance between core and peripheral labor among highly educated employees has been maintained in the same period. The result is a growing convergence of the share of core and peripheral labor for the different educational groups of employees by the end of the decade. This policy is in harmony with the extensive use of continuous competence development and training for employee groups evident in these firms.

9.4 Mobility and destination

The moderate net growth of employment tends to conceal developments in the employment system supporting the need for firm-specific competences, but also a moderate turnover, among all three educational groups of employees. In spite of integration there is still a certain degree of mobility. The question is whether the mobility includes periods of unemployment or it is a firm-to-firm mobility. We will examine this in the tables below.

Table 9.19.1 Rates of exit to other firms and to unemployment from panel firms by product innovation in 1993-1995 and/or 1998-2000

	1990		1991		1992		1993		1994	
	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl
P/S 95+00	7.2	4.7	6.5	4.4	6.3	5.1	8.3	2.9	-	-
P/S 95/00	11.7	5.3	10.0	6.3	10.4	6.6	12.4	4.5	-	-
No P/S	11.8	6.3	11.1	6.7	12.3	8.4	14.8	4.4	-	-
All firms	9.2	5.2	8.3	5.3	8.5	6.1	10.5	3.6	-	-

Due to missing data the exit rate for 1994 is not calculated and presented in the table.

Table 9.19.2 Rates of exit to other firms and to unemployment from panel firms by product innovation 1993-1995 and/or 1998-2000

	1995		1996		1997		1998		1999	
	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl
P/S 95+00	10.4	3.3	10.5	2.4	-	-	10.4	2.8	-	-
P/S 95/00	12.7	3.3	13.6	2.7	-	-	12.2	2.6	-	-
No P/S	16.4	4.3	15.6	2.8	-	-	14.3	3.3	-	-
All firms	12.0	3.4	12.1	2.5	-	-	11.5	2.8	-	-

Due to missing data the exit rates for 1997 and 1999 are not calculated and presented in the table.

Table 9.19 shows the rates of exit to other firms or to unemployment from firms with continuous product or service innovation (P/S95+00), firms with product or service innovation in one of the two periods (PS95/00), and firms with no P/S innovation. At the beginning of the decade, rates of exit from the firms with continuous product or service innovation are lower, both to other firms and to unemployment, compared to the other groups of firms. However, the difference between the rates of exit to other firms and to unemployment is not as large for the continuously innovative firms compared to the other groups of firms. The difference is diminishing up through the decade, and in 1998 the rate of exit to other firms has increased to 10% and the rate of exit to unemployment has decreased to 3% for the firms with continuous

competence development. The rate of exit to other firms varies somewhat between the three groups of firms, but the rate of exit to unemployment differs only marginally. Generally, the rate of exit to other firms increases towards the end of the period, while the rate of exit to unemployment diminishes. This can be observed for all three groups of firms.

Table 9.20.1 Rates of exit to other firms and to unemployment from panel firms in 1990 to 1994 by learning organization in 1993-95 and/or 1998-2000

	1990		1991		1992		1993		1994	
	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl
LO 95+00	8.3	4.8	7.4	5.0	7.3	5.6	9.4	3.3	-	-
LO 95/00	10.4	6.1	10.9	6.2	10.7	7.0	12.2	4.1	-	-
Not LO	15.6	6.5	11.9	6.7	13.4	7.2	16.3	3.7	-	-
All firms	9.4	5.3	8.6	5.4	8.6	6.1	10.6	3.6	-	-

Due to missing data the exit rate for 1994 is not calculated and presented in the table.

Table 9.20.2 Rates of exit to other firms and to unemployment from panel firms in 1995 to 1999 by learning organization 1993-95 and/or 1998-2000

	1995		1996		1997		1998		1999	
	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl	Firm	Unempl
LO 95+00	10.7	3.5	10.8	2.5	-	-	10.5	2.8	-	-
LO 95/00	14.7	3.3	15.3	2.8	-	-	13.4	3.1	-	-
Not LO	17.4	3.2	16.3	2.6	-	-	16.0	2.3	-	-
All firms	12.1	3.5	12.3	2.6	-	-	11.6	2.8	-	-

Due to missing data the exit rates for 1997 and 1999 are not calculated and presented in the table.

Among the groups of firms with varying degrees of advancement in learning organization, the difference between rates of exit to other firms is larger at the beginning of the decade compared to the differences we found in table 9.19. The rate of exit to unemployment is lower among the firms with continuous learning organization compared to the other groups of firms. In general, the

rate of exit to unemployment is decreasing in the last part of the period, while the rates of exit to other firms are increasing. This is true for all three types of firms. This is indication of a more efficient labor market, with less waste of labor resources in relation to mobility. Exit to unemployment means inefficiency in the labor market, such as lost production and costs of unemployment benefit. This increasing efficiency of the labor market may be related to the decreasing use in the firms of peripheral employees among the skilled and unskilled groups. On the market for core labor, quits may be more frequent than lay-offs. On the market for peripheral labor, lay-offs followed by unemployment or redundancy may be more frequent. Another explanation could be the growth in competence clusters in the nineties, composed mainly of core labor mobile between the different firms in the clusters.

9.5 Concluding observations

Personnel policies and strategies are approached as the carried-out behavior rather than formal intentions and written documents. The main results from the analysis of personnel policies and strategies are that:

- Internal and external flexibility provides means for regulating and adjusting the human resources in accordance with the long-term as well as short-term needs of the individual firms.

- Product and service innovative firms make use of all flexibility measures in their personnel policy, but most often the measures of internal flexibility.

- Even though the firms with learning organization use the internal flexibility measures intensively, these firms use the external flexibility measures frequently as well.

- Functional flexibility is the measure most often used by the firms with continuous competence development. Thus, functional flexibility is an instrument belonging in the organizational toolbox of competence development.

- Firms using functional flexibility continuously have a slightly decreasing employment trend and the lowest employment variation in the decade.

- Firms using numerical flexibility continuously experience a decrease in employment of 8 percent points over the decade. Firms that do not regulate numerically have the highest employment growth, with an increase of 29 percent points.

- Firms which outsourced in both periods reach the highest index number of employment at the end of the decade, compared to the other groups of firms practicing a flexibility form continuously.

- Among the various groups of firms, the group with continuous product or service innovation has the highest growth in core labor force and the group without product or service innovation the lowest growth.

- The moderate employment growth in the firms with learning organization is related to their decreasing use of peripheral labor, and must be seen in relation to their increasing use of core labor.

- Among the firms with continuous competence development we find the lowest share of peripheral labor at the end of the decade.

- The pattern between core and peripheral labor for employees with higher education is rather stable over the decade. The continuous learning organizations have the highest share of core labor, though it diminishes marginally through the last half of the decade.

- For skilled employees, the share of core labor is 19 percent points lower than the share of highly educated core labor at the beginning of the decade, but the share is growing up through the decade and ends up on 80%, which is the same proportion we find among the employees with higher education.

- The unskilled employees have the lowest share of core labor at the beginning of the decade, but as for skilled employees, the share of unskilled core labor in firms with continuous learning organization increases to 72%, which is a growth of 49%.

- The changing personnel profiles in the firms have taken place mainly at the expense of the peripheral labor groups among the skilled and particularly the unskilled employees.

- The rate of exit to unemployment is decreasing in the last part of the decade, while the rates of exit to other firms are increasing. This is indication of a more efficient labor market.

Chapter 10

Conclusion

The nineties saw a growing economic importance of innovation, learning and knowledge. It is the implications of this growing importance on employment dynamics, qualifications demands, competence development and personnel strategies we have been studying empirically in this book. The study has been governed by a theoretical framework combining a system of innovation and a system of employment approach, applied in a learning perspective. The system of innovation approach focuses on product innovation as well as process innovation, and the relations between the innovation forms inside the firms (Edquist et.al. 2001). In the system of innovation, enterprises play a central role (Lundvall op.cit. 2006). The system of employment provides a complementary framework for analyzing allocation and qualification of labor in relation to business strategies. The concepts the two systems have in common are the organizational dimensions and institutions related to learning inside and in relation to the context of the firms. Thus, product innovations are considered expressions of learning processes taking place inside the firms and involving different functional groups and various decision levels, as well as relations with the firm's customers and subcontractors. The empirical analyses show that size and global orientation matters for a firm's propensity to innovate. Most of the product or service innovations are local and only new to the firms, not to the market; but being a national innovator means good chances of becoming a radical product or service innovator at a later stage. Firms that are product innovative in the decade increase employment, while firms that did not innovate in the two periods surveyed lose jobs. The continuous innovation strategies seem to be related to the most balanced employment growth and job dynamics.

Process innovations are defined as new ways of producing goods and services. The new ways may involve new technology and new organization forms

(Edquist et.al. op.cit. 2001). Among the new technologies, information and communication technology has gained increasing importance in the nineties. The analysis indicates that new purposes related to a firm's innovation system are furthered by the ICT innovations of the nineties. ICT innovations are most common among manufacturing and business services firms. Size is important here, too, as well as global orientation. What is surprising is that the most positive employment development is found in firms that have been continuously ICT innovative in the nineties, and that the ICT innovations do not seem to influence the level of hiring and separation rates, relative to the other groups of firms where ICT innovations have been more sporadic.

New organization forms are important in the light of product innovation as a learning system. Besides improved efficiency of the daily work, one of the important driving forces of continuous organizational change is the ability to strengthen and renew knowledge and know-how. It is obvious that communication of useful knowledge becomes ever more important. We have sought to identify theoretically the dimensions of learning organizations and have investigated empirically how the firms adopted these dimensions up through the nineties. Surprisingly, the firms do not increase their use of dimensions in the last part of the decade from 1995 to 2000. Still, more than one third of the firms have retained a highly developed learning organization throughout the decade, and this means an almost 6 times higher chance of product innovation, compared to the group of firms without learning organization. Furthermore, the firms with continuous learning organization show a moderate employment growth and also moderate job turnover in the decade.

The triad of qualifications needed in the learning organization is formal education, competence development and social capital. The analysis of the demand for formal education as a qualification in the various groups of firms shows that firms with continuous learning organization create many jobs for employees with higher education, while the trend for skilled and especially unskilled employees is declining over the decade. Women have an increasing and stronger position in the continuous learning organizations, whereas employees 50 years or older have a more moderate position in these firms, compared to the other groups of firms. The development of personnel profiles

in the learning organizations in the nineties indicates a skills bias in favor of highly educated, whereas unskilled employees lose many jobs in the decade. The decline in jobs for the unskilled employees takes place in an environment of short-term numerical regulations for this group as well. This means double pressure on unskilled employees.

Learning is crucial for innovation, and continuously innovating learning must be closely connected to the job situation and to the job assignments in such a way that the internal and external work relations and experiences become reflective fuel in the learning processes. However, to create innovative learning, it is necessary to combine experience-based and reflective learning with new knowledge achieved from formal training and education. This means that learning becomes knowledge-based as well as experience-based, and then it may evolve dynamically in the context of the organization. Competence development is defined as a continuous development of experiences, skills, influence, possibilities and responsibilities, related to the job situation, tasks and context of the employees. Competence development is synonymous with the experience and situated part of innovative learning. This relates the analysis of competence development to the active use of the potentials in the organization and the management principles. The firms combining such instruments in continuous competence development have a significantly higher chance of product or service innovation, and there is a high correlation between continuous competence development and highly developed learning organizations as well. Continuous competence development is also related to changing personnel profiles, with increasing proportions of highly educated and decreasing proportions of unskilled employees.

Besides situated and experience-based learning, new theoretical and methodological knowledge is of decisive importance when firms face the challenge of developing new products or services. Use of extensive continuous vocational training is closely related to competence development and to continuous learning organizations. Like continuous competence development, use of extensive continuous vocational training is related to changing personnel profiles, with increasing proportions of highly educated and decreasing proportions of unskilled employees. Nevertheless, the flows of unskilled employ-

ees in and out of firms are lowest in firms with high extensiveness of training, where the unskilled employees are often included in the training activities. This means that these firms, as learning organizations, endeavor to secure that their investments in human resources keep growing, regardless of formal education.

Findings related to the various elements of the employment system bring the question of the personnel policies and strategies applied by the different groups of firms into focus. The analytical approach to personnel policies and strategies is to examine actual behaviour rather than formal intentions. Personnel policy is thus defined as the actual behaviour which ensures that the personnel resources are in accordance with the needs of the firm. This definition brings the concept of flexibility at the top of the analytical agenda. A taxonomy is constructed with dimensions for long-term integration as well as short-term regulation of personnel resources related to measures of internal and external flexibility. Among firms with learning organization, high proportions use internal flexibility measures, but external flexibility is also frequently used in these firms. This is in accordance with John Atkinson's understanding of "the flexible firm", where the long-term considerations of competence development and training go hand in hand with short-time regulations of employment in the firms. Continuous use of internal flexibility and outsourcing is related to slightly decreesing employment, while use of numerical flexibility is related to more distinctly decreasing employment in the decade. Use of the flexibility measures are logically and empirically related to developments over time of core and peripheral groups of employees in the firms. Generally, the core groups of employees are increasing over the decade, while the shares of peripheral groups are decreasing. This is an important observation in relation to the moderate employment growth found among the group of firms with continuous learning organization. The moderate employment growth is first of all related to the decreasing use of peripheral labor, and it must be considered in relation to the increasing use of core labor over the decade. Broken down on educational groups, the analyses show that for the highly educated labor, the pattern of core and peripheral labor remains rather stable throughout the decade. However, the share of skilled as well as unskilled core labor is

growing in the decade, while the share of peripheral labor among these groups shows a distinct decrease.

The important contribution of the personnel policy and strategy dimension to the cumulative analysis of the employment system in learning organizations is that behind the moderate net employment growth, a change in personnel profile is taking place, resulting in higher shares of employees with higher education and lower shares of unskilled employees. This development happens primarily at the expense of the peripheral labor groups among the skilled and particularly the unskilled employees, resulting in growing convergence between the different educational groups of employees as to core and peripheral labor by the end of the decade. This policy is perfectly in harmony with the extensive use of continuous competence development and training for all employee groups in these firms. Also the decreasing rate of exit to unemployment and the increasing exit to other firms is an important facet in the picture emerging in this study of an increasingly competence-based employment system.

References

Albæk, K. & Sørensen B.E. (1995): *Worker Flows and Job Flows in Danish Manufacturing, 1980-91*, København, Økonomisk institut.

Albæk, K. (1997): *Jobbevægelser og arbejdsløshed*, i Pedersen, L. (red.): Er der veje til fuld beskæftigelse?, København, SFI.

Atkinson, John: (1985) *Flexibility, Uncertainty and Manpower Management*, Brighton, IMS.

Asheim, B. (2000): *The Learning Firm in the Learning Region: Workers Participation as Social Capital*, DRUID's Summer Conference 2000.

Beer, M. et.al. (1984): *Managing Human Assets*, New York, Free Press,

Becker, Gary S. (1976): *Human Capital*, New York.

Black, S.E. (2000): *What's driving the new economy: the benefits of workplace innovation*, NBER working paper 7479.

Burns, T. & Stalker, G.M. (1961): *The Management of Innovation*, London, Tavistock.

Danmarks Statistik (1991): *IDA - en integreret database for arbejdsmarkedsforskning*, København, Danmarks Statistik.

Dansk Management Forum & Handelshøjskolen i København (1999): *Carnet-E undersøgelsen 1999 - HRM i danske virksomheder*, København, DMF & HHK.

Ducatel, K. (1998): *Learning and skills in the Knowledge Economy*, Seville.

Dyer, L. & Reeves, T. (1995): *Human resources strategies and firm performance: what do we know and where do we need to go?* in the International Journal of Human Ressource Management, vol:6, no.3.

Edquist, C. Hommen, L. & McKelvey (2001): *Innovation and Employment – Process versus Product Innovation*, Northampton, Edward Elgar Publishing Limited.

Elkjær, B. & Høyrup, S. (2003) *Kompetencer og kompetenceudvikling i arbejdslivet*, i Uddannelse, nr. 1, 2003.

Ellstrøm, P.-E. (1992): *Kompetens, utbildning och lørande i arbetslivet*, Stockholm, Fritzes.

European Commission (1993): *Harmonized Innovation Surveys, 1992/93: Final Questionnaire*, Brussels, European Commission.

Freeman, C. (2001): *A hard landing for the "new economy"? Information Technology and the United States National System of Innovation*, Sussex, SPRU.

Freeman C. & Perez C. (1988): *Long Waves and Changes in Employment Patterns*, in Structural Change and Labour Market Policy, Stockholm, ALC.

Freeman, C. & Soete, L.L.G. (1997) *The economics of industrial innovation*, London, Pinter.

Gjerding, A. Næs (1996): *Technical innovation and organizational change*, Aalborg, Aalborg Universitetsforlag.

Gjerding, A. Næs m.fl. (1997): *Den fleksible virksomhed - Omstillingspres og fornyelse i dansk erhvervsliv*, København, Erhvervsudviklingsrådet.

Hendry, Chris (1995): *Human Ressource Management - a strategic approach to employment*, Oxford, BH.

Huselid, M. (1995): *The impact of human ressource management on turnover, productivity and corporate financial performance*, in Academy of Management Journal vol. 38 no. 3.

Huselid, M et.al. (1996): *Technical and strategic human ressource management effectiveness as derterminants of firm performance*, in Academy of Management Jourmal.

Hyman, J. & Mason B. (1995): *Managing Employee Involvement and Participation*, London, Sage.

Høyrup, S. & Pedersen, K. (2002): *Lærings- og kompetencebegreberne i arbejdslivsforskningen*, i Illeris, K (red.): Udspil om læring i arbejdslivet, Roskilde, Roskilde universitetsforlag.

Jensen, T. & Prahl, A. (2000): *Kompetence som intersubjektiv fænomen*, i Andersen, T. (red.): Kompetence - i et organisatorisk perspektiv, Roskilde, Roskilde Universitetsforlag.

Jørgensen, H., Lind, J. & Nielsen, P. (1990): *Personale, planlægning og politik*, Aalborg, ATA.

King, N. & Anderson, N. (1995): *Innovation and change in organizations*, London, Routledge.

Kallehauge, L. & Madsen, P.T (1990): *Produktivitetsudviklingen i dansk fremstillingsvirksomhed*, in Gjerding, A.N. m.fl.: Jagten på den forsvundne produktivitet, København, Jurist og Økonomforbundets forlag.

Kanter, R. M. (1983): *The Change Masters*, London, Unwin.

Kongshøj Madsen, P. (2005): *The Danish Road to 'Flexicurity' Where are we? And how did we get there?* in, Bredgaard, T. & Larsen, F. (eds.): Employment Policy form Different Angles, Copenhagen, DJØF Publishing.

Lam, A. (1999): *Tacit Knowledge, Organizational Learning and Societal Institutions: An integrated Framework*, Aalborg, DRUID.

Laursen, K. (2001): *The importance of sectoral differences in the application of (complementary) HRM practices for innovation performance*, Copenhagen, Danish Ministry of Trade and Industry.

Lave, J. & Wenger, E. (1995): *Situated Learning. Legitimate Peripheral Participation*, Cambridge, Cambridge University Press.

Lazonick, W. (1994): *Business organization and the myth of the market economy*, Cambridge, Cambridge University Press.

Lund Vinding, A. (2000): *Absorptive capasity and innovative performance: A human capital approach*, Aalborg, DRUID.

Lundvall, B.-Å. (2006): *National Innovation Systems: Analytical Focusing Device and Policy Learning Tool*, Aalborg University, Contribution to Center for tilväxtpolitiska studier 2006.

Lundvall, B.-Å. (2003): *Product innovation and technological Unemployment in a small open economy*, Aalborg, Aalborg University

Lundvall, B.-Å. (2003): *Why the New Economy is a learning Economy*, in Economia et Politica Industriale, no. 117.

Lundvall, B.-Å. (2002): *Innovation, Growth and Social Cohesion*, Northampton, Edward Elgar.

Lundvall, B.-Å & Nielsen, P. (1999): *Competition and Transformation in the Learning Economy*, in Revue D'Economie Industrielle, vol. 88, no. 2.

Lundvall, B.-Å. (1992): *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning*, London, Pinter Publishers.

Marsden, D. (1999): *A Theory of Employment Systems*, Oxford, Oxford University Press.

Nielsen, P. (1999): *Personale og fornyelse - menneskelige ressourcer i det nationale innovationssystem*, København, Erhvervsudviklingsrådet.

Nielsen, P. (2004): *Personale i vidensøkonomien – innovation, vidensorganisationer og kompetenceudvikling I det nye årtusinde*, Aalborg, Aalborg Universitetsforlag.

Nonaka, I. & Takeuchi, H. (1995): *The Knowledge Creating Company*, New York, Oxford University Press.

NUTEK (1996): *Toward a Flexible Organization, Stockholm*, Nutek Analys.

OECD (1996): *Employment and Growth in the Knowledge-based Economy*, Paris OECD.

OECD (1999) *Flexible Working Practices: Where are they found and what are their labour market implications?* Paris, OECD.

OECD (2000): *Is There a New Economy?* First Report on the OECD Growth Project, Paris, OECD.

OECD (2001): *Knowledge, work organization and economic growth*, Paris, OECD.

Osterman, P. (2000): *Work reorganization in an era of restructuring: trends in diffusion and effects on employee welfare*, in Industrial and Labor Relations Review, Vol. 53, No. 2

Peters, T.J. & Waterman, R.H. (1982): *In Search of Excellence: Lessons from America's Best-Run Companies*, New York, Harper and Row.

Pianta, M. (1997): *Patterns of Innovation, Demand and Employment*, Paris

Røvik, K.A. (1998): *Moderne organisasjoner - trender i organisationstenkningen ved tusenårsskiftet*, Bergen, Fakbokforlaget.

Røvik, K.A. (1992): *Institusjonaliserte standarder og multistandardorganisationer*, Oslo, Norsk Statsvitenskapelig Tidsskrift.

Schumpeter,J. (1911): *The Theory of Economic Development*, (R. Opie, trans.) (1934 English edn.) Cambridge, MA: Harvard University Press.

Somonetti, R. Taylor, K. & Vivarelli, M. (2000): *Modelling the employment impact of innovation: do compensation mechanisms work*, in Vivarelli, M. & Pianta, M.: The Employment Impact of Innovation, London, Routledge.

Sisson, Keith (ed.) (1995): *Personnel Management*, Oxford, Blackwell

Spineza, V. & Vivarelli, M. (2000): *The analysis of thechnological change and employment*, in Vivarelli, M. & Pianta, M.: The Employment Impact of Innovation, London, Routledge.

Tidemand, F. & Lindstrøm, P. (2003): *Arbejde der uddanner*, København, DI.

Vejrup-Hansen (1985): *Arbejdskraftbevægelser og beskæftigelse*, København, SFI.

Velfærdskommisionen (1995): *Informationsteknologi, produktivitet og beskæftigelse*, København.

Wood, S. (1999): *Getting the Measure of the transformed high-performance organization*, in British Journal of Industrial Relations, London, Blackwell.

Zuboff, S. (1985): *Technologies that Inform: Implications for human ressource management in the computerized industrial workplace*, in Walton, R.E. & Lawrence, P.R. (eds.): HRM - trends and challenges, Boston, Harvard.

Appendix A

Danish Work Organization, Innovation and Competence Development Panel

DISKO - Survey: 1993-95
1900 firms (3993)

- Organizational changes
- Job designs
- Qualification demands
- Education and training
- Product and ICT inovation

DISKO - Survey + Register data: 1990-97
1544 firms/workplaces (134.000 - 145.000 emp.)

- Value added - productivity
- Assets
- Turnover
- Job flows
- Worker flows
- Wages

DISKO2/IOC - Survey: 1998-00
637 of 1363 surviving DISKO firms (Panel)
2007 firms (Cross Section)
Questionaries to management & employee representative

- DISKO - measures
- Personnel planning
- Processes of change
- Workplace IR - Participation
- Consequences of change

DISKO2/IOC + Register data: 1990-00
Panel design: 637 firms
Time series design: 1900 + 2007 firms

- ICT variables (e-trade ect.)
- Value added - productivity
- Assets
- Turnover
- Job flows
- Worker flows
- Wages