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Knowledge intensive service activities and innovation in the Norwegian software industry

Part project report from the OECD KISA study

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ABSTRACT

This report is the first of three studies of the use of knowledge intensive service activities (KISA) in innovation in specific industries. The report consists of the Norwegian part of an OECD study which includes several other countries. The main focus is on KISA in the software industry in Norway. One of the main objectives of the study is to provide insights into how software firms maintain and develop productive and innovative capabilities through utilisation of KISA, provided by internal and / or external sources. However, the ultimate objective of the KISA project proper, i.e. the study of the three specific industries, is to inform government policy and programs on how to use KISA in building innovation capability of firms and organisations across various industries and sectors in the economy. Typical examples of knowledge intensive service activities provided both internally and obtained by external input in firms and organisations include: R&D, management consulting, IT services, human resource management, accounting and financial service activities, marketing and sales, project management, organisational activities, training etc.

KEYWORDS	ENGLISH	NORWEGIAN
GROUP 1	Industrial Management	
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Preface

This report presents the results of the first of three case studies in the project on Knowledge Intensive Service Activities (KISA). The KISA project is conducted under the auspices of the OECD Group on Technology and Innovation Policy (TIP) subordinated the Committee on Science and Technology Policy (CSTP). The lead countries of the KISA project are Australia and Finland and additional participating countries are Korea, New Zealand, Spain, Ireland and Norway.

The first mandatory case study focuses on KISA in the software industry and will be followed by case studies of KISA in health care by all participating countries. The remaining one or two case studies are optional. In the Norwegian part of the project the final case study will focus on KISA in the aquaculture industry.

The Norwegian KISA project is financed by the PULS and the ICT program of the Norwegian Research council. The KISA project is governed by an internal steering group of the Council consisting of Helge Klitzing, Øystein Strandli, Tron Espelid and Trine Paus. The authors would like to thank this group for valuable contributions as the project has evolved and for inputs to this report.

The KISA project is being conducted by STEP - Center for Innovation Research. The research team consists of Arne Isaksen (project leader), Heidi Wiig Aslesen and Marianne Broch. Additionally Johan Hauknes and Siri Aanstad have contributed with valuable inputs in various phases of this first case study. Marianne Broch has written chapter 1, 3, 4, 5, 6 and 8 of this first report, Arne Isaksen has written chapter 7 and the authors have cooperated closely regarding the remaining chapters 2 and 9.

Oslo, 20.02.2004

Marianne Broch and Arne Isaksen

Executive summary

This report is the first of three studies of the use of knowledge intensive service activities (KISA) in innovation in specific industries. The report consists of the Norwegian part of an OECD study which includes several other countries. The main focus is on KISA in the software industry in Norway. One of the main objectives of the study is to provide insights into how software firms maintain and develop productive and innovative capabilities through utilisation of KISA, provided by internal and / or external sources. However, the ultimate objective of the KISA project proper, i.e. the study of the three specific industries, is to inform government policy and programs on how to use KISA in building innovation capability of firms and organisations across various industries and sectors in the economy. Typical examples of knowledge intensive service activities provided both internally and obtained by external input in firms and organisations include: R&D, management consulting, IT services, human resource management, accounting and financial service activities, marketing and sales, project management, organisational activities, training etc.

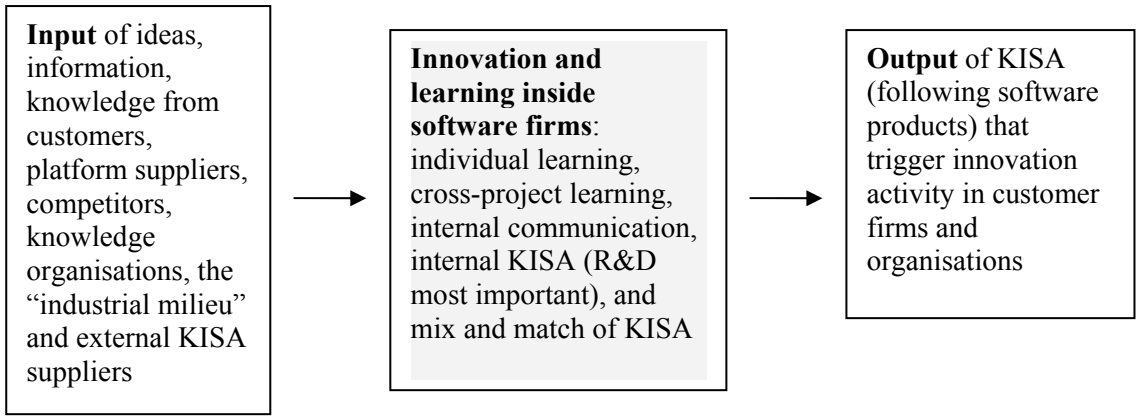
A set of common research steps for the OECD project is followed in this study. The first two steps describe key aspects of the Norwegian software industry, and policies and programmes of importance for the software and ICT industry in Norway, respectively. The third step includes studying innovation activity and the role of knowledge intensive service activities in innovation processes in the software industry as well as a part considering the software firms as providers of important KISA to other firms and organisations. The main data for this analysis is in-depth interviews with 16 Norwegian software firms. The fourth step discusses policy implications from the KISA software study and depicts a possible framework for systemizing policy implications of all the KISA studies to be conducted. This summary concentrates in particular on important results from the two last steps of the report.

Thus, key aspects of the innovation activity in the Norwegian software industry are summarised in Figure 1. The figure shows a kind of value chain as regards software production. The software sector certainly appears as a very innovative industry when using the common indicators to measure the innovativeness of firms. Software firms often regularly develop new standard solutions, or they develop tailor-made software for individual customers. Development work is first of all based upon pre-existing experience and software modules of the firms.

Thus, an explanation of how innovation in general takes place in software firms can start with the box at the centre of Figure 1 (below). A key point is that innovation activity mostly rests on long-term building up of competence inside firms. The organisational learning involved takes place in several corresponding ways. The efforts of individual workers to keep their knowledge up to date are important. An important part of the individual learning is learning by doing, i.e. learning when developing new software solutions for specific customers. Important for leaning and innovation is also internal communication in order to make individual knowledge more of a company asset. Companies have established routines for diffusing information and knowledge inside the companies, for example by putting together project teams consisting of experienced and less experienced employees, and having a sophisticated system for cross-project learning. Some firms also carry out basic research and development, which may take place in dedicated R&D departments. Lastly, innovation activity in software firms builds upon external information and knowledge.

Use of external sources of knowledge brings us to the input side of the figure. Software firms seldom use packages of standard knowledge intensive services from external sources when innovating. The case is rather that software firms receive signals and information from different external players. Software firms first of all receive information from clients, and firms often have some pilot clients which test and give important feedback on new software solutions. Further, software firms collaborate with platform suppliers to get early access to new technology. Software firms also benefit from being located in areas containing numerous competitors, which creates an innovation pressure, and from being in an area where they can pick up ideas and information in formal and informal settings, such as branch forums, meetings and seminars. Thus, the bulk of the software industry in Norway is located in the Oslo area, while the other large cities also have comparatively many jobs in the software industry. Relatively few software firms seem to have project co-operation with knowledge organisations such as universities and research institutes.

Figure 1.1: Innovation and the role of knowledge intensive services activities in software firms



The study particularly investigates software firms' use of knowledge intensive service activities, provided both internally and externally to the firms, and its possible effects on innovation activity of software firms. The research shows that Norwegian software firms consider research and development activities as the most important KISA, and that these activities are mostly provided internally. Other important KISA activities also mostly provided in-house are project management and the development of strategy and business plans. Likewise, software firms hold that some activities considered of medium importance are also provided mainly internally in the firms. These are the activities related to the development or introduction of new information technology systems for internal use as well as organisational development and team building.

Finally, regarding some KISA activities the software firms report considerable interaction and cooperation with external providers of knowledge intensive services. In these cases a mix and match of knowledge and competences of internal and external experts is high. The mix and match of competences and knowledge services is particularly evident in marketing and sales services, training services and recruitment services.

External KISA providers are used in many ways and for different purposes by software firms. The objectives for externalising knowledge intensive services vary between software firms.

To which extent external KISA affects learning and innovation is also mostly dependent upon the intensions of the firms for externalising the activity. In many instances the intensions are not to learn from the external provider, and then it cannot be expected that external KISA providers contribute to innovation activity in customer firms. But in some instances they may contribute significantly, particularly when the external KISA providers, through their deliveries, contribute in changing the working methods and ways of doing things in their customer firms. According to this study, this is in particular the case as regards management training, sales training and public relations activities.

The software industry is special as to analyses of KISA, inasmuch as the industry is also an important producer of knowledge intensive services. Even in the case when a software firm produces standard solutions, services related to installation of the software, modification of existing data, and training of employees of the clients accompany the delivery of the software programme. The new software solutions may also require organisational development and new ways of working by the client. The clients' cost on accompanying services generally amount to between one and two times the costs of the software products themselves. Thus, software solutions are typically products which cannot be delivered solely as a product, but include services that must be delivered from one human to another.

Thus, software firms perform knowledge intensive service activities in their innovation activity, which mean that they mix internal experience and knowledge with external ideas, information and knowledge. Software firms are also important producers of knowledge intensive service activities.

The ultimate goal of the KISA project is to come up with ideas to public policymaking. Discussions of policy implications will, however, greatly benefit from the two other industry studies to be carried out in Norway, and not least will policy discussions benefit from results of the other countries participating in the OECD KISA project. Results from other countries and industry studies are not available at this moment. Thus, the report first of all put forward a tentative framework for organizing discussions of policy. The framework may be used in the overall OECD study to summarize policy implications from all the industry and country studies conducted in the project.

The main objective of the policy targeting KISA should be to improve innovation capability, competitiveness and efficiency of private firms in all industries as well as in public organisations. The focus on knowledge intensive service activities is not an aim in itself; it is a mean to achieve the overall objective of more innovation, competitiveness and so on. Thus, related to the software industry per se, the means could be to stimulate increased use of software solutions by firms and organisations as a trigger of innovations in client firms. More generally, the means may be to stimulate knowledge intensive service activities in firms and organisations, based on the idea that KISA are central ingredients in the innovation processes of firms and organisations.

On one hand policy may stimulate the users of software as such or KISA more generally to demand and utilize such knowledge intensive services. On the other hand policy may want to influence the providers of software (and their inherent software services) in particular or providers of other knowledge intensive services, in order to improve the supply and quality of these services.

Arguments such as these lead to the framework in Table 1 below which may serve as a point of departure for discussing policy issues. Supply-side policy includes creating favourable conditions for the development of providers of KISA in general and the software industry in particular. Supply-side policy also includes stimulating KISA inside firms and organisations, as KISA are seen to be important in triggering innovation processes in firms. Demand-side policy, on the other hand, includes supporting the purchase and use of external knowledge intensive services by firms and organisations, and the use of software solution. Increased use of such services is seen to be important in innovation processes. Network policy consists of bringing together providers and users of knowledge intensive services (and of software as a special case), so that an interactive mix and match of activities may occur and give impetus for mutual learning and possible innovation on both sides

Chapter 9 of the report discusses in more detail the policy instruments which may belong to the various boxes of Table 1, based on results from the study of the software industry.

Table I-1: A framework for discussion of policy implications

Targets of policy tools	Stimulate supply and quality of KISA	Stimulate networking	Stimulate demand for KISA
Internal KISA in all types of firms and organisations	Stimulate KISA internally in firms and organisations	Support cooperation between internal users and providers of knowledge intensive services	Stimulate / support the demand for internal KISA from internal users of knowledge intensive services
External KISA providers to all types of firms and organisations	Create favourable conditions for the development of independent providers of KISA	Support cooperation between external providers and internal users of knowledge intensive services	Stimulate demand of firms and organisations for external knowledge intensive services
The software industry (as external KISA provider industry)	Create favourable conditions for the development of a nation's software industry. Create awareness among software firms of their role as provider of KISA.	Stimulate cooperation between software firms and external providers of knowledge intensive services (to software firms)	Stimulate the use of (new) software solutions by firms and organisations, as a mean to increase innovation and competitiveness in customer firms and organis.

1. Introduction

Innovation is on the policy agenda in all OECD countries after two decades of research by the OECD itself and by researchers in many fields. The awareness of the importance of innovation is demonstrated by the introduction of policies that cross many aspects of the innovative process and target all sectors of the economy.

The literature clearly indicates the multiple dimensions of innovation and innovative activity by firms. From an initial focus on product innovation alone, the interest now also includes new production methods, new marketing methods, new delivery methods and new organisational forms taken up by firms and organisations. It has become clear that all these aspects of change characterise innovative organisations and influence their competitive success.

Over the last decades substantial structural changes have occurred as concerns the generation of competences and capabilities in the economy. New markets and suppliers of productive knowledge and capabilities have emerged. Also new modes of interactions between suppliers and users of such knowledge and capabilities have developed. Related to competence and capability generation in the economy, public policy has traditionally supported research and technology development through government research and technology organisations (RTOs). However, research has also pointed to other suppliers of competence and capabilities, and to other capability enhancing activities that need to be considered and included in policy thinking related to knowledge development and innovative activities of firms and organisations.

One group of new suppliers of productive knowledge is so called knowledge intensive business services (KIBS), increasingly competing with the traditional RTOs in various areas of knowledge and competence development and diffusion. The competition mainly concerns the provision of services that can directly be appropriated by clients. Both the new suppliers and the more traditional suppliers, however, provide highly knowledge intensive services to their customers. These services are based on a set of activities that may be termed knowledge intensive service activities. However, such knowledge intensive service activities (KISA) take place not only within KIBS and RTOs. The knowledge intensive services provided by these kinds of organisations to their clients are most often co-produced in interaction between providers and users. Thus, KISA are an important part of the internal activities of *all types of firms and organisations*, even though the firms and organisations as such may not be regarded as particularly knowledge intensive, for example according to industrial classification standards. Nevertheless it is important to understand the role of knowledge intensive service activities (KISA) provided either internally in firms and organisations or externally by e.g. KIBS firms and RTOs, and the dynamic interaction between them. KISA are believed to be of vital importance for learning and innovation capability building inside firms and organisations (Wood 2002).

1.1. The KISA project

In this OECD project KISA are defined as *innovation services provided either internally or externally to a firm or organisation*, with *innovation services* understood as services related to the development of an organisation and its patterns and objectives of innovation – of changes

in its "way of doing things in the way of economic life"[1]. This definition of innovation prominently includes the introduction and sale of new and altered (service) products, the modes of producing these products and the structure of supplying these to customers.

This study on the use of KISA in innovation in the software industry is a part of a 15 country OECD research project. The KISA study proper, of which this software case study is the first part, mainly focuses on the structural changes indicated above.

- The core objective of the KISA project is to explore the functional provision and use of KISA in innovation in three sectors[2] and recent policy initiatives in this area in a range of countries. The three functional sectors include software production and health care, both of which will be studied by all participating countries. The third sector in Norway will be aquaculture.

- The project will provide insights into how firms and organisations maintain and develop productive and innovative capabilities through utilisation of KISA, provided internally or through various institutional channels. One basic aim of the project is to obtain a broad understanding of the role of KISA in firms and organisations and its potential role in the wider innovation system.

- With this as a basis the project provides implications for innovation policies related to knowledge intensive service activities.

These objectives will be attained through research organised in four steps in each sector.

The four steps of the various case studies are:

1. Review and analysis of national statistics on the contours of the sectors selected.
2. Description and evaluation of government and semi-public programs and policies and private ones if appropriate.
3. Interviews with representatives of firms and organisations (investigating the use and integration of KISA in firms / organisations).
4. Policy implications of KISA for the development of National Innovation Systems.

1.2. Method and data of the KISA software study

The four steps in the case studies build on different data material and use different methods for collecting information.

Step 1

The review of national statistics of the Norwegian software industry builds on a variety of sources:

- The Firm and Enterprise Register of Statistics Norway
- National accounts of Statistics Norway

[1] Joseph Schumpeter (1939) *Business Cycles*. Vol.1, Mac Graw-Hill, New York

[2] Some of the OECD national studies will include four KISA studies, the mandatory two studies of software and health care and two optional studies.

- Norwegian Labour Force Surveys
- The Community Innovation Survey for Norway 1997 and 2001

Step 2

The data used in the evaluation of government and semi-public programs and policies is based on information on the web sites of the various agencies responsible for the policies or programs, telephone based communication with persons responsible for the programs as well as the EU commission Trend Chart database for Innovation[3].

Step 3

For the KISA software study in-depth interviews with 16 Norwegian software firms have been undertaken. The software firms and the contact persons are presented in Appendix 1. The semi-structured interviews are based on the main themes drawn from the common research questions of the project presented below. The main themes discussed with the software firms were, apart from background information and firm organisation, how they perceive their bundle of products and services, their markets and customer relations, supplier structures and relations. Further, the interviews included discussions of the use of knowledge intensive service activities, both internal and external, possible effects or contributions of KISA, competitor situation, core competences and learning in the software firms, innovations and its financing, innovation collaboration, innovation barriers, as well as the firms' view of the role of public sector to innovation in the software industry.

1.3. Research questions

The research questions / themes agreed by the KISA focus group in OECD are as follows:

1. Overview of the software industry with a specific focus on innovation.
2. Characteristics of the innovations and innovation processes within the software industry.
3. Challenges in the development of innovations in the industry.
4. The role of KISA in innovation within the software industry.

   Do firms build innovation capability through the use of knowledge intensive services?
5. Do firms integrate knowledge intensive services from different sources?

   How does the integration take place?

   Are there any intellectual property related issues?
6. Impacts of KISA on innovation within the industry.
7. What is the role of the public sector as regards the role and impact of KISA in innovation within the software industry?

[3] www.cordis.lu/trendchart

2. KISA and innovation activity

This chapter gives a short description of how innovation activity is often seen to occur in industry and the role of knowledge intensive service activities in innovation processes. The chapter serves as a background for the empirical analyses in the report.

2.1. Innovation as interactive learning

Innovation is seen as an increasingly important activity in stimulating the competitiveness of firms and organisations. The importance relates to the conceptualisation of the contemporary post-Fordist economy by for example the economist Bengt-Åke Lundvall as a globalising learning economy. "Globalisation has not only increased market competition, but also transformed it into market competition based increasingly on knowledge and learning" (Lundvall and Borrás 1997: 28). While capitalism has always rested on its capacity to create new products and new ways of producing them, a common place assumption is that the contemporary economy is less standardised and predictable than in the Fordist period, requiring innovation and adaptation to be competitive. Thus, it is the capability to learn and innovate, and the ability to connect the innovative effort to wider markets that increasingly is seen to determine the relative position of individuals, firms, regions and countries. Firms in high costs locations in particular found their competitiveness on the ability to introduce new products, alter existing products, use efficient production equipment, organisation methods etc.

Innovation activity is seen as a complex, interactive, non-linear learning process. Learning then includes the building of new competencies and establishing new skills by individual workers, firms and organisations, and not only to get access to new information. This view of the innovation process is based on a broad definition of innovation, to include both improvements in technology and better methods or ways of doing things (COM 1995). The broad definition involves a critique of the linear, sequential model of innovation, which focuses on more radical, technological innovations. The broad understanding of innovation means an extension of the range of industries that can be viewed as innovative from typical high-tech industries also to include traditional, non-R&D-intensive industries. One of the basic critiques of the linear model is precisely the equation of innovative activities with R&D, giving poor prospects for the traditional industries, service industries and the public sector.

The conceptualisation of innovation as interactive learning furthermore emphasises the importance of co-operation in innovation processes as well as a systemic view of innovation. The build-up of different local organisations and the intensity of interaction between these to create "institutional thickness" (Amin and Thrift 1994) is emphasised as important in stimulating co-operation, learning and innovative activity. If successful, the institutional thickness of a region may be the basis for an innovative inter-firm division of labour and exchange of information, knowledge and competences, the provision of critical resources, and the development of a set of norms and values promoting co-operation (Lutz et. al. 2003). Moreover, the concept of innovation *system* is based on the idea that the overall innovation performance of an economy to a large extent depends on how firms manage to utilise the experience and knowledge in other firms, research institutions, the government sector etc. and mix this with internal capabilities in the innovation process (Gregersen and Johnson 1997).

Firms combine resources and knowledge by many actors in building unique, firm-specific competencies that cannot rapidly be imitated by competitors (Maskell et. al. 1998).
With the perspective on innovation as interactive learning, networking and co-operation are considered to be of strategic importance in promoting competitiveness of firms and organisations. Co-operation almost always includes interpersonal, human linkages. These linkages are quite different from arms-length, anonymous market transactions, and the existence of social institutions facilitates collaboration and the exchange of qualitative information between actors. Thus, 'in networks and other kinds of "organised" market relations, people develop codes of communication, styles of behaviour, trust, methods of co-operation etc. to facilitate and support interactive learning' (Gregersen and Johnson 1997: 482).

2.2. The role of KISA in innovation processes

The above conceptualisation of innovation as interactive learning underscores the importance of knowledge intensive service activities (KISA). Firms and organisations must build up internal competences and knowledge, and most often mix internal and external knowledge and competences in their learning and innovation processes. We are then at the heart of how KISA is to be conceptualised. According to Hales (2001) it is, however, important to distinguish between knowledge intensive service activities as functions performed within all firms and organisations *and* knowledge intensive services in particular institutional settings. According to traditional industry classifications service firms (institutions) may be categorised as "knowledge intensive" and thereby perform knowledge intensive service activities (KISA). Knowledge intensive firms rely heavily on qualified professionals (input). Knowledge intensive service activities are, however, not bound to the institutional settings of particular knowledge intensive service firms. All firms and organisations, regardless of being perceived as knowledge intensive or not, to a various degree perform and make use of a set of knowledge intensive service activities, provided internally and externally to the firm or organisation in question. The KISA project sets out to explore the functional perspective of knowledge intensive service activities. In this context KISA should rather be seen in terms of the output of the knowledge intensive service activities performed, perceivably increased competences and the development of enhanced innovative capabilities and innovation activity.

Competences are defined as abilities to do certain things in competitive settings. According to Hales (ibid) included in the concept of competences are "shippable" aspects of science and technology-related services (such as configured equipment, prototypes, documents, software and platforms, i.e. embodied knowledge) and "performed" and interpreted elements of services and competences. Knowledge of the codified type, on the other hand is frequently viewed as "possessions" not embedded in a particular context and can be exchanged between contexts in unproblematic ways. Competences do *not* only support (manufactured) products. In the service economy competences may themselves be (service) products, competence development may in fact be product development.

2.2.1. On the difference between delivering and getting a competence

Cohen and Levinthal (1990:28) argue that '…the ability to evaluate and utilize outside knowledge is a function of the level of prior related knowledge… (which) confers an ability to

recognize the value of new information, assimilate it, and apply it to commercial ends. These abilities collectively constitute what we call a firm's "absorptive capacity"'.
It is important to distinguish between the service "offered" by a supplier and the service "received" by a participant in a service interaction. Complementary competences must be mobilised by "receiving" firms and organisations to make sure that the outcomes of a given service delivery interaction may be translated into a significant competence for them.

As pointed out above suppliers of competences may, however, not explicitly be selling innovation services. Innovation services may be tacit or informal as well as explicit, and may be provided as part of the business mix by suppliers whose main business is production rather than development. In the KISA project it may be helpful to consider that all forms of "knowledge intensive" production (manufacturing production as well as service production) may potentially be viewed as sources of competence, and thus as furnishing tacit or "bundled" innovation services.

3. The Norwegian software industry

3.1. A growing and centrally located industry

3.1.1. The software sector

Defining software usually starts out with the definition of hardware, where *hardware* is defined as physical machinery and equipment. *Software*, however, constitutes the catalyst that enables the machinery and equipment to execute actual tasks, the computer program. The software communicates with the hardware by means of various machine languages, transmitting different codes of information digitally.

There are many different kinds of software. One distinction is made between *computer software* and *embedded software*. Embedded software refers to software integrated into other industrial products like electronic capital goods and white goods and are not sold separately. Embedded software will not be included in this study.

Computer software may be divided into two main entities: *basic technology* (platforms) and *applications software*. Basic technology performs the basic tasks within the computer. Applications software lies on top of the basic software and consists of computer programmes enabling users to perform specific activities. Applications software can be broken down by user type into i) consumer/home (user interface) applications and ii) business (intermediary) applications.

Consumer and home (user interface) applications software includes applications to enable users to perform non-business activities at home such as education, personal finance, word processing or games. The KISA case study will not consider consumer and home applications software.

Business (intermediary) applications can be further divided into cross-industry applications and vertical industry applications. Cross-industry applications are activities related to a particular business function, like enterprise resource planning applications, accounting, human resource management or word processing. Vertical industry applications comprise software targeted to perform activities in specific industries. The most popular products in this segment are computer-aided manufacturing (CAM), computer-aided design (CAD) and computer-aided engineering (CAE). Applications software is the largest segment in the market for packaged software.

The main focus of the in-depth case study will be on the segment of cross-industry business applications. As shown above the software sector is multifarious, and to be able to focus the study of the production and use of knowledge intensive service activities one particular segment had to be chosen. The software firms interviewed are therefore predominantly engaged in developing intermediary applications directed towards other business firms in a variety of industries. The various fields of software applications represented in the in-depth case study sample will be presented in a later chapter.

Additionally there are two fundamental variants of traded (business) software applications, *standard* and *customer tailored/ customised*. The types of products range from standard "packaged" software products delivered "as is", without any changes to a large number of customers, to customer tailored software, software developed according to the needs and

specification of individual customers. Tailor-made software is often software implementation projects based on advanced customers' business needs.

3.1.2. Open source

Open source software is software whose source code[4] is publicly available. The logic behind the open source movement is to make the source code of a computer programme available so that anyone can modify or improve it. The improvements can then be shared and adopted by anyone else using the software.

Open source software made numerous contributions to the early development of software in general and aided initial developments underlying the Internet. However, as the software industry became an increasingly profitable business, proprietary source code (protected by intellectual property rights) gained share to open source ones.

The rapid speed of the Internet and the subsequent urgent need for interconnection and compatibility between different software and hardware platforms has re-opened the debate of whether source codes should be proprietary or not. There is now a widespread use and mainstream acceptance of open-source software.

The sample of firms of the in-depth case study of the KISA project includes two firms producing open source software.

3.1.3. Statistical overview of software related services in the Norwegian economy

The mapping of the software related services takes departure in the traditional industry classification, NACE[5]. NACE categorises companies into groups of industries by using their major product as the denominator. This report focuses on software development, product supply and related consultancy activities. Software is broadly corresponding to the NACE category 722, but it is necessary to start out analysing the data more broadly, and then identify the relevant subcategories in the data sources where they are available[6]. Core of this study will thus initially be focusing on "Computer and related activities" in the NACE industrial classification, the aggregate 72 category, but will use "Software consultancy and supply" when data is available. The study will be based on the use of a range of national data sources, mainly statistics generated and organised by Statistics Norway[7].

The software industry is itself part of the cluster of KIBS (knowledge intensive business services) industries that today somewhat simplistically is seen as a one of the major components of the transition to a so-called "new" or "knowledge intensive" economy. This cluster of industries has included the fastest growing industries in many advanced economies during the 1990s and has been given a strong policy focus in recent national and international

[4] Source code is a computer program in its original form, the way it was written by the programmer. The source code cannot be performed by the computer directly, but has to be translated into machine language by a compiler, assembler or an interpreter.

[5] Nomenclature générale des Activités économiques dans les Communautés Européennes

[6] A separate issue concerning firm statistics is the fact that industrial classification of firms is based on the criterion of "the most important industrial activity" at the KAU (kind of activity unit) level. This further emphasises the need of a nuanced approach to analysing these statistics to capture the relevant software provision and development elements.

[7] For a discussion of the structure and limitations of economic statistics and related classification standards, see Hauknes (1999)

policy initiatives. Furthermore the bursting of the credit based ICT bubble economy during 2000-2001 raises serious needs of understanding the structure and evolution of these industries during the 1990s to interpret what the outcome of the present shake-out process on many of the related markets will be, and what policy needs this raises.

3.1.4. Economic characteristics of computers and related activities

In the below section the computers and related activities sector will be presented in terms of economic characteristics in the period from 1989 to 1999. Based on the Firm and Enterprise Register of Statistics Norway (Statistisk Sentralbyrå, SSB) focus will be the main developments capturing the employment growth of the sector, other relevant characteristics related to the workforce as well as geographical distribution, firm size and investments made by the sector of computers and related activities.

The computers and related activities sector consists of several sub sectors of which the software consultancy has been the largest and most important sub sector regarding employment during the last decade. The sub sectors within computers and related activities are:

- Data processing
- Database activities
- Hardware consultancy (and supply)
- Maintenance and repair of computers
- Other computer related activities
- Software consultancy (and supply)

As the table below shows there has been a marked growth in the number of firms in computers and related activities during the 1990s in Norway.

Table 3.1: Number of firms in Computers and related activities, 1989-2000, in actual numbers

Year\Sub sector	Data processing	Database activities	Hardware consultancy	Maintenance and repair of computers	Other computer related activities	Software consultancy	Grand total
1993	147	21	61	91	74	613	1007
2000	272	765	102	199	126	5028	6492

Source: STEP based on the Firm and Enterprise Register, SSB

3.1.5. Firm size

From 1989 to 1999 the size structure of the firms in the computer and related activities remained rather stable despite the substantial growth of the sector. In terms of employment the most significant growth took place amongst small firms, firms of less than 50 employees. The micro firms with 1 to 9 employees experienced a growth of 3,5 percent. However, the category of small, but rather medium sized firms, employing between 10 and 49 employees, shows the highest growth with about 6 percent. The most Substantial reduction regarding firm size can be seen in the category of very large firms of more than 250 employees. This group of firms had a share of 36 percent in 1989 and only 24 percent ten years later.

Looking at the sub sectors of the computers and related activities the picture gets rather blurred. The various sub sectors show rather dissimilar structures and it is hard to single out any main trends. The software consultancy and supply sub sector shows the same

development trend as the aggregate computers category, with an increase of firms in the small size categories and a substantial decrease of firms in the large firm category. This may reflect a high rate of new firm formation of mainly small firms between 1989 and 1999. The sector is characterised by a levelling out in terms of relative shares of size groups in the sub sector.

Table 3.2: Change in the number of employees in firms in Computers and related activities 1989-1999, in %

	Data processing	Database activities	Hardware consultancy	Maint. & rep. of computers	Other computer related activities	Software consultancy	Grand Total
Empl. 1 – 9	-	19,5	-5,6	-2,9	-11,1	5,8	3244
Empl. 10 – 49	13,3	11,7	-4,9	-30,6	-38,5	3,8	5475
Empl. 50 – 99	-6,5	12,8	-18,5	7,2	0	6,9	1945
Empl. 100 – 249	-12,9	19,5	-28,4	19,7	0	9	2199
Over 250	5,1	-65,8	55,9	0	46,5	-28,9	2730
No empl.	1,1	2,4	1,5	6,6	3	3,5	841
Grand Total	-	-	-	-	-	-	16434

Source: STEP based on the Firm and Enterprise Register, SSB

3.1.6. Employment

The number of employees working in the computers and related activities sector in Norway around the turn of the century was just above 27 000 persons, growing rapidly from about 10 000 in 1989. The general development trend of the business service sector in most developed countries since the 1960s has been one of rapid employment growth. The extensive growth in use of information and communication technology in all sectors of the economy has made the computers and related activities sector boom during the 1990s.

As a share of total national employment the computers and related activities sector shows a low and stable share throughout the whole decade 1989-1999. However, from 1995 the growth of the sector can be detected with a rise from 0, 4 percent of the total employment in 1995 to 1,14 percent in 1999.

Table 3.3: Employment (actual numbers and share of total national employment) in the computers and related activities, 1989-99

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Goods production	469841	455933	440707	432158	424802	429758	527122	538829	558711	566868	555444
Service production	510748	506940	502101	505995	502921	508699	546347	557543	572190	586011	599684
Computers and related activities	10679	10420	11623	11935	11453	11509	12411	15313	18478	22901	27113
% of total	0,35	0,34	0,37	0,38	0,37	0,37	0,40	0,49	0,59	0,72	1,14

Source: Statistics Norway

Regarding numbers of employees the various sub sectors of the computers sector at the beginning of the 1990s did not differ too much from one another. Some sub sectors employed only a couple of hundred, like the maintenance and repair and the other computer related activities. In 1989 the largest sub sectors, software consultancy and hardware consultancy, did not employ more than just above and just below 4000 employees each.

The developments of the decade show that the structure of the computers sector changed quite a bit. The most eye catching development is of course the enormous growth of the software

consultancy to almost 19000 employees in 1999. Making up 40 percent of the employees in the sector in 1989 the software consultancy ten years later totally dominates the computers sector with almost 70 percent of the employees.

However, the 1989 number two largest sub sector, hardware consultancy, has also undergone a substantial alteration. From employing more than every third employee in 1989 the Norwegian hardware sector at the end of the 1990s employs just above 3 percent of the workforce in the computers service sector, about the same level as the relatively marginal sub sectors of maintenance and repair and other computer related activities.

The sub sectors of data processing and database activities have both grown in actual numbers but makes up about the same share of the sector as at the beginning of the period.

Table 3.4: Number of employees in Computers and related activities 1989-99, actual numbers

Year	Data processing	Database activities	Hardware consultancy	Maint. & rep. of computers	Other computer related activities	Software consultancy	Grand Total (N=)
1989	1322	878	3846	200	117	4316	10679
1999	3593	2532	827	767	692	18702	27113

Source: STEP based on the Firm and Enterprise Register, SSB

3.1.7. Education of employees

The educational structure of the sub sector of software consultancy and supply in 1989 and 1999 is presented below. The main trend is that the share of employees with primary education has decreased considerably from 18 percent of the workforce at the beginning of the 1990s to below 9 percent at the end. The level of employees with secondary education has remained more stable, but nevertheless it has decreased with almost 5 percent point from around 28 percent of the employees in 1989 to around 23 percent ten years later. Together the share of employees in the software sector without higher education has decreased with a considerable 14 percent point. The goods producing sector and the service sector have also experienced a reduction of low educated employees, however from a much higher level (of about 80 percent to about 70 percent). These trends are most probably part of the general educational boom of the 1990s, encouraging most young people to get a higher education because of the difficulties obtaining a job at the beginning of the 1990s, while elderly people leaving the labour market generally have lower education than the young ones.

Table 3.5: Educational background of employees in Software consultancy and supply, 1989 and 1999

Year	% in 1989 N=4316	% in 1999 N=18702
Primary education	18,1	8,7
Secondary education	28,3	23,4
Craft certified	0,5	1,1
1-4 yrs higher education	38,7	45,1
5++ yrs higher education	10,5	7,8
Unknown	3,9	3,8
Grand Total	100,0	100,0

Source: STEP based on the Firm and Enterprise Register, SSB

The most frequent appearing higher educations in the software sector are engineering, economics and natural sciences. Economics has remained stable at around 13 percent of the workforce in the 10 year period. As a comparison the level of economics educated persons in

the software sector is much higher than in the goods producing and the service sector in general. At both moments in time economics make up less than 5 percent of the workforce in these sectors.

The engineering educated part of the employees in the software sector has grown from about 17 percent in 1989 to about 21 percent in 1999, by this making up the by fare the most important higher educated growth of the workforce in the sub sector. Engineering is of relatively low importance in goods production (about 5 percent in both years) and is not at all important in the service sector (2 percent). The group of employees with educations within natural sciences has grown from around 10 percent to almost 15 percent of the workforce. As engineering the natural sciences education is of minor importance to the goods producing and the services sector in general.

3.1.8. Age of employees

There are only minor differences between the different sub sectors in the computers and related activities sector related to the age of the workforce. The general development during the 1990s is that the sector as a whole employees less young people (16-24) at the end of the decade and employees more people over 55 years of age, but at rather low levels for both age categories. Employing less young people is most probably a consequence of the educational developments of the 1990s mentioned above. In hardware consultancy the share of employees above 55 years is particularly high at the end of the period. This should perhaps be seen in combination with the dramatic reduction of employees in this sub sector during the 1990s, the most experienced personnel keeping their jobs while employees with less experience from the sector move to other sectors.

3.1.9. Income of employees

In average employees in the computers sector have a higher level of income than employees in goods production and in services in general. In goods production just one out of four employees have an income level above 350,000 NOK. In services only one out of five of the workforce has an income above 350,000 NOK, possibly reflecting a relatively high share of part-time workers in the service sector. In the computers and related activities sector a large proportion of the employees of several of the sub sectors have a relatively high income level. In data processing, hardware consultancy, other computer related activities and software consultancy around every second employee has an income of more than 350,000 NOK. Database activities and maintenance and repair show lower shares of highly paid workers than the other sub sectors.

3.1.10. Geographical distribution of employees

The general picture related to geographical location of firms in the computers sector is a concentration in the capital region of Oslo and Akershus. In 1989 the concentration of firms in the various sub sectors to the Oslo region was the following:

- Data processing: 61,9 percent of the firms in the sub sector
- Database activities: 94,4 percent
- Hardware consultancy: 36,8 percent
- Maintenance and repair: 44,0 percent
- Other computer related activities: 18,0 percent
- Software consultancy: 58,7 percent

Particularly the database activities, data processing and software consultancy and supply parts of the computer related sector shows this concentration pattern. The development of the 1990s is one of de-concentration of activities to other parts of country however the sector is still mainly located in the capital region. As the table below shows there has been a levelling out amongst the sub sectors. The sectors range in concentration from 55-60 percent of the firms in the software consultancy and other computer related activities concentrated in this region to around 40 percent of the firms in hardware consultancy and maintenance and repair of computers.

Other than the Oslo-Akershus region one can point out the western county of Hordaland as a concentration area of firms in the computer industry. In 1989 there was no particular concentration of computer related firms in this region other than 14 percent employees in the hardware consultancy sector. In 1999 three of the sub sectors have grown considerably. The hardware consultancy and supply firms located in Hordaland make up 35 percent of total number of employees in that sub sector in Norway. From close to zero employed in firms specialising in data processing in Hordaland in 1989 the share employees at the end of the 1990s is close to 10 percent. Also the database activities firms show a substantial growth in this county from around 1 percent to 7 percent.

3.1.11. Investments

Despite the growth in the computers and related activities sector the sector remains a rather small sector in Norway as a share of total employment. However, looking at the investments made by this sector 1993-2000 a substantial growth is evident. The figures vary quite a lot from year to year in this period, but the general trend is a substantial growth in investments.

Table 3.6: Investment in Computers and related activities, 1993-2000, in mill. USD (PPP)

1993	1994	1995	1996	1997	1998	1999	2000
52,3	31,1	135,5	75,6	102,6	133,9	111,6	129,8

Source: Statistics Norway, Real Estate, Renting and Business activities, 1993-2000

From low levels in 1993 and 1994 of between 30-50 million USD the investment levels since 1997 have been above 100 million USD ending up at about 130 million USD in 2000. Because of the ICT bubble bursting in 2000-2001 and the subsequent decline in economic activity particularly in this sector the level of investments will surely be declining since 2000.

3.1.12. Inter-industrial linkages - Computer and related activities as a "user" industry

To get an overall impression of the software sector as a user of KISA services provided externally to the sector one possibility is to analyse the shares of intermediate inputs into the sector. The input-output data of the national accounts does, however, not include data at the level of the software sector, so the computer and related activities sector must be used in stead. National accounts are divided into domestic input and output, reflecting the streams of goods and services traded between Norwegian sectors, as well as imports. For 1993 unfortunately the data set does not include imports of goods and services from abroad into computers and related activities; however this is included in the 1999 data.

In 1993 the by fare most important domestic input into the computer sector comes from real estate, renting and business activities which may be from the consultancy sectors and from the

software sector itself. The categories are unfortunately at such an aggregate level that it is impossible to indicate the origin of the input in more detail. The second most important intermediate input into the computer sector comes from the manufacturing sector, all other input sources seem unimportant.

Table 3.7: Share of all intermediate inputs of computers and related activities, 1993, domestic

From	Into NACE 72	Share of intermediate inputs
Agriculture/ mining	14836	0,4
Manufacturing	521495	14,3
Electricity, gas and water supply	41274	1,1
Construction	214945	5,9
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	201831	5,6
Hotels and restaurants	58462	1,6
Transport, storage and communications	261539	7,2
Financial intermediation	223419	6,1
Real estate, renting and business activities	1387117	38,2
Public administration and defence; compulsory social security	38502	1,1
Education	11963	0,3
Health and social work	183074	5,0
Total intermediate input	3635987	100,0

Source: Statistics Norway, National accounts, 1993

At the beginning of the 1990s real estate, renting, but most of all business services was the dominant intermediate input into the computers and related activities. In 1999 the share of domestic input from these services make up more than half of total input into computers and related activities. The second largest intermediate input, from the manufacturing sector, has been reduced since 1993 from 14 to 10 percent of total input into computers and related activities.

While considering the share of inputs into computers and related activities from foreign suppliers of goods and services the data show that inputs from manufacturing make up the largest share from suppliers abroad. Almost 40 percent of total imports into the sector originate from foreign manufacturers. Second most important is again real estate, renting and business services, making up around 30 percent of total import input to computers and related services.

Table 3.8: Share of all intermediate inputs to computers and related activities, 1999, domestic and imports

From	Into NACE 72 (domestic)	Share of intermediate inputs (domestic)	Into NACE 72 (imports)	Share of intermediate inputs (imports)
Agriculture/ mining	118 720	1,0	5 646	0,2
Manufacturing	1 225 312	10,3	1 063 674	39,5
Electricity, gas and water supply	40 024	0,3	793	0,0
Construction	86 689	0,7	15	0,0
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	481 683	4,0	151 656	5,6
Hotels and restaurants	272 175	2,3	0	0,0
Transport, storage and communications	1 861 264	15,6	64 730	2,4
Financial intermediation	976 429	8,2	76 715	2,8
Real estate, renting and business activities	5 990 820	50,2	812 025	30,1
Public administration and defence; compulsory social security	73 102	0,6	0	0,0
Education	38 969	0,3	0	0,0
Health and social work	771 701	6,5	520 724	19,3
Total intermediate input	11 936 888	100,0	2 695 978	100,0

Source: Statistics Norway, National accounts, 1999

3.1.13. Occupations

The interesting approach proposed in the KISA project is that it takes a functional perspective to the analysis of the provision and use of KISA. The main focus is put on the actual knowledge intensive service activities produced, not the institutional settings in which they are provided. The important aim of the study is to investigate the role of the KISA provision, either internally or externally, in firms classified as KISA providers as well as in firms classified according to their main product (non-KISA), however providing important KISA services internally. The shift from an institutional to a functional framework of analysis is difficult and resource consuming, a challenge this project will attempt to explore. One way of exploring KISA provision from a functional perspective is to investigate the actual occupations of employees working in the various sectors. Educational background might give indications of what tasks the employees execute but occupational statistics specify in an exact and functional way what tasks the employees actually is set to do.

The data used in the case of Norway is the Labour Force Survey, a sample survey with a limited number of participants[8]. There are considerable error sources connected to the use of this data, for all there are very few observations in each category. The table below should therefore be read only as an indication of the occupational patterns in the sector, and not as exact and reliable results.

In this part of the KISA study the occupations (NACE 72) have been divided into three main groups: “information technology professions” and “other specialist professions”, which together make up the large group of KISA occupations in the sector, as well as a third residual category of firms. Unfortunately Norway is not able to obtain data on three-digit level from Statistics Norway. The numbers shown in the table below are not for software consultancy and supply but for computers and related activities, the aggregate category of which software consultancy make up by fare the largest group of employees.

The overall picture is that the group of information technology professions is the largest group of employees in computers and related services. About two out of three employees in this sector is occupied within information technology professions. There has been a slight decline in this main group of employees from 1996 to 2000, but still this group is the most dominant group within computers and related services. Internally in this group, computer associate professionals make up the largest group in 1996, followed closely by computing professionals. In 2000 there has been a marked growth in computing professionals and a corresponding decrease in employees occupied by computer associate professionals.

[8] The Labour Force Survey data is weighted, and the number of employees of the sector computers and related services therefore does not match the numbers from Statistics Norway.

Table 3.9: Share of employment in Computers and related activities (NACE 72), 1996-2000

ISCO-88	Occupations	1996, no of empl	1996 in %	2000 no of empl	2000 in %
	Information technology professions	*12536*	*66,4*	*23850*	*63,7*
1236	Computing services managers	0	0	125	0,3
213	Computing professionals	5309	28,1	16320	43,6
312	Computer associate professionals	7228	38,3	7406	19,8
	Other specialist professions	*2027*	*10,7*	*2629*	*7,0*
123	"Special managers"	256	1,4	1073	2,9
211	Physicist, chemist and related professionals	0	0	0	0
212	Mathematicians, statisticians, related professionals	0	0	0	0
214	Architects, engineers and related professionals	119	0,6	546	1,5
221	Life science professionals (biologists etc)	0	0	0	0
235	"Teaching professionals"	0	0	195	0,5
241	Business professionals	119	0,6	0	0
242	Legal professionals	0	0	0	0
311	Physical, chemical and engineering science technicians	1216	6,4	290	0,8
342	Business services agents and trade brokers	0	0	0	0
343	Administrative associate professionals	316	1,7	525	1,4
	KISA employment	*14563*	*77,1*	*26479*	*70,8*
	Other employment	*4318*	*22,9*	*10936*	*29,2*
	TOTAL	*18881*	*100,0*	*37415*	*100,0*

Source: Norwegian Labour Force Surveys, 1996-2000

The "other specialist professions" is a limited group of employees in computers and related activities, making up only about 10 percent in 1996 and 7 percent in 2000. The decline of "other specialist professions" including for instance business professions may be related to the decline of the group of particularly large firms in computers and related activities. The growth in this period has been in the group of small and medium sized firms, and these firms often have a rather limited part of the staff occupied with business services. Most internal tasks in small and newly established firms are done by the entrepreneurs themselves and the group of employed information technology professionals.

The growth of the category of "other employment" from 1996 to 2000 was about 60 percent as to only about 45 percent in KISA employment. All in all there has been a decline in those categories defined as KISA employment in computers and related services.

3.1.14. Summary

There has been a marked growth in the number of firms in computers and related activities during the 1990s in Norway from about 1000 in 1993 to about 6500 in 2000. From 1989 to 1999 the size structure of the firms in the computer and related activities remained rather stable despite the substantial growth of the sector. In terms of employment the most significant growth took place amongst small firms, firms of less than 50 employees.

The number of employees working in the computers and related activities sector in Norway around the turn of the century was just above 27 000 persons, growing rapidly from about 10 000 in 1989.

The developments of the decade show that the structure of the computers sector changed quite a bit. The most eye catching development is of course the enormous growth of the software consultancy to almost 19 000 employees in 1999. Making up 40 percent of the employees in the sector in 1989 the software consultancy ten years later totally dominates the computers sector with almost 70 percent of the employees.

Regarding the education of the employees in software consultancy and supply the main trend is that the share of employees with primary education has decreased considerably from 18 percent of the workforce at the beginning of the 1990s to below 9 percent at the end. These trends are most probably part of the general educational boom of the 1990s, encouraging most young people to get a higher education because of the difficulties obtaining a job at the beginning of the 1990s, while elderly people leaving the labour market generally have lower education than the young ones. The most frequent appearing higher educations in the software sector are engineering, economics and natural sciences.

Despite the growth in the computers and related activities sector the sector remains a rather small sector in Norway as a share of total employment. However, looking at the investments made by this sector 1993-2000 a substantial growth is evident.

4. Main activities in the software industry

4.1. Characteristics of the survey firms

4.1.1. Organisation

The majority of the firms interviewed were established during the 1980s and 1990s. The firms interviewed make up a combination of independent enterprises and being either part of a Norwegian or an international industrial group. The tendency is that the smaller firms interviewed are mostly independent firms and the larger firms are more likely to be a part of an industrial group.

Being part of an industrial group may have influence on the sovereignty of the firm and the possibilities of affecting its own development in a variety of ways. Only one firm being part of a listed Norwegian company reports to be rather controlled by the mother firm. The mother company exerts economic control with all its subsidiaries in six countries, thus important functions of product development (innovation), marketing, financial and economic control of the Norwegian subsidiary is centralised to the main company.

Most of the firms that are part of an industrial group thus feel that they are very independent within the group despite the fact that important strategic and development functions most often are executed "externally" to the firm in question. One of the firms reports to have close connections to the industrial group management. The industrial group has subsidiaries in Norway, Sweden and Denmark and strategy development functions and long-time planning is controlled centrally. The Norwegian firm, however, feels that it has great freedom regarding the day-to-day operations of the firm. At the moment the firm is working out a common development competence for the whole industrial group to be responsible for basic technology. Due to the higher technological level in Sweden the development unit will most probably be located there. However, each subsidiary will still have its own local development unit in the industrial group.

One particular characteristic of software as a product is that it is not a physical, but an informational product, which has unique cost specificities very different from those of a physical product. An informational, or digital, product is expensive to produce, but rather inexpensive to reproduce. The cost of producing copies of an already developed software product is very low and additionally the variable costs of digital products are typically small. There are hardly any capacity constraints in software production which creates great economies of scale to the producer.

4.1.2. Activities of software firms

The software sector can be said to be characterised by a number of main activities, where single firms may usually perform more than one of these activities. The activities, roughly following the value chain of software firms, include platform supply, software production, consultancy and after-sales (Isaksen, 2004).

Table 4.1: Main activities in the software consulting industry

Firms/activities	Products/services	Important customers	Main factors in building competitiveness
Platform supply	Basic technology and tools	Software producers and consultants	High R&D efforts. First-mover advantage
Software production	Standard software solutions	Organisations that need "simple" ICT solutions	Continuous upgrading of solutions based on signals from clients
Consultancy	Tailor-made ICT solutions, advice	Advanced ICT users	Re-use of solutions and know-how from project to project
After-sales	Training, support, running ICT systems	All types of organisations	Dependent on the first three activities

Source: Isaksen (2004)

Platform supply is the delivery of generic technology and tools that are the basis for developing software solutions (applications). Platform suppliers are often large, global and US based corporations with subsidiaries or branch offices in many countries. As the table above shows the most important customers of platform suppliers are software producers and consultants.

Software production consists of constructing standard solutions for a large number of customers, which are companies or public organisations. Some software producers deliver standard software with little or no adaptation for individual customers. Others do adapt their software to each client. Consulting services such as installation, integration and training of employees are often included in the sale of the software.

Consultancy services are delivered to more advanced customers than the customers of standard solutions. Consulting projects often consist of tailor-made solutions for each customer including both development and implementation of a new software solution. These solutions are often based on generic tools and/or familiar components and knowledge.

After-sales services mainly consist of the distribution of software products and the running of software systems, training of customer employees, customer support and the operation and management of hardware and software systems. These services are most often standard services with specific routines. After-sales services also often include external courses to build both internal competences of the software firms and in diffusing competence internally and externally.

4.1.3. Main activities of the firms interviewed

Most of the firms interviewed in-depth in this KISA study are to be found within the segment of cross-industry business applications. The firms develop intermediary software directed towards other business firms or other organisations, for instance in the public sector. The software often relate to particular business or organisational functions, like resource planning applications, accounting, human resource management or word processing.

Related to the main activities of software firms it is important to re-emphasise that individual firms often perform several of the activities referred to by Isaksen (2004). This is also the case regarding the firms of our sample, and the description below is meant to be a rough categorisation only. All of the firms in the survey report to conduct a variety of the main

activities characterising the software consulting industry. In the analysis of the firms we found that the firms may be categorised as:

- Suppliers of standard software solutions
- Suppliers of tailor-made software solutions and
- Suppliers that combine standard and tailor-made solutions

By fare the largest share of the firms of the survey are predominantly occupied with the activity of standard software production, producing, selling and delivering standard software solutions to their customers. The customers of the firms will be described in a later section. Secondly about one fourth of the firms seem mainly to be occupied with tailor-made software solutions to their customers. Another fourth of the firms make up a residual category of firms that offer both standard as well as tailor-made solutions to their customers.

Table 4.2: Main activities of the firms of the survey, mainly standard software solutions (but also some tailoring)

Main products/business area (standard software)	Product type	Service component (share of costs)	Content of service component (KISA)	Additional services (KISA)
Training support, **project management** and **cooperation** system	Stand. products in large series, as well as module based products in smaller series	10	Implementation, support	Solution management (to 95 of all its customers), training
Software for **annual settlement** (report and accounts)	Stand. products in large series, module based, some tailoring	Very small	Consultancy services in relation to tailoring of particular module (small part)	Training (major part), support (considerable, most customers have full support contracts)
Software for **finance management**	Stand. products	Varying degree depending on number of users. The more users, the larger the service component. From 80 to almost 0.	Implementation, reengineering, training, user support and consultancy, net based management of software	-
Broad **ERP[9] suite**	Stand. products in large series, module based	60	Installation, implementation, training, consultancy	Implementation of third party products
Customer Relation Management	Stand. products in large series, also some tailoring	50	Installation	Training (of direct customers as well as partners)
CRM, DMS (document management), business intelligence and data warehouse	Flexible standard products, module based, also some tailoring	If software is part of sale, 70	Analysis, design, system development, consultancy, mentoring, project management, quality assurance	Training, user support and administration
Software for **finance/ administrative management**	Stand. products, module based	50	Consultancy, delivery, integration, training, converting of existing data	Special made reports, tailor-made visual display
IT solutions within selected branches	Traditionally tailor-made solutions, but moves towards recyclable (stand.) components	Varies between divisions, from 50 to 100	Application development, resource management (human, financial, information, organisational), consultancy, outsourcing and application management	Courses and training
Software **supporting core processes** in within the **health and social sector**	Stand. products in large series, but not off-the-shelf software, some tailoring, module based	At initial sale: 50, In a customer life time: could have given the software away	Installation/ adaptation, training, user support, annual maintenance, report production	Distance management and data security services, consulting, arrange annual user conferences

Source: In-depth interviews with Norwegian software firms (2003)

[9] ERP: Enterprise Resource Planning. A term used on systems helping a firm administering all the different parts of its business area. This includes among other things finance, human resources, purchasing, material management, sales and distribution, production and order management. ERP applications are software helping firms administering its whole value chain in a best possible way.

In addition to the main products/business areas and product types of the firms of the survey the tables indicate the share of services offered in relation to a standard sale of a software product, the *service component* of a software delivery.

Amongst the firms offering fairly standardised software to their customers the service component varies considerably. Some of the firms report to have a very low service component, and one of these firms explains that in its particular case the service component is a function of how many users there will be of the software product. The more users of the software, the larger the service component will be. However, the majority of the suppliers of standard software state that more than half of the cost of a software delivery can be ascribed to services like implementation/installation, adaptation/integration, consultancy, user-support and training. If not included in the main delivery additional services often include training, user-support, solution management and up-dating.

The service component of the firms offering predominantly tailor-made software is in general lower than by the majority of the firms with standard software solutions. One explanation for this is that the software products per se have to be developed specifically to individual customers. The particular needs of individual customers require new solutions to be developed by the software firms. The particular cost specificities that apply to software production mentioned earlier, with relatively high cost of initial development and low costs of reproduction, becomes evident by tailor-made software development. The technical development costs exceed the share of services accompanying the tailor-made software product.

Table 4.3: Main activities of the firms of the survey, mainly tailor-made software

Main products/business area (tailor-made software)	Product type	Service component (share of costs)	Content of service component (KISA)	Additional services (KISA)
Data based training or e-learning	Products in small series, tailor-made	10	Implementation, training, consultancy	Solution management (in relation to tailor-made solutions)
Content Management System (CMS)	Tailor-made, module based	30-40	Project development/ management, customer business development, (some) training	Administration and management (outsourced) of software
Development of **electronic patient case records** for the primary health service	Products in small series	At initial sale (within one year): 20, In a customer life time: more than double	Customer support, up-dating	Training, Consulting (small part)

Source: In-depth interviews with Norwegian software firms (2003)

Related to the main activities described by Isaksen (2004) only one of the firms in the sample develops tools to be used in the process of software production of other software producers, and may be termed platform supplier. This firm belongs to the subsidiary category of firms combining both standard solutions and tailor-made software. In the subsidiary category of software firms interviewed the service component varies considerably amongst the firms.

Table 4.4: Main activities of the firms of the survey, combination of standard software solutions and tailor-made software (consultancy)

Main products/business area (combination)	Product type	Service component (share of costs)	Content of service component (KISA)	Additional services (KISA)
Building tool software in other software development	Open source software, combination of stand. product + tailor-made product, module based	15	Installation, e-mail support (the first year), up-dating	Training (courses open to all or particular firms) Support (extending the first year support)
Application Service Provider[10] functionality	Combination of tailor-made and stand. products	50	Consultancy, management of applications, up-dating	-
Object orientation and **artificial intelligence**	Tailor-made, based on generic knowledge and stand. products	Varies on products. One product 80, another product 20	Modelling, training, consultancy (via partners), enterprise architecture (particularly in USA)	-
Security solution software	Partly open source software, combination of standard and tailor-made solutions	80	Consultancy, application development, adaptation	Training courses, management services, 50 percent of customers enter into maintenance contracts

Source: In-depth interviews with Norwegian software firms (2003)

4.1.4. Customers, markets and competitors

The customers of the firms interviewed are of course diverse. The firms were asked to mention their three most important customers and state the relative importance of the customers in relation to the total turnover of the firm in question. One main observation is that most of the customers of the software companies are rather large and well-known organisations in the Norwegian market (with some exceptions of Nordic customer organisations and one Dutch). The customers of the software companies are both in the private and public sectors. Public sector related organisations have a rather dominant position as the most important customers of the firms interviewed. The university sector, the nationalised health enterprises[11] and the Norwegian Defence are regarded most important customers to some of the firms. Likewise the state owned company of Statoil and the earlier publicly run postal service, now an independent company, Norway Post are the most important.

Practically all the firms in the survey state to have a one-to-many relationship to its customers. In fact, only one of the firms evaluate that the market situation of one of its products is more characterised by a one-to-one or one-to-a few customer relationship. This, however, differs from the other main products of the firm. All the other software firms state to have many customer organisations. Having a one-to-many customer relationship is, however, a relative matter: One firm hold that it has a one-to-many customer relationship, and report to have 15 customers. Another firm states the same and has 1500.

In relation to the total turnover of the software firms the relative importance of the most important customers seems to be rather great. A majority of the software firms states that its most important customer make up in between 20 and 40 percent of the turnover of the firms, a rather high share. One firm has a very high concentration of its turnover in one particular market segment, public higher education and schools, with as much as 90 of its total turnover

[10] Application Service Provider (ASP) is an organisation offering software application through network servers. The applications are stored on the network servers in the location of the ASP and can be accessed by subscribing clients through the network (e.g. a rented line). The advantage for subscriber firms is that it does not have to administer this itself. Many times it is possible to rent storing space for data storing by the ASP (e.g. for documents).

[11] In Norwegian: "Helseforetak"

in 2002. On the other hand a firm producing software for customer relation management has the most dispersed customer portfolio of all the firms interviewed. CRM may be used by many types of firms in many branches.

The firms interviewed mostly have their markets in Norway. By fare the majority of the firms have in between 80 and 100 of their turnover in national markets. One firm that stands particularly out from the other firms is Trolltech which has a very small share of their turnover in Norway, namely 2 percent. (The products of Trolltech are Qt and Qtopia). The international market shares of this firm are dispersed on 45 percent North America, 45 percent Europe and 10 percent Asia. Another firm specialising on software for the health market has already tried out an internationalisation strategy in Germany, failed in that particular market, but now considers Estonia as a new and promising market for their health-related software products.

Of the other firms with varying degree of international operations many hold that foreign markets are of increasing importance. One firm specialised in accounting software has great expectations that the harmonising of accountancy and tax rules with the European Union will render entrance into the European markets possible. Due to perceived limited national markets another firm strongly believe in increased operations in international markets. Yet another firm has ambitions increasing its share of international market operations of total turnover to 80 percent. The planned strategy of the firm is first to focus on the Nordic and the Baltic markets.

When characterising its markets most of the firms view these to be growing. Some firms regard their markets to be fairly stabile, but in a rather positive way. One of the firms evaluating its markets to be stabile in Norway thus has great ambitions of international expansion (in the Nordic and Baltic regions). Another firm interviewed holds that its market situation is at a stable low level and is rather pessimistic about the near future developments regarding expansions. “The ambitions of the firm vanished with the crack of the IT bubble in the spring of 2000”, the firm holds.

Market expansions may take place in a variety of ways. New establishments can be made in a new geographical market, firms can establish themselves in relation to new customer groups and firms may develop themselves into new products areas. Despite the very optimistic view of the prospects of international market opportunities in the future none of the firms interviewed had during the past five years made establishments in new geographical markets. During this period the most important way of market expansion amongst the firms in the survey has been to include new customer groups into its markets. Related to the inclusion of new customer groups is the fact that most of the firms had also established themselves in new product areas.

4.1.5. Core competences

Competences are defined as abilities to do certain things in competitive settings. Included in the concept of competence are “shippable” aspects of science and technology-related services such as for instance software and platforms as well as “performed” and interpreted elements of service and competence. In the service economy competences may themselves be (service) products (Hales, 2001).

Core competences are discussed by Prahaled and Hamel (1990) which defines these competences as a matter of the limited number of specific capabilities mastered by a firm. To be competitive in the market software firms must offer good products to their customers and the firms are therefore dependent on a set of core competences to be successful in business. The firms' combination of core competences is thus of vital importance.

Common core competences to the software firms of the survey may be divided into at least three categories;

- Technical competences
- Market-related competences and
- Competences of the field(s) of particular specialisation.

Core competences within the technical area include all aspects of developmental work, programming, testing, design etc. Market-related core competences include in-depth knowledge about the market in which the software firms operate as well as the needs of customers and the deep insight into branch of operation. It may also include competence of public relation management and sales. Thirdly firms may have important core competences related to the special subject or field on which the software production is funded.

Table 4.5: Core competences of the firms of the survey

Technical, developmental, programming	Customer, market-related	Special field
Mintra	-	Mintra
IFS	IFS	-
Hiadata	Hiadata	Hiadata
Fronter	-	Fonter
-	Finale Systemer	Finale Systemer
Electric Farm	Electric Farm	-
Trolltech	-	Trolltech
Profdoc	Profdoc	-
SuperOffice	-	-
Visma	Visma	-
Software Innovation	Software Innovation	-
EDB Business Partner	-	-
-	Agresso	-
Tieto Enator	-	-
Linpro	-	Linpro
Computas	-	-

Source: In-depth interviews with Norwegian software firms (2003)

Software firms emphasise their technical competence as very important when considering their own core competences. However, only about one third of the companies hold technical core competence to be the one and only competence needed to be competitive in the markets they are in. Most of the software firms also report other core competences to be of considerable importance.

Market-related competences are mentioned by many of the firms interviewed. One firm holds that the combination of technological competence, including programming and system development, and customer handling, are the keys to its success as a software firm. The competence of understanding the needs of the customers and then to tailor-make solutions according to these needs is stressed by yet another firm emphasising the importance of tight linkages between the market (the customers) and the development staff of the software firm. A third firm emphasises its large and effective customer support organisation as a core competence of the firm.

One forth of the firms additionally point out their specialist competences in particular fields as very important competitive factor in the market. Examples of special field core competences are education didactics (used in e-learning), competences related to the health and social professional areas, specialist competences in accounting and tax issues as well as specialist competences on open source software.

Since the core competences of the firms are of vital importance to their competitiveness one may expect that the development and maintenance of these competences should also receive considerable attention within the software firms. Most of the firms in the survey show that they normally manage the development and up keep of core competences through regular project work in the day-to-day operations of the firms. Project work may consist of collaboration with customers or be internal developmental projects or updating of applications internally. In most cases the core competences are developed through learning-by-doing; the knowledge is developed as the work is done.

Ways to develop and maintenance the core competences of the software firms:

- Project-work
- Internal competence development projects (individual, groups, divisions etc)
- Courses or seminars (internal or external)
- Internet surfing
- Temporary external suppliers of knowledge

However, some of the software firms do have specific internal projects to develop the core competences of the firms. One firm e.g. has internal activities and specific budgets for competence development of the firm's employees. Each employee has an individual competence plan to be followed up closely. This is also the case of another firm, recently introducing individual competence development plans for its staff. Additionally this firm offers an extra week of vacation each year with economic support (NOK 3000,-) for individual competence development, e.g. course participation to its employees. The primary goal of this particular arrangement is to inspire the employees to come up with innovative ideas.

Another way of developing and maintaining core competences mentioned by the software firms interviewed are regular course participation either internally or externally, as well as the participation in branch seminars. However, several of the firms report to be too passive-minded in relation to core competence up keep and development. One firm hold that it focuses too little on post-qualifying education and training, another firm admits that the development of core competence is an under focused area and that much responsibility is put on the individual employee. The philosophy of that firm is that the employee on its own must make itself valuable to the firm.

Finally some firms report to collaborate closely with external knowledge intensive partners such as research institutes, consultancy firms or suppliers of technology. One firm states that SINTEF Technology Management as well as two large consulting firms (Hartmark and KPMG) are important collaborating partners regarding development of core competences and intellectual capital of the firm. Another firm reports that in relation to commission projects external competences are exerted to compliment or strengthen the knowledge and competence of internal employees. One firm holds that it has a network to external suppliers of technological platforms and uses these suppliers in combination with internal resources.

How then is new knowledge spread within the organisations of the software firms so that it might be turned into useful competence of the employees of the firms? Ways of knowledge diffusion within the firms may be:

- Internal training courses
- Group meetings, professional forums, seminars, get-togethers
- Firm organisation (mix of employees with various length of work experience, job-rotation etc)
- Codified knowledge (check lists, manuals, examples etc)
- Technology (intranet, internal newspapers etc)

As mentioned above some of the firms report internal training courses to be amongst the most important arenas for competence development and knowledge diffusion in the firms. Additionally software firms of the survey arrange specific group meetings, professional forums, internal seminars and get-togethers to enhance the spread of knowledge in the organisation. The knowledge is mostly spread by oral communication in these settings.

Related to knowledge diffusion the internal organisation of the employees seems be important to many of the software firms. In some firms the employees are divided into specific professional groups, each responsible for the sharing of new knowledge internally in the group. One firm emphasises that these matrix based groups are different from the regular departments of the firm, overlapping the departments, and thus secure knowledge transfer across the organisation. Another firm emphasises the importance of mixing experienced and new employees in the project work, the collaboration with customers in projects and the professional multi-disciplinarity of the firm. The firm has experienced that all these aspects are important to assure the spread of new knowledge within the organisation. Yet some firms carry out a job rotation principle amongst its employees as a way of spreading knowledge and competence within the organisation. Lastly, one firm stresses that the product management has a particular responsibility regarding information communication, or “translation” of knowledge from the technically oriented part of the organisation to the more sales and marketing oriented part of firm. The sales and marketing department is dependent on such knowledge transfer to be able to communicate well with the market.

Codified knowledge is yet another way of diffusing knowledge and experience throughout the software firms. Many firms have various forms of professional materials like check lists, manuals, project instruction books, reference/concept descriptions, experience reports and examples etc, codified tools for the employees to use in their project work, readily available to the employees.

Almost all the software firms additionally point out technological solutions to enhance the spread of knowledge inside the firms. Most firms have an intranet or an electronic knowledge sharing system, one firm even has an internal newspaper where new knowledge is publicised. The intranets used by the firms are mostly organised by specific knowledge or experience categories. More originally one of the firms emphasise the importance of its “source library” handling and preserving sources of inspiration for new and innovative ideas to be further developed within the firm.

4.1.6. Summary

By fare the largest share of the firms of the survey are predominantly occupied with the activity of standard software production, producing, selling and delivering standard software solutions to their customers. About one fourth of the firms seem mainly to be occupied with tailor-made software solutions to their customers. Another fourth of the firms make up a residual category of firms that offer both standard as well as tailor-made solutions to their customers.

Amongst the firms offering fairly standardised software to their customers the service component varies considerably. Some of the firms report to have a very low service component, however, the majority of the suppliers of standard software state that more than half of the cost of a software delivery can be ascribed to services like implementation/installation, adaptation/integration, consultancy, user-support and training.

The service component of the firms offering predominantly tailor-made software is in general lower than by the majority of the firms with standard software solutions.

The customers of the firms interviewed are of course diverse. Most of the customers of the software companies are rather large and well-known organisations in the Norwegian market. The customers of the software companies are both in the private and public sectors. Public sector related organisations have a rather dominant position as the most important customers of the firms interviewed. Practically all the firms in the survey state to have a one-to-many relationship to its customers. In relation to the total turnover of the software firms the relative importance of the most important customers seems to be rather great. A majority of the software firms states that their most important customer makes up in between 20 and 40 percent of the turnover of the firms. When characterising their markets most of the firms view these to be growing.

Common core competences to the software firms of the survey may be divided into at least three categories; technical competences, market-related competences and competences of the field(s) of particular specialisation.

Since the core competences of the firms are of vital importance to their competitiveness one may expect that the development and maintenance of these competences should also receive considerable attention within the software firms. Ways to develop and maintenance the core competences of the software firms are through project-work, internal competence development projects, courses or seminars, internet surfing and temporary external suppliers of knowledge.

New knowledge is spread within the organisations of the software firms in a variety of ways. It is spread by internal training courses, group meetings, professional forums, seminars, get-togethers, firm organisation (mix of employees with various length of work experience, job-rotation etc), codified knowledge (check lists, manuals, examples etc) and technology (intranet, internal newspapers etc).

5. Characteristics of innovation in the software industry

5.1. A highly innovative industry

Below innovation in the software sector is presented focusing on the characteristics of innovation related activities in Norwegian software firms.

Innovation statistics is based on the Norwegian part of the Community Innovation Survey[12] of 1997 and 2001. The CIS survey has been undertaken in 1992, in 1997 and in 2001. The service sector was, however, not part of the 1992 survey.

The innovation data will contribute to the statistical analysis of the KISA activities in the software sector by indicating

- The level of innovation activity in the software sector (and thereby the level of internal KISA activity[13])
- What types of innovation activities take place (internal/external acquisition) in the sector
- Who the software firms collaborate with in relation to innovation (external KISA)
- Where the software firms get ideas and inputs for their innovation activities (e.g. from external KISA provision)
- What factors are inhibiting innovation in firms of the software sector

5.1.1. Level of innovation

The table below presents the firms participating in the Norwegian 1997 and 2001 CIS surveys. The 1997 survey sample consists of 3261 firms, representing 9036 firms in the actual population of Norwegian firms (weighted). Correspondingly the sample of the 2001 survey was 3899 representing 11892 firms in the population. Throughout this study the weighted data from the CIS survey will be presented. As highlighted in the previous section the software sector is characterised by a large number of small firms. In 1999 one out of five firms in the Norwegian software sector employs less than 10 employees. Firms with less than 10 employees are by definition not covered by the CIS sample survey[14].

In the CIS survey innovation activity is rather strictly defined as having successfully introduced new or substantially improved products, processes, services or methods to produce or deliver these services. In 1997 the overall picture of all sectors shows that about 30 of the firms were innovative. However, the table below shows a negative trend from 1997 to 2001

[12] The Norwegian part of the Eurostat Community Innovation Survey (CIS) is performed by Statistics Norway. The unit of the CIS is the enterprise. The survey is conducted as a representative sample survey of all enterprises with more than 10 employees, combined with a full scale count of all enterprises with more than 100 employees. All industries, a selection of service sectors as well as for building and construction, electricity and water supply, oil and gas, mining and finally fish farming are included in the CIS survey. The enterprises are imposed the duty of reporting, so that lacking responses is a very marginal problem. All numbers are scaled up to represent the whole population of enterprises represented in the industries concerning branch categorisation and size categories covered by the survey (weighted).

[13] KISA activities in the KISA study are defined as "innovation services", knowledge intensive service activities "…related to the development of organisations and their patterns and objectives of innovation" (see def. pg.XX).

[14] See footnote 6.

regarding the innovativeness amongst Norwegian firms participating in the survey. In 2001 only 26, 4 percent of the firms report to have introduced new or substantially improved products, processes, services or methods to produce or deliver these services.

Table 5.1: Number of firms in sample and population, actual numbers and share of non-innovative and innovative firms, 1997 and 2001.

	1997			2001		
	Total	**Non-innovating firms**	**Innovating firms**	**Total**	**Non-innovating firms**	**Innovating firms**
Sample	3261	1964	1297	3899	2517	1382
Population	9036	6346	2690	11832	8708	3124
Share of population	100,0%	70,2%	29,8%	100,0%	73,6%	26,4%

Source: Community Innovation Survey for Norway 1997 and 2001

Compared to the total population of firms software firms show a much higher propensity to report to have introduced new products or services (or methods to produce and deliver services) than other firms. In the period 1995-1997 every other firm in the software sector was innovative. In the next period, 1999-2001 software firms have increased their share of innovative firms by more than 10 percentage points. Almost 62 percent of the software firms participating in the 2001 survey report to have introduced an innovation in the period in question.

Table 5.2: Share of innovating firms in Software consultancy and supply, actual numbers and percent, 1997 and 2001

	1995-1997			1999-2001		
	Total	**Non-innovating software firms**	**Innovating software firms**	**Total**	**Non-innovating software firms**	**Innovating software firms**
Population	207	103	104	465	177	288
Share of population	100,0%	49,8%	50,2%	100,0%	38,1%	61,9%

Source: Community Innovation Survey for Norway 1997 and 2001

One particular question in the questionnaire asks whether the firms have introduced *original* or *radical* innovations, innovations not only new to the firm but also new to the market. Firms in the software sector also show a very high level of *original* innovations, not only general innovative behaviour. In 1997 almost 60 percent of the innovative firms in the software sector report to also have introduced totally new products to the market. Although at a slightly lower level in 2001 almost 56 percent of the software firms report radical innovations. At both moments in time software firms show a marked higher propensity to innovate than manufacturing and service firms in general.

Table 5.3: Innovative firms developing or introducing new products, services and or methods to produce and deliver services that were not only new to the firm but also new to the market (i.e. radical innovations), 1995-1997

	1997			2001		
	Manufacturing	**Services**	**Software**	**Manufacturing**	**Services**	**Software**
Radical/original innovations	465	398	61	582	668	161
Total N=	1565	942	102	1256	1366	288
Share of total	29,7%	42,2%	59,8%	46,3%	48,9%	55,9%

Source: Community Innovation Survey for Norway 1997 and 2001

The level of innovation in software firms is generally very high compared to other industries. The tendency of software firms having successfully introduced new or substantially improved products, processes, services or methods to produce or deliver these services is growing and

in the period 1999-2001 almost two out of three software firms introduce renewals and improved products to their customers, mainly incremental innovations. Introducing new functionalities and improvements to the products and services is most often an integral part of the business of a software firm, particularly if the software firm offers a relatively high degree of tailor-made software to its customers. However, when it comes to radical improvements or totally new product or services this kind of innovation activities often requires dedicated efforts and resources set aside to this by the firm. The later period covered by the CIS survey shows a declining tendency of software firms to introduce radical innovations. One feasible explanation for this finding is that in the period in question firms have been preoccupied with the regular business activities of the firms, and to handle the negative economic developments which particularly struck the information technology industry in this period. Radical and dedicated innovation activities may temporarily have been set aside, and may be one of many possible explanatory factors for this particular finding.

5.1.2. Innovation activities

Innovation is a complex process mostly involving a whole range of activities and actors and firms choose different strategies for its development activities. One strategy is to keep the responsibility of all the activities inside the firm depending solely on internal innovation capabilities and resources. Another possibility is to collaborate with other firms or institutions either informally or on a project basis or setting up a more formal development organisation such as a strategic alliance or joint venture. This strategy implies that the firm gives up some of the responsibility of the innovation activities to external actors. Other firms might want to externalise most parts of the responsibility for innovation activities to other institutions such as for instance research institutes.

The table below shows that of in 1997 innovating firms in the software sector in general keep most of the responsibility for development or innovation activities inside the firm and only to a small degree hand over this responsibility to others by collaborating with externals in such activities. In the manufacturing and service sectors almost one out of three firms state to have joint responsibility with other organisations in development activities as to only about every tenth in the software sector. Of the firms leaving the responsibilities for development activities to other firms or institutes service firms in general dominates with 16,5 percent, opposed to firms in the software sector which hardly externalise such activities at all.

Table 5.4: Responsibility for product, process or service development in innovating firms, 1995-97

	Manufacturing	Services	Software	Share of Manufacturing	Share of Services	Share of Software
Mainly own firm	657	476	91	61,1%	51,4%	87,5%
Firm in collaboration with other firms or institutes	323	298	11	30,0%	32,1%	10,6%
Mainly other firms/ institutes	96	153	2	8,9%	16,5%	1,9%
Total N=	1076	928	104	100,0%	100,0%	100,0%

Source: Community Innovation Survey for Norway 1997

In the 2001 survey both manufacturing firms and service firms report that the responsibility for product, process and/or service development to a larger degree is kept within the boundary of the firms. Software firms, however, show a stable tendency of keeping the responsibility for developing most of its products, processes and/or services inside the firm. Service firms in general are the most willing to cooperate and share responsibility with externals in relation to process or service development at a stable 16 percent.

Table 5.5: Responsibility for product, process or service development in innovating firms, 1999-2001

	Manufacturing	Services	Software	Share of Manufacturing	Share of Services	Share of Software
Mainly own firm	951	844	256	75,7%	63,0%	89,1%
Firm in collaboration with other firms or institutes	236	282	24	18,8%	21,0%	8,4%
Mainly other firms/ institutes	68	213	7	5,4%	16,0%	2,5%
Total N=	1256	1343	288	100,0%	100,0%	100,0%

Source: Community Innovation Survey for Norway 2001

5.1.3. Type of innovation activity

Innovation and renewal activities in firms comprise of a range of different activities. The various activities captured in the CIS 97 have a very traditional focus based on a manufacturing view of innovation. The focus is rather technological and does for instance not include innovation or knowledge intensive activities related to areas such as organisational change or design. These aspects are incorporated into the 2001 survey.

The type of innovation activities, however, performed inside the firms gives an indication of the knowledge intensive service activities (KISA) conducted within the firms in the various sectors. It might perhaps also indicate where the mix with external KISA provision apparently can be expected to be important.

Table 5.6: Types of innovation activities in innovative firms, share of firms reporting such innovation activities of total innovative firms, 1997

	Manufacturing N=1565 (%)	Services N=1056 (%)	Software N=104 (%)
R&D in own firm (internal R&D)	43,1	46,5	82,7
Acquisition of R&D services (external R&D)	29,3	24,6	14,8
Acquisition of machinery and equipment in relation to technological innovations	61,1	54,1	50,5
Acquisition of data programs or other external technology related to technological innovations	17,3	61,9	56,7
Manufacturing: Industrial design and other improvements related to product and process innovations Services: Preparations for introduction of new or substantially improved services or methods to produce or deliver them	21,5	38,1	43,4
Competence building in direct relation to technological innovations	39,4	54,9	62,9
Market introduction of technological innovations	20,3	29,9	46,8

Source: Community Innovation Survey for Norway 1997

In 1997 above 80 percent of the software firms report to undertake internal R&D activity followed by competence building in direct relation to technological innovation (63 percent). Acquisition of data programs or other external technology (related to technological innovation) seems to be of particular importance to both firms in the service sector in general and to software firms more particularly. Software firms are rather focused on competence building in that above 60 percent of the firms report to have carried out such activities. Acquisition of machinery and equipment (in relation to technological innovations) is rather important to all types of firms. Few software firms (about 15 percent) state to have acquired external R&D services.

From the findings the 1997 survey the mix and match of KISA activities in the software sector presumably take place when software firms interact with external suppliers of data programs and technology and suppliers of machinery and equipment, and that competence building internally might rely on and profit from these interactions.

In the 2001 survey the question on types of innovation activities undertaken in the participating firms is shaped differently, including some of the objections held against the 1997 version. The technological aspect is de-emphasised to fit both manufacturing and service firms not particularly characterised by technological innovation. The new category of "other external knowledge" is included to also incorporate other types of knowledge possibly important to develop innovative capacity and innovation activity in firms than traditional technological knowledge. Additionally a separate design category is included.

Table 5.7: Types of innovation activities in innovative firms, share of firms reporting such innovation activities of total firms, in 2001

	Manufacturing N=1256 (%)	Services N=1353 (%)	Software N=288 (%)
R&D in own firm (internal R&D)	64,5	52,7	75,9
Acquisition of R&D services (external R&D)	37,0	22,3	28,1
Acquisition of machinery and equipment (incl. IT hardware)	38,5	37,4	41,7
Other external knowledge (purchase of rights to use patents, non-patented inventions, licences, know-how, drawings, and consultancy services (ex R&D), as well as computer programs not specified elsewhere)	17,6	27,5	24,0
Competence building (training of personnel in direct connection to development and/or introduction of new or improved products or processes)	44,6	45,9	50,8
Market introduction of innovations	33,3	36,1	38,0
Design, other preparatory work for production and delivery	31,9	20,9	27,1

Source: Community Innovation Survey for Norway 2001

In 2001 about 75 percent of the software firms report to have undertaken internal R&D, a small reduction compared to the previous survey. Manufacturing firms and services firms, however, show a growing tendency to perform internal R&D. Both these categories of firms have increased their level of internal R&D with about 10 percentage points.

In 1997 software firms show a very low level of acquiring external R&D, but in 2001 acquisition of R&D services by software firms has grown with more than 10 percentage points, to include almost 30 percent of the software firms. Purchased R&D services include knowledge intensive activities perceived important for developing innovation capability in firms. The new category of "other external knowledge" among other things includes consultancy services (excluding R&D services) and computer programs. Like R&D services external consultancy services in general may contribute with valuable input to internal innovation capability and activity. Computer programs in themselves and the services (implementation, adaptation and so forth) most often accompanying the delivery of such programs may also have positive effects on the internal innovation activity of the firms acquiring such programs. One out of four software firm and about the same proportion of service firms in general states to have acquired such other external knowledge however, it is not possible in detail to detect what external knowledge is of particular importance to these firms.

In the 2001 acquisition of machinery and equipment is still important to software firms however seems to be of less importance than in 1997. Only about 40 percent of the firms report purchase of machinery and equipment, as to more than 50 percent in 1997. There seem to have been a tendentious shift by software firms to a larger extent to purchase knowledge incorporated into specific R&D services than to rely on the acquisition of knowledge which is incorporated into machinery and equipment.

As in 1997 competence building is still important to software firms in 2001. More than half of the software firms participating in the survey report training of personnel to be amongst their most important innovation activities undertaken in 2001.

5.1.4. Sources of information

One hypothesis of the KISA project is that through innovation collaboration with external KISA providers as well as other external contacts firms will be exposed to other ways of thinking and other sources of information that might give impetus to innovative ideas yet to be exploited in the firms collaborating with external KISA providers. The most important sources of information or ideas for innovation of software firms are treated below.

In 1997 software firms report *internal* sources of information and ideas for innovation activities most important. Among external actors not surprisingly software firms report that customers are important sources of ideas for innovation. Nearly all of the software firms evaluate customers to be of medium to great importance as source of information and ideas to innovation. Of other important information sources to innovation activity 87 percent of the software firms report other firms within the same industrial group to be of medium to high importance and about 85 percent report that data based information networks as for instance the internet to be of equal importance.

Table 5.8: Sources of information or ideas for innovation activity of firms in Software consultancy and supply 1995-1997 (information sources evaluated "medium to high importance"), in %

	Manufacturing (%)	Services (%)	Software (%)
Within the firm	83,5	75,0	100,0
Other firms within the same industrial group	47,6	71,7	87,5
Competitors	58,8	57,8	67,5
Customers	78,3	88,3	99,3
Consultancy firms	23,2	37,1	12,3
Suppliers of equipment, material, components or data programs	70,2	66,5	53,7
Universities and colleges	21,2	10,3	13,4
Public or private non-profit research institutes	24,5	5,3	10,6
Public patent documents	7,6	0,6	0,4
Conferences, meetings, professional periodicals or journals	43,3	49,3	66,0
Data based information networks as for instance the internet	18,3	29,2	85,4
Fairs and exhibitions	59,2	26,9	56,5

Source: Community Innovation Survey for Norway 1997

From 1997 to 2001 again the questionnaire has been changed which makes comparisons of sources of information less straight forward. The software firms still evaluate internal resources to be the most important source of information for innovation activities, however at a slightly lower level. Customers are also still one of the most important sources of information for innovation activities to software firms. Customers give feed-back on the functionality and usability of the software product and its ancillary services and help software firms improve and/or develop new innovation.

All types of firms rate suppliers of equipment, material, components and data programs rather important sources of information in both 1997 and 2001. About half of the software firms state that suppliers are medium to important sources of information to innovation activities in the firms. Much embodied knowledge accrues to buyers of such technology and thereby this source of information is of particular importance in the KISA project (Smith, 2000). It is of vital importance that the firm receiving such embodied knowledge have developed the skills and competences to use the advanced knowledge-based technology incorporated into the

intermediate inputs from technological suppliers. Additionally, the acquisition of equipment, material, components and data programs is most often accompanied by knowledge intensive services provided by the suppliers of such, and the delivery often requires close cooperation between the external KISA suppliers and internal KISA actors.

Other KISA related sources of information are consultancy firms, universities and colleges, public and private research institutes and commercial laboratories or R&D enterprises. Between 1997 and 2001 the main trend regarding software firms and their use of KISA related sources of information seems to be a marked growth in the evaluation of consultants as important sources to innovative ideas in the firms. From a relatively low level in 1997 compared to manufacturing firms and service firms in general almost 30 percent of the software firms in 2001 rate consultants of medium to great importance as sources of information for innovation activities. Universities and colleges as well as research institutes remain fairly stable at a rather low level of importance to Norwegian software firms (and to all firms in general).

Table 5.9: Sources of information or ideas for innovation activity of firms in Software consultancy and supply 2001 (information sources evaluated "medium to high importance")

	Manufacturing (%)	Services (%)	Software (%)
Within the firm	80,6	55,5	97,3
Other firms within the same industrial group	37,0	74,9	60,7
Competitors	37,5	51,3	43,4
Customers	66,9	72,3	84,8
Consultancy firms	14,9	19,5	29,2
Suppliers of equipment, material, components or data programs	63,3	31,7	54,5
Commercial laboratories/R&D enterprises	6,6	5,8	4,4
Universities and colleges	11,0	6,6	13,4
Public or private non-profit research institutes	15,8	14,1	7,3
Conferences, meetings, professional periodicals or journals	46,5	36,7	55,6
Fairs and exhibitions	46,5	46,1	36,1

Source: Community Innovation Survey for Norway 2001

5.1.5. Innovation cooperation

In the period 1997-1999 above 60 percent of innovating firms in the software sector report to collaborate with other firms or organisations related to innovation, above the average of both manufacturing and service firms in general. During the next period (1999-2001) the reported collaboration in all firms seems to have dropped considerably. About 40 percent of manufacturing and service firms report to have been engaged in innovation cooperating activities with other firms and organisations, as to only just above 30 percent of the software firms. One possible explanation for this is that the last period covered by the CIS survey (1999-2001) is the period of negative development particularly for the firms of the software industry. Since the burst of the IT bubble in 2000 many firms in the sector have strived to survive and this may have influenced the propensity to engage in innovation in general and innovation cooperation with external partners in particular.

Table 5.10: Innovating firms' collaboration with other firms or organisations related to innovation activities, 1995-1997

	1995-97			1999-2001		
	Manufacturing (N=1142) (%)	**Services (N=1056) (%)**	**Software (N=104) (%)**	**Manufacturing (N=1256) (%)**	**Services (N=1365) (%)**	**Software (N=288) (%)**
No collaboration	45,2	43,5	36,3	58,7	60,0	69,1
Collaboration	54,8	56,5	63,7	41,3	40,0	30,9
Total	100,0	100,0	100,0	100,0	100,0	100,0

Source: Community Innovation Survey for Norway 1997 and 2001

When the firms in the software industry cooperated, who then do the firms collaborate with in relation to innovation activities? The general trend amongst all firms in the survey is that customers are the most important Norwegian collaborating partners to the firms participating, and it is particularly evident regarding software firms. In 1997 close to 60 percent of the software firms cooperate with their customers in important innovation projects, as to around 40 percent by service firms in general. The trend of very high collaborating activities with customers of software firms is also evident in the 2001 survey. Customers rank as the most important collaboration partners again to around 60 percent of the software firms.

Considering all firms the second most important collaboration partners are various types of suppliers. In 1997 suppliers of equipment, material, components or data programs are rated important collaborators in innovation projects by about 57 percent of service firms in general, 40 percent of manufacturing firms and about 33 percent of software firms in particular. Suppliers make up an important source of information and expertise that the collaborating firms may take advantage of in their innovation projects. As emphasised above the hypothesis is that suppliers may therefore be important contributors of knowledge intensive service activities related to the input they offer to their customers[15].

Table 5.11: Type of innovation collaboration partners in Norway, share of firms reporting such innovation collaboration, 1995-1997 (share of N=those who have answered the question)

	Manufacturing firms (N=625) (%)	**Service firms (N=597) (%)**	**Software firms (N=68) (%)**
Other firms within the same industrial group	39,1	55,2	22,7
Competitors	10,9	13,1	12,5
Customers	47,2	40,9	57,8
Consultancy firms	26,0	33,7	42,7
Suppliers of equipment, material, components or data programs	39,5	57,2	33,3
Universities and colleges	32,5	15,6	28,3
Public or private non-profit research institutes	37,8	22,3	19,0

Source: Community Innovation Survey for Norway 1997

However, suppliers of equipment, material, components and data programs are not the only collaborating partners that may contribute with knowledge intensive service activities to firms. Consultancy firms may contribute with potential important impacts on the innovation capacity of their client firms. In 1997 more than 40 percent of the software firms state that consultancy firms are important Norwegian collaborating partners. Every third service firm rate consultancy firms as important collaborating partners and every forth manufacturing firm state the same. The trend is, however, declining. In 2001 only about 20 percent of software

[15] Software firms may act as KISA suppliers to other firms (See Chapter 7). Software firms often offer ancillary services to customer firms in relation to a software sale. The use of suppliers of various types of input to manufacturing firms and service firms in general may indicate software firms' role as suppliers of knowledge intensive activities to other firms and sectors. In fact many software firms consider themselves consultancy firms rather than pure suppliers of a software product.

firms report to collaborate with consultancy firms. One possible explanation for this may again be the business downturn experienced by many firms in the IT industry.

Table 5.12: Type of innovation collaboration partners in Norway, share of firms reporting such innovation collaboration, 1999-2001 (share of N=those who have answered the question)

	Manufacturing firms (N=518) (%)	Service firms (N=620) (%)	Software firms (N=89) (%)
Other firms within the same industrial group	30,6	23,1	20,7
Competitors	12,3	13,4	12,2
Customers	42,3	51,6	60,2
Consultancy firms	32,0	29,7	21,5
Suppliers of equipment, material, components or data programs	40,7	48,1	32,3
Universities and colleges	34,2	15,4	14,6
Public or private non-profit research institutes	35,5	17,2	17,7
Commercial laboratories / R&D enterprises	22,5	8,0	4,7

Source: Community Innovation Survey for Norway 2001

Less important collaborating partners and thereby also possible contributors of knowledge intensive service activities are universities and colleges, public or private non-profit research institutes as well as commercial laboratories or R&D enterprises. These particular institutions are specialists in science based knowledge from research and development activities. At both moments in time manufacturing firms in general are more tended to engage in collaborating relationships with these partners than service firms, including software firms. Service firms' low degree of collaboration with these actors corresponds well with the finding regarding important sources to information and ideas for innovation above. Universities and colleges as well as research institutes and laboratories are rated rather low as sources to information and innovative ideas to all firms, software firms included.

5.1.6. Innovation barriers

Many factors may influence the ability of firms to innovate and be of vital importance to whether firms innovate or not. Hindrances to innovation may be of internal and external origin, and may be coped with in various ways. The provision of public KISA may for instance be aimed at assisting firms to overcome such barriers.

Experienced barriers to innovation are perceived different by innovating firms in manufacturing, services and software production. The possible effects of these hindrances may be that innovation projects are seriously delayed, that the projects are interrupted for various reasons and more damaging, that the innovation projects are inhibited from starting up all together.

Table 5.13: Unwanted development of minimum one innovation project of innovating firms, 1995-1997

	Manufacturing N=1142 (%)	Services N=967 (%)	Software N=104 (%)
Innovation project seriously delayed	37,8	35,0	54,4
Innovation project interrupted	16,8	11,7	13,9
Innovation project inhibited from starting up	20,9	20,3	25,2

Source: Community Innovation Survey for Norway 1997

In the period 1995 to 1997 all innovative firms of the survey experience that at least one innovation project have been seriously delayed due to various reasons, but for software firms this seems have been be a particular problem. More than every other software firm has experienced that an innovation project has been postponed for a long time, compared to only every third manufacturing firm and service firms in general. Likewise software firms seem

also to be particularly exposed to innovation projects being inhibited from starting up at all. One out of four software firms have experienced this.

In the 2001 survey innovation projects prevented from starting up are the most frequent unwanted developments experienced by innovative firms. Again this might be caused by the fact that the software sector as a result of the burst of the IT bubble has experienced a serious down-turn during this period. Investments in innovation activities are often amongst the first to suffer when firms experience financial constraints.

Table 5.14: Unwanted development of innovation activities of innovating firms, 1999-2001

	Manufacturing N=1435 (%)	Services N=1613 (%)	Software N=465 (%)
Innovation project seriously delayed	21,3	16,8	16,1
Innovation project interrupted	20,1	15,7	12,2
Innovation project inhibited from starting up	53,8	43,8	41,7

Source: Community Innovation Survey for Norway 2001

In the 2001 survey the firms are asked to consider the importance of various types of barriers to innovation. The table below summarizes how firms rate different factors possibly inhibiting innovation activities in the firms. Innovation activities are usually perceived risky undertakings for instance because the outcomes of innovation efforts by nature are unknown. The firms never know in advance whether the innovation projects will be successful and resulting in better products, processes, services, delivery methods, sales or marketing methods, organisational change or whatever the purpose of the innovation activity of the firms are.

Amongst all participating firms high economic risk seems to be the most important factor inhibiting firms to undertake innovation activities, and this is particularly the case regarding software firms. More than half of the software firms rate the high economic risk of innovation projects as either of medium or high importance. Tightly connected to the perceived economic risk of firms is the fact that innovation is a costly activity to many firms. All the firms hold that too high costs of innovation are in fact inhibiting them from starting up such innovation projects. Again software firms seem to be more hampered by this than manufacturing firms and service firms in general. Almost 50 percent of the firms in the software sector report high innovation cost to be an important factor inhibiting innovation in the sector, as to only about 25 percent in the service sector in general. A third barrier to many firms seems to be the lack of appropriate financing possibilities for innovation projects. Again software firms rate this factor high, higher than both manufacturing firms and particularly service firms in general. Limited financing possibilities are important to 47 percent of the software firms as to only about 25 percent of service firms in general.

There is also a middle category of factors inhibiting innovation in software firms in particularly. The lack of interest for renewals and innovation amongst customers, the lack of qualified personnel as well as lack of market information are more common inhibiting factors for software firms than amongst manufacturing and services firms in general. These innovation barriers are important to in between 20 and 30 percent of the software firms in 2001.

Amongst firms in all sectors the factors not held to inhibit innovation to a large extent seem to be too strict standards and regulations as well as the lack of technological information.

Related to the software firms there are in general very few standards or regulations directed towards the sector in Norway.

Table 5.15: Factors inhibiting innovation activities, medium to high degree of importance (share of N=those who have answered the question), 1999-2001, all firms

	Manufacturing firms N=3202 (%)	Service firms N=4170 (%)	Software N=399 (%)
Too great economic risk	33,9	27,5	53,5
Too high innovation costs	33,4	24,1	48,0
Lack of appropriate financing possibilities	24,5	16,8	47,0
Organisational conditions	15,0	21,9	21,6
Lack of qualified personnel	18,0	15,8	26,1
Lack of technological information	9,5	7,7	10,8
Lack of market information	12,4	12,5	21,1
Too strict standards and regulations	17,1	9,0	10,4
Lack of interest for new products and processes amongst customers	20,1	19,9	28,9

Source: Community Innovation Survey for Norway 2001

5.1.7. Summary

Software firms are very innovative, both in relation to general innovative behaviour and more radical innovations, introducing not only innovations new to the firm, but innovations totally new on the market.

Most firms in the software sector keep the main responsibility of developing new products, processes, services, delivery methods, sales or marketing methods, organisational change or other forms of innovation inside the boundary of the firms. The most important innovation activity undertaken by software firms is therefore naturally enough internal research and development activities.

Other innovation activities important to software firms are on the internal side competence building, in the form of training activities of employees related to development and innovation activities, and on the external side acquisition of machinery and equipment from various types of suppliers. Software firms also report a marked growth in the acquisition of research and development services from external suppliers. Suppliers of machinery and equipment with appurtenant knowledge intensive service activities as well as suppliers of knowledge intensive R&D service activities are therefore important to software firm in relation to their innovative undertakings.

As sources of information or ideas to innovation the entire sample of software firms in the survey emphasise that important sources to innovation are found in-house. Secondly nearly all firms evaluate customers to be important as information resource to innovation in the firms of the software industry. Thirdly firms within the same industrial group are important information sources to innovation for software firms belonging to such a group. And lastly, data based information networks as for instance the information found on the internet play a particular role as sources of ideas for innovations to software firms.

Although software firms tend to keep the responsibility for innovation inside the boundaries of the firm, software firms are engaging in collaboration activities with external actors. Regarding collaborative involvement in general the development since 1999 seems to show a decreasing trend in innovation collaboration of software firms. However, when software firms collaborate they again emphasise the importance of customer as collaboration partners. Second most important collaboration partner group in the period 1999-2001 to software firm

are suppliers of equipment, material, components or data programs. This group of suppliers has grown in importance as innovation collaboration partner on behalf of the group of suppliers of consultancy services. In the period 1997-1999 consultancy firms were regarded important collaborators for innovation to more software firms than suppliers of equipment etc.

The factors rated to be the most important barriers to innovation to software firms in 2001 were the facts that innovation activities are risky economic undertakings; that innovation costs are too high; and that software firms perceive to have limited opportunities to finance innovation activities.

5.2. Innovation processes of survey firms

From the Community Innovation survey we learned that software firms are very innovative, both in relation to general innovative behaviour and in relation to radical innovation. The software sector is a very self-sufficient sector related to innovation; the most important innovation activity undertaken by software firms is internal research and development activities and the most important sources to innovation are found inside the boundary of software firms themselves. When software firms do collaborate with others on innovation projects customers are held to be the most important collaborating partners, followed by suppliers of equipment, material, components or data programs.

5.2.1. Innovation

The firms interviewed in the KISA survey all report to have developed new products and services in 2002[16]. The innovation costs as a proportion of total turnover vary quite a lot between the firms. There does not seem to be any particular relationships between the size of the firms or the age of the firms and the percentage spent on innovation activities of total turnover. The only exception from this is that the firms of the sample spending least resources on innovation activities (less than 10 percent of total turnover) are rather large firms.

The majority of the firms allocate between 10 and 20 percent of their total turnover to renewal or innovation activities. In the category of firms spending between 10 and 20 percent of its turnover on the development of new products and services the whole range of firm sizes are represented. The firm spending by fare the highest percentage of their total turnover on developing new products and services (50 to 60 percent) is a small firm of less than 20 employees. This firm is also the youngest firm of the sample, established in 1998. The firm seems to follow a common development path of software firms, with high initial investments in developing the first version of the software product. The particular firm of the survey, however, views these development activities as a continual process and states that all resources outside fixed costs are dedicated new product development.

In addition to the innovation activity, viewed as "non-invoice"[17] time one firm states that much of its innovation activities take place in customer projects. This means that the innovation activities of the software firm are partly financed by customer firms. This might

[16] The sample regarding innovation characteristics are 9 firms only, otherwise 16. The findings related to innovation characteristics of the firms of the in-depth survey should therefore be treated with particular care. However, the findings of this section of the survey will be compared with the results of the CIS survey, which will function as an aggregate guide to the findings of this limited section of the in-depth survey.
[17] Norsk: "Ikke-fakturerbar tid"

indicate that customers possibly are of great importance as a source of finance and a practical arena for developing innovations of the software firms.

5.2.2. Radical innovations

The firms of the survey were asked to describe their most important innovation developed during the last three years and to evaluate how radical this innovation is. The great majority, two thirds, of the software firms of the KISA survey assess their innovations to be rather or very radical. According to the firms many of the software products are new in the world and have revolutionised its markets. Others are new to the Norwegian market or are rather radical regarding technical solutions, graphical interface and scaling possibilities. One third of the firms on the other hand evaluate their products more as important improvements of already existing products in the market or new to the firm in question based on an improvement of an existing product of the firm.

The very high level of introducing radical innovations amongst the firms in the sample corresponds well with the findings of the CIS survey presented in a previous chapter. In both periods included in the CIS surveys software firms show a very high propensity, in between 55 and 60 percent of the firms, to have introduced original or radical innovations.

When asked what distinguishes these innovations from other products and services in their markets many of the firms emphasise a better functionality of the products compared to existing products. Some firms emphasise other distinguishing aspects e.g. that they have a better understanding of their markets of operation and are therefore offering more innovative products to their customers. Other firms feel that they have a better underlying methodology related to the specific area that the software in question addresses. Additionally some firms hold that they distinguish themselves from others by developing new user areas for the software in question.

5.2.3. Financing innovation

Innovation is an expensive and time consuming undertaking. Possible sources for innovation financing are equity financing, business angels like family and friends, venture capital, public support of various kinds, customers, regular bank loans etc. Amongst the firms of the survey almost all firms finance their most important innovation during the last three years by internally generated funds. Most of the firms additionally had other financing sources like public support and customers. One of the firms financed its most important innovation activity the last three years by venture capital.

The various forms of public support mentioned by the firms for the funding of innovation and renewal activity range from the general tax incentive measure called FUNN (now replaced by Skattefunn), the New Technology program for firms in the region of Northern Norway (NT-programmet), the Public research and development contracts program (OFU – Offentlige forsknings- og utviklingskontrakter) as well as indirect funding from a ministry through another partner in the project.

5.2.4. Innovation cooperation and strategic alliances

At an aggregate level the findings from the CIS surveys in a previous chapter show that the most important cooperating partners to software firms in innovation are customers. Secondly

software firms tend to collaborate with suppliers of equipment, material, components and data programs followed by suppliers of consultancy services. Both suppliers of equipment, material, components and data programs and suppliers of consultancy services may provide software firms with knowledge intensive service activities. The tendency of consultancy services is, however, declining, and in 2001 this type of KISA supplier is important innovation collaboration partner to only about one out of five software firms. Other KISA suppliers like universities and colleges, public or private research institutes, commercial laboratories and R&D enterprises are of limited importance to software firms according to the CIS surveys.

All but one of the software firms[18] have been engaged in innovation collaboration in the course of the last three years. The firms were asked to mention the three most important cooperation partners related to the most important innovation of the firm in this period. A whole variety of organisations seems to act as important innovation collaboration partners to Norwegian software firms.

Of all the firms that report to have collaborated with external partners in relation to innovation each and all have collaborated with some kind of KISA supplier. Generally the institutional setting of KISA suppliers may be both in the private and public sector, or in a goods producing or service providing organisation. In the case of this survey, however, the firms mention innovation collaborating partners in terms of KISA providers in the service category only. The knowledge intensive service activities suppliers exemplified by the software firms range from other software or system development companies, individual consultants or consultancy firms, research and development institutes, universities and colleges as well as public regulatory authorities and directorates.

Evaluating the status or type of collaborating relationships of the firms interviewed the large majority of the firms regard their collaboration relationships to its innovation partners as formal. Thus, one firm states to have businesslike but informal collaboration relations to all of its most important innovation partners during the last three years. Yet another firm states that its most important innovation partners have been connected to the firm informally only. This firm is, however, engaged in a continual formal cooperation relation, a strategic alliance[19], with another software firm. The purpose of this long-term alliance is to further develop an already launched software product of the firm, in other words a collaboration agreement regarding incremental innovation. Another firm is part of joint ventures[20] with other actors. Many of the firms state that the purpose of the innovation cooperation is usually to gain technological competences and knowledge.

[18] There was a sample of 9 firms on this question.

[19] A strategic alliance is an agreement between two or more individuals or entities stating that the involved parties will act in a certain way in order to achieve a common goal. Strategic alliances usually make sense when the parties involved have complementary strengths. Strategic alliances are partnerships in which the entities combine efforts in a business effort involving anything from getting a better price for goods by buying in bulk together to seeking business together with each of the entities providing part of the product or undertake innovation activities. The basic idea behind alliances is to minimize risk while maximizing leverage.

[20] A joint venture consists of two or more businesses joining together under a contractual agreement to conduct a specific business enterprise with both parties sharing profits and losses. The venture is for one specific project only, rather than for a continuing business relationship as in a strategic alliance.

5.2.5. Knowledge through informal networks

In the CIS survey[21] about 85 percent of the software firms report that data based information networks as for instance the internet is an important source of information or ideas to innovation. This finding is in accordance to the in-depth survey undertaken. Of the firms interviewed most of the firms hold that informal networks such as news groups on the internet are an important source of new knowledge and information to the software firms. The software firms participate in a system of high degree of knowledge sharing. The firms telephone, e-mail, ask peers questions, put things out on the shared webs, collect news and get information about conferences. There is a great deal of cooperation between firms using the same type of knowledge generating system. Such informal networks are particularly important regarding technical knowledge and expert professional knowledge, focusing on e.g. legislation and specific regulations in different sectors. News group and such technical environments are of great importance for the development competence of the firms.

Many of the firms also organise news groups for their own customers. The user groups of the companies are very important in providing significant knowledge about the products and market of the products of the software companies.

5.3. Innovation challenges

Many firms experience that innovation is not a straight forward and easy process. There are many reasons for failed innovations or not innovating at all. Factors inhibiting innovation activities to be undertaken in firms may be that the economic risks of innovation are perceived to be too great. The economic risks are caused by the costly nature of innovation activities and the fact that the outcome of such processes is very uncertain. Firms may also experience that it is difficult to obtain appropriate financing for innovation because of the risks involved. Private commercial banks are often dubitative to fund explorative and innovative activities of firms due to the lack of securities of the loans needed. This is one of the rationales for public funding of innovation activities.

Innovation also requires appropriate and qualified personnel to undertake innovative activities, both at the management level and at the practical level. Shortage of qualified personnel is an important hindrance to innovation. The lack of information of various kinds may also be a hinder for firms to innovate. This can be the shortage of technical as well as commercial and market related information. Additionally some firms may experience a lack of interest for new products and services amongst its customers. In some industries too strict standards and regulations are a larger barrier to innovation than in others. The impediments mentioned above are some of the many possibilities of unsuccessful or absent innovation of firms in general.

5.3.1. Barriers to innovation

Of the software firms interviewed there are four barriers that seem to be of particular importance in relation to innovation; time, money, human resources and market related issues.

[21] Community Innovation Survey 1997.

Some firms hold that the lack of time is the most important obstacle of innovation in their firms. The pressure from everyday work is too great! One firm tells that in a very intensive period of the year it is occupied by updating its products (the firm offers standardised software) and the rest of the year is thus used to catch up for that. The firm does not recognise product updating as innovation activity in itself, but rather a reason for *not* innovating. Yet another firm mentions time constraints as the most important factor inhibiting innovation. The enormous pressure for invoicing, due to the negative market situation during the last couple of years, forces the firm to neglect innovation activities. A third firm agrees that that it is very difficult to combine production and innovation. The development projects undertaken in the firms must be shielded from regular production work, allowing them sufficient room and time, in other words good framework conditions. To be most efficient development personnel should also work with innovation tasks only, the firm explains. The time factor being the most important inhibiting factor for innovation amongst the software firms interviewed in the KISA survey is not even mentioned as an alternative in the CIS survey of 2001.

The second most important factor emphasised by the firms of the KISA survey is the lack of innovation financing. Some of the firms hold that scarcity of money or low willingness to invest in innovation from external investors is one of the most important hindrances to innovation. One firm holds that the lack of investment will in the software sector at the moment is due to the general negative developments in the sector. However, the firm still believes that if the ideas are good enough it *is* possible to overcome the financing barriers in the software sector.

The importance of limited financing possibilities as a barrier to innovation in the software sector finds support in the CIS survey. Lack of financing is perceived an inhibiting factor of innovation to a large part of the firms in the Norwegian software sector. One finding worth re-emphasising is that most of the firms in the KISA survey state to have financed the most important innovation of the last three years through a combination of internally generated funds and other external financing sources like public support and customers. During the last two years there the general economic development has been rather negative for many firms in the software sector. The difficult economic situation of software firms prevailing might be one possible explanation for the software firms of the survey being rather dependent on external sources of financing of innovation. It might also indicate that public innovation funding has an important role to play for software firms to overcome innovation financing barriers in periods of economic downturns in a particular sector.

In the CIS survey the lack of qualified personnel is held to be of importance to one out of four software firms. Amongst the software firms interviewed the third impeding factor to innovation is in fact related to the lack of human resources required for development work and innovation activity. Some of the firms hold that a shortage of competence and creativity internally is the most important barrier to innovation in the firms. Two of the firms first stating that there are no barriers or restrictions at all to innovation in their firms later hold that if they should point out something, it would be the lack of internal competence. One of these firms states that internal resource management is a particular challenge and that it is very important for an organisation to take care of its competences.
The scarcity of qualified personnel, the supply of “the right people”, seems previously to have been a major problem in the software sector. Some of the firms, however, still feel this to be the largest problem and impeding factor to innovation in their firms. One firm performing research and development activities both in the United States (some R&D activity) and in Norway (most of the R&D activity) holds that the shortage of technical specialist competence

(development competence) is most problematic in Norway. Additionally the firm points out that it is particularly difficult to find people with good sales and marketing competence related to sales of standardised software products at international markets in Norway and Europe. In the United States this is not a problem, but they fit the American market only, the representative of the firm explains.

The last main barrier and major challenge to innovation in the software sector pointed out particularly by the firms of the survey is market related hindrances. Many of the firms hold that the Norwegian markets in many ways are "too small" both related to producer and user markets. In some software segments the firms emphasise that "too small" means that there are too many actors in that particular niche market. The user market is thus felt to be too narrow and the consequence of this is that there are limitations to innovations in this area[22]. However, there are of course still possibilities for renewal activities, one firm hold. The firm states that the software firms are "thinking too small", that is they adjust themselves towards small segments and the national market only and therefore have too small customer groups to experience good returns on investments made. One of the main challenges for innovation in software firms in Norway, this firm reports, is to help such software firms to bring their products onto larger markets. Another firm likewise emphasises that one of the real challenges to innovation in the software sector is to support firms in their commercialisation of good niche products, particularly when introducing the products into international markets. Many Norwegian niche software products will have a unique position for internationalisation, the firm reports.

Oppositely "Too small" might also be related to the producer markets of software products. One firm holds that the software environments in Norway are in themselves too small, and that this is what impedes innovation, not the perceived limited user markets.

Another market related issue brought up as an important innovation challenge is that producers with a generic grip of the market, like for instance Microsoft, may steal functionality from smaller actors. Despite this challenge the firm believes that there will always be room for smaller niche producers in the software sector.

5.3.2. Summary

The KISA survey shows that there is a very high degree of radical innovation amongst software firms. Two thirds of the firms of the survey have introduced innovations considered of radical nature to their markets. The firms perceive the radical innovations introduced to be distinguished by better functionality than the products of competitors in the markets. The software firms of the survey finance their most important innovation within the last three years by internally generated funds, equity funding, combined with external financing like public or customer funding.

[22] Related to limited user markets in Norway one factor that may be of importance is whether software firms have a set of few, but particularly demanding customers in the Norwegian market. Demanding customers may give important impulses to innovation in software firms. The market may be small, but at the same time demanding. This aspect was, however, unfortunately not brought up in the interviews with the software firms. But the fact that many firms state that the user market in Norway is limited, important and demanding customers seem not to be able to compensate for the perceived limited size of the Norwegian software market, and therefore to be one of the barriers to innovation of Norwegian software firms.

When it comes to particular innovation challenges or innovation barriers to software firms, the most important obstructing factor of firms of the survey is the lack of time to conduct innovation activities at all. Secondly software firms in the period have felt the inhibiting aspect of limited sources of innovation financing. In addition to time constraints and lack of financing software firms hold that the lack of human resources required for development work is one of the factors inhibiting them to undertake innovation activities. Lastly, market related factors, like for instance too limited Norwegian user markets, as well as a limited number of national software producers, are perceived barriers to innovation amongst the software firms interviewed.

6. The role of KISA in innovation within the software industry

6.1. Software firms' use of KISA

Knowledge intensive service activities as a category of activities is not easily captured within the data collection frameworks of economic statistics. These services may include the acquisition of service activities from external sources, but it may also include various forms of non-traded internal supply of service activities within an organisation, not at all covered by the statistics.

The reasons to provide a particular knowledge intensive service activity internally or purchase the service activity from an external provider vary from firm to firm. Transaction cost theory (Williamson, 1975, 1991) is often used to explain the propensity of firms to externalise or internalise various business functions. The dilemma of choosing internal or external provision of knowledge intensive services activities will be treated more in-depth later in this chapter.

Service activities which mainly are comprised by knowledge and competences are as emphasised before characterised by its tacit nature and uncertainty of outcome. The market for knowledge services is characterised by a high degree of information asymmetry between the providers and the customers. The provider of a knowledge service has by nature more information about the particular area in question than the potential customer. To be able to sell its knowledge product the provider cannot reveal the content of the knowledge product in advance. The incentives of retaining information to its potential customer are high. For the potential service customer it is therefore in advance not possible to evaluate the quality of the service product offered by external providers of knowledge intensive services. This uncertainty is one dimension in transaction cost theory. The uncertainty of external provision of knowledge intensive services may cause the firm rather to provide these services in-house. Transaction cost theory often also considers how often the firm is in need of the function and the degree to which the firm has invested in assets that are very specifically related to the function in question.

In the section below we will investigate how Norwegian software firms use both internal and external knowledge intensive service activities. The questions to be answered are whether software firms integrate KISA from different sources and if so, how the integration takes place. Secondly we will seek to answer what roles KISA may play in relation to innovation in the software industry, and whether firms build innovation capability through the use of KISA. And the third question to be answered is how KISA may impact on innovation in software firms.

Some activities or functions are expected to be of core importance to the firms and therefore provided in-house. Other activities perhaps perceived less critical to core business of the software firms might be subjected to strategic decision-making by the firms as whether to be undertaken in-house or be purchased through external KISA providers, with the possible uncertainty connected to this transaction of services.

Of all the knowledge intensive services activities perceived important to firms in the software industry the general trend is fairly unambiguous: the activities of medium and high importance to the firms are to a large degree provided by internal KISA suppliers. Core competences in software firms include among other things technological, development and

programming competences (cf. chapter 4.1), which correspond to the knowledge intensive service activities considered important to the software firms. While performing these core activities solely in-house resources are used and the firms are entirely dependent on internal employees having the right competences.

We will now discuss different KISA, and the reasons for using external providers or internal sources of these. The activities are presented in roughly decreasing importance, i.e. the most important KISA are discussed first. These include such activities as research and development services, project management, strategy or business plan development services, organisational development or team building services, all services mostly provided internally in software firms and marketing and/or sales services, training services and recruitment services mostly provided in interaction with external KISA suppliers as well as accountancy and legal services mostly provided solely by external KISA suppliers.

6.1.1. Research and development services

Most of the firms interviewed undertake research and development services internally; however some firms hold that these are development services only, and not basic research. The internal R&D activities are mostly connected to what is perceived as core business of the firms. Some firms hold that testing is an important part of the development activities, while others consider testing more routine and has outsourced this task to external suppliers of testing services.

Of other external partners, research institutes are found important as providers of R&D services to some of the firms only. The research institute SINTEF (SINTEF Tele and Data) as well as the quality assurance firm Det norske Veritas are mentioned important to some of the firms interviewed. Universities and colleges are not reported to be of importance as R&D service suppliers to any of the firms interviewed. Some firms acquire product testing services from large firms such as Microsoft and IBM and some firms buy research services from other unspecified software companies. One firm emphasise that small components producing software firms are important for this large firm producing standardised software products. The importance of these small supplier firms is that the components developed there have a potential of being combined with the solutions of the large software firms. One of the firms interviewed acquire development services from an external testing firm. The firm has managed to isolate parts of the quality assurance work of product development and has outsourced what this firm perceive R&D activity to an Indian company. The firm, however, characterise the quality assurance as fairly routine work[23] and therefore this R&D task is easily transferred to the Indian company. Generally the firm holds that overseas outsourcing is common in the software business, particularly to India, offering highly educated personnel and low wages.

6.1.2. Project management

Like organisational development services the great majority of the firms tend to internalise most of the knowledge intensive service activity of project management. Some firms choose a mix of internal and external provision. The use of both internal and external project management service activities is favourable to the firms because of the flexibility in resource

[23] One point to be made in relation to this is that if the outsourced development activities are considered routine activities, then it should perhaps not be termed and treated as R&D, but rather regular production work.

planning, e.g. they use external project management consultants occasionally due to capacity constraints within the firm. Additionally the firms may use external resources on some occasions because of the local connections of a particular project manager. If the firm has a project in a city where the firm does not have a local unit, the firm will engage an external project manager. Another firm emphasise that external project managers may be involved in particular development project because the firm needs a "neutral" party to evaluate the idea. The development idea might need an evaluation from someone external, to get a more objective mandate for further development of the idea, the firm explains.

Of the firms interviewed there are a few software firms choosing a pure externalisation strategy regarding project management service activities. One of the larger firms, with more than 200 employees, as well as the smallest firm, with less than 15 employees have chosen to externalise all the project management activities of the firms to consultants not employed by the firms. The larger firm use a network of "friends" of the company, independent consultants brought in to manage particular projects. The small firm cooperates with a consultancy firm closely connected to the firm through joint ownership.

6.1.3. Strategy / business plan development services

While focusing on the software firms' core activities the most important additional tasks is to develop a firm strategy. Strategy processes and business plan development is by all firms interviewed taken care of by internal resources. One of the firms belonging to an industrial group uses strategy or business development services worked out by other parts of the industrial group. Some other firms, however, bring in external strategy consultants in addition to internal resources to develop strategies and business plans for the software firms.

6.1.4. Organisational development / team building services

The majority of the software companies interviewed use internal resources for the development of the organisation of the firm. Most firms have dedicated persons or departments responsible for organisational development services. However, many of the firms also bring in external service providers for the development of their organisation. Many firms mention as external services management development including coaching services for the top management, as well as mentoring services for middle management. Other important organisational development services purchased from external providers are general teambuilding and organisational development consultancy services.

6.1.5. Marketing and/or sales services

Regarding marketing and sales services the picture is somewhat mixed. Some of the firms mostly use marketing services developed internally to the firm when promoting their software products on the market, however complemented with marketing services from external providers. Other firms externalise most of their marketing services, but still have internal marketing resources to plan and manage the marketing services supplied by external providers.
Amongst the software firms interviewed the most common external marketing providers would be advertising or public relations agencies or sales consultants. These external KISA providers assist the software firms in relation to tasks such as telemarketing, customer satisfaction analyses, market analyses as well as general advertising and marketing consultancy services. One firm states that the use of external marketing services is dependent

on the general economic conditions in the market. A general economic recession, such as the present makes the firm externalise marketing services and vice versa.

6.1.6. Training services

In the software firms interviewed the development of knowledge and skills of the employees seems to be obtained through a mix of services provided internally to the firms as well as training services acquired through external expert services.

Training activities are important knowledge intensive service activities of the software firms. As highlighted in a previous section training activities are of vital importance for the firms to develop and maintain core competences of the firms, to remain competitive, dynamic and innovative. The common core competences of the software firms interviewed are i) technical competences, ii) market-related competences and iii) competences of the field(s) of particular specialisation.

The internal development, up keep of core competences and training activities in software firms is managed mainly though regular project work in the day-to-day operations of the firms. Some of the firms emphasise the importance of mixing internal employees with various length of work experience and professional expertise to secure on-the-job training of less experienced employees. Quite a few of the software firms additionally have specific competence development plans for the individual employees to be followed up by training activities of various kinds. The internal training may take the form of internal courses, seminars and professional forums, or self study training activities through e-learning courses developed either specifically for the firm or more general knowledge developed by external e-course suppliers but available in the intranet (e-learning portal) of the firm.
The firms interviewed also acquire training service activities from external sources. Employees of the firms participate in external courses of various kinds. Many of the firms emphasise the importance of external technical training activities. Some firms mention training in the use of new tools for software development in the firms, others mention training in more standardised software, the latest versions etc. For some firms this might not include training persons of the external software firm, but training in the form of self-tuition studies. Some of the firms engage in particular partnerships with e.g. Microsoft related to training and information services.

Quite a few of the firms include management development in the training services category acquired externally. Other firms emphasize sales training and the use of external sales competence as the most important training services acquired from external actors. Firms valuating their core competences to be in a field of particular specialisation tend to focus their acquisition of external training activities in these professional areas.

6.1.7. Recruitment services

Employing the right employees is important to any firm. The fast development of the software sector during the 1990s, creating a temporary shortage of potential personnel with relevant competences, made recruitment processes particularly important. The majority of the software firms deal with recruitment (and workforce reductions) issues in a combination of internal resources with external acquisition of services from recruitment or head hunting agencies.

Most of the firms have used recruitment services provided by external firms with a varying degree of success. The motivation for engaging external recruitment consultants may also vary. Related to the purchase of external recruitment services one firm emphasise that such external service activities have successfully been used as a quality assurance for hiring a person. Another firm is particularly satisfied with the use of external recruitment services in relation to the appointment of top leaders in the firm. Yet another firm mentions that the use of external recruitment services was more important in the phase of great expansion in the sector, until year 2001, a period with more limited access to skilled personnel. Now that the recession has hit the sector greatly, recruiting competent personnel is no longer particularly difficult and software firms may to a larger degree manage this activity themselves, the firm holds.

6.1.8. Accountancy / economic services

The majority of the software firms interviewed either buy accountancy services on the market from specialised accountancy firms or have a combination of internal and external service provision. One third of the firms, however, use internal expertise and resources related to accountancy or economic services, particularly and naturally those firms that are specialised in accountancy and finance management software. Some of the firms that at the moment take care of accountancy and economic services internally state that these services used to be externalised. One firm holds that the reason for internal service production is that the firm wants full control over *all* its activities. Otherwise accounting and financial services seems to be a KISA service not considered part of the core activities of the firms interviewed and therefore an activity easily transferred to external service providers. Although many firms choose an externalisation strategy on accountancy and economic services they nevertheless often have internal competence resources in relation to accountancy and financial management. Most of the firms internalising accountancy and economic services are rather large firms.

6.1.9. Legal services

Of the software firms interviewed the majority of the firms use external services related to legal questions and particularly in connection to patent entitlement. Some firms, however, use internal services to deal with legal questions related to patenting, or a combination of external and internal services. One of the firms with a particular oil unit, use internal legal resources in relation to patenting questions in this industry since patenting questions are of particular importance in the oil industry.

Many of the firms belonging to an industrial group use legal services external to the firm in question, but internal to the industrial group it belongs to. Legal KISA services are then often used only in relation to disagreements or disputes with customers. The rest of the firms rely on external provision of all legal services including services connected to patent entitlements. The providers of legal services most used by software firms are law offices. Legal firms may contribute when the software firms enter into a contract and in relation to risk assessments. Patenting issues in general does not seem to be of much importance to the software firms. As a general picture the use of legal services seems to be of minor importance to the majority of the software firms interviewed.

6.1.10. Summary

The use of knowledge intensive service activities amongst the software firms interviewed may be summarised in the table below. We have considered whether the service activities generally have been said to be provided by actors internally or externally to the firm. We have considered how the software firms interviewed perceive the importance of the various knowledge intensive service activities, and whether the services activity areas are considered part of the core competence or activities of the firms in question. Then we have focused on identifying in what service activity areas software firms mainly are self-sufficient and then focused particularly on the service activity areas where the mix and match of knowledge intensive service activities are reported to be considerable by the software firms interviewed.

The KISA areas where software firms consider the activity very important and thereby mostly providing internal KISA are in relation to activities such as research and development, project management and the development of strategy and business plans. Likewise the software firms hold that some activities of medium importance are also provided mainly internally in the firms. These are the activities related to the development or introduction of new information technology systems for internal use as well as organisational development and team building services. In all these knowledge intensive service activities the software firms solely depend on internal resources to get the activities done.

On the other hand some service activities are reported to be mostly handled by external KISA providers, such as legal services and accountancy or economic services. Both these knowledge intensive service areas are considered rather unimportant to the core business of the software firms.

Table 6.1: Provision and importance of various forms of KISA

KISA activity	Internal and/or external provision	Importance of activity for the firms
Research and development services	Mainly internal	High importance, core competence
Development services or introduction of new information technology systems for internal use	Mainly internal	Medium importance
Marketing and/or sales services	Mix	Medium importance, core competence
Legal services (e.g. in connection to patent entitlements)	External	Low importance
Accountancy / economic services	Mainly external	Low importance
Organisational development / team building services	Mainly internal	Medium importance
Project management	Mainly internal	High importance
Training services	Mix	High importance, core competence
Recruitment services	Mix	Medium importance
Strategy / business plan development services	Mainly internal	High importance, core competence

Source: In-depth interviews with Norwegian software firms (2003)

Finally there are the service activity areas where the software firms report considerable interaction and cooperation with external providers of knowledge intensive service activities. These are most often considered to be of medium importance to the software firms. Related to the activities where software firms interact and collaborate with external providers of KISA a mix and match of knowledge and competences of the professionals both internally and externally is expected to be high. This mix and match of competences and knowledge services is particularly evident in the areas of marketing and sales services, training services as well as recruitment services.

All in all it seems as though software firms do not integrate KISA in those areas of greatest importance to them regarding what they perceive as core activities of the firms. However, software firms do integrate KISA from various sources in those areas considered of medium or low importance to the firms. The differences in how the integration takes place between the areas of medium and low importance, which will be discussed in more detail below.

As a general observation all the software firms interviewed select new KISA providers on the basis of references made by contacts and acquaintances to the firm, a quality assurance method used by most companies acquiring knowledge intensive services.

6.2. Internal or external supply of KISA

6.2.1. Strategy for internalisation or externalisation

Although the above findings show that particularly core activities such as research and development, project management and strategic planning and business plan development are undertaken internally generally most of the firms interviewed seems not to have an outspoken strategy regarding internalisation or externalisation of knowledge intensive service activities. As shown above the firms, however, do explicitly and consciously navigate between the two strategies related to various service activities. The firms are in a constant cost-benefit evaluation situation and the provision of these service activities either internally or externally vary between the firms.

The majority of the software firms emphasise that core activities of the firms naturally take place internally in the firms. Services that are of less importance to core business of the firms are more easily externalised to service suppliers outside the boundaries of the firms, either provided solely by external providers, or in a mix and match of internal and external providers. Some software firms hold that they are the best to know how to do their business making it difficult to involve externals in the core activities of the firms. Other firms hold that they hopefully realise their own weaknesses and purchase service activities from external experts if needed. An interesting question is thus motives for the strategies chosen by the software firms interviewed.

There are several motives depicted for choosing a predominantly *internalisation strategy* amongst the firms. One firm holds that instinctively it feels that it should do most activities internally, partly because this is how it is done in the ”role model” companies of the firm and partly because the firm has some bad experiences with externalising knowledge intensive activities. Additionally the firm generally feels that it does not get the quality demanded when externalising knowledge intensive service activities. Due to rather specialised products the firm emphasises that very few knowledge intensive service activities connected to its products can be provided satisfactory by external suppliers. The providers of such KISA services must work inside the firm to execute the tasks in a satisfactory manner.

Another medium-sized firm holds that financial restrictions necessitate internal production of most of the knowledge intensive service activities of the firm and therefore the firm for instance stimulates its employees to take responsibility for their own training activities. However, there are some KISA that require external assistance, e. g. in relation to legal services, because of lacking these competences internally. Regarding salaries and accountancy services the firm, belonging to an industrial group, has chosen to follow the externalisation policy of the group as a whole, but according to this firm this strategy is not

successful thus fare. The reason for externalisation was initially to cut costs, but this prerequisite has not yet been fulfilled.

Being a small entrepreneurial firm with limited resources is the reason for the internalisation strategy of another firm. The firm does most kinds of knowledge intensive activities internally, not only because of the financial situation of the firm, but because strong personalities within the firm believe that the firm actually has the competence required internally.

Motives for internalisation of KISA activities emphasised by the software firms are

- To keep core activities in-house
- Control with the outcome of service provision
- Internal resources perceived better than external
- Limited financial resources to acquire external KISA

Likewise there are various reasons for choosing an *externalisation strategy* regarding the provision of KISAs to firms, and the reasons for internalising service activities in one company may be used for externalising service activities in another. This is particularly the case regarding the size of the firm and the situation of limited resources. As one firm above argued for internalisation of services due to its small company size another small company argues for externalisation because the firm cannot afford to occupy all KISA competence needed internally.

Another firm holds that even though it has a strong wish to handle most activities internally it has experienced a trend towards involving increasingly more service partners. The increased number of service partners is for one thing due to an increased focus on the software product itself, the most essential and core activity of the firm. Additionally the firm wants to spread risk. By purchasing services from external KISA providers the firm is more flexible regarding changes in the market situation, avoiding the redundancy of manpower in weak periods. A third factor for increased externalisation of knowledge services is for marketing reasons. The firm consciously utilize the external service providers as a way of diffusing knowledge about the products of the firm to potential customers, knowing that such KISA providers function as nodes of knowledge distribution in the market.

There are also disadvantages related to an externalisation strategy of knowledge intensive service activities. One of the disadvantages is the possible vulnerability of giving up control of an important service activity, a critical core activity or more peripheral or operational, but perceived important activities. One of the larger firms interviewed emphasises that through the use of external KISA providers it purchases important experience and expertise[24], and that at times this externalisation strategy make them feel quite helpless. Obtaining expertise from outside the firm due to a "crisis" of lacking competence or knowledge internally has been a fairly costly affair to this firm at times. The quality of the knowledge intensive service activity acquired from the external provider did not harmonize with the expectations and actual needs of the firm.

The feeling of increased vulnerability due to externalisation is, however, not the main trend of the firms interviewed. Many firms emphasise that the externalisation of KISA enhances the flexibility of the firm. For one thing externalisation gives the freedom to change service

[24] "According to the Norwegian tale about Askeladden and his good helpers".

supplier whenever the firm may wish. One firm even holds that by providing all services internally and not being successful in providing these services in a satisfactory way, in fact would make the firm feel vulnerable. Another positive aspect of externalising KISA services is that resources are released internally to other tasks.

Motives for externalisation of KISA activities are

- Cost reductions
- Limited resources, both financial and human
- Increased focus on core activities, externalise the rest
- Risk dispersion
- Dispersion of knowledge about the firm
- Flexibility
- Access to important experience and expertise

Table 6.2: Advantages and disadvantages with internalisation and externalisation of KISA

Internalisation		Externalisation	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Control of core activities	High risk	Risk dispersion	Uncertainty with service outcome
	Less flexible	Flexibility	Vulnerability
	Fixed costs	Variable costs	Requires strong management
		Resources released internally to other uses	
		Freedom to choose supplier	
		Quality assurance	
		Opportunity to learn from wider knowledge base	

Source: In-depth interviews with Norwegian software firms (2003)

6.2.2. Quality of external KISA

By producing the knowledge intensive service activity internally the firm has full control over the KISAs provided and thereby also the quality of these service activities. When acquiring knowledge intensive service activities from external suppliers on the open market there is a much greater uncertainty involved regarding the quality of the service offered.

The problem of evaluating quality is fundamentally difficult in all kinds of service provision. Due to the intangibility of the service product it is not possible to judge the actual quality of the service in advance of the service provision. Another characteristic of most service production is the adaptability of the services to the customer, which makes the valuation of the service a subjective matter, not an objective consideration. The choice of service provider is thus most often based on the reputation of the service provider.

In the case of KISA provision and quality assessments the knowledge component plays an even more problematic role to the potential service customer. The content and the outcome of the service provision are often not known in advance.

As a general observation all the software firms interviewed select new KISA providers on the basis of references made by contacts and acquaintances to the firm, a quality assurance method used by most companies acquiring knowledge intensive services. Previous experience

working with a KISA provider or inside information and knowledge of the KISA markets is also used as a quality evaluating method by some firms. Many firms state that deciding what service provider to engage is an informal process and that few resources are spent on comprehensive procurement rounds etc. On the other hand some firms put much effort into the choice of KISA supplier, asking for offers, organising in-depth interviews with the personnel proposed for the job by the KISA provider as well as executing profile analyses of the various supplier firms. Requirement specifications are rather seldom worked out in advance of the calls for tender, but some of the software firms use this strategy. One firm explains that it is in a transition phase related to the selection processes of external providers of knowledge services from informal to more formal processes. Earlier the firm assessed the quality of a provider from general experience, knowledge about the knowledge supplier and checking the track record of the supplier in question. Now the quality assurance process in advance is more focused on measurable process maturity levels (an ISO standard with a scale from 1 to 5) of the suppliers of knowledge intensive services.

Using informal or more formal methods to evaluate the quality of the external KISA provider, however, the focus on the individuals actually doing the job seems to be of great importance to the software firms. Personal interviews are often made where the software firm informs the potential KISA supplier about the purpose of the task required and what the firm wants to achieve etc., hereby checking out the potential for successful collaboration. Another important experience is that hiring external KISA providers requires a strong management and involvement of the software firm to get the best possible results.

6.2.3. Ex post measurement of actual quality

Most of the software firms interviewed informally evaluate the external services performed. Many of the firms state that there are no formal procedures or universal parameters for assessing the quality of the knowledge services provided by the external supplier. Quite a few of the firms mention that the ultimate parameter of good quality of knowledge services is re-purchase of the service. The evaluation parameters may, however, vary according to the nature of the various services offered.

One firm holds that related to evaluating the quality of e.g. programming services delivered to the firm by external service providers the process is a continuous subjective assessment of speed, preciseness and smartness of the service provider. Another firm states that the quality of the service is assessed in terms of good or bad progression in the project and the evaluation of the final output. The assessment variables mentioned above might not be clear parameters for evaluation of the exact quality of the service, but give some impression of what software firms see as important quality dimensions in their demand for knowledge intensive services.

Of the more formal evaluation procedures one firm reports to perform analyses of the projects undertaken and the assessment of external services provided are part of these project analyses. The firm had e.g. been dissatisfied with some of its newly appointed personnel hired through the use of external employment services and the result of this was that the firm changed suppliers of recruitment KISAs several times. Another firm emphasises the “consultancy board” of internal employees responsible for the follow-up of external consultants as a formal way of assessing the quality of the knowledge activity performed and provided. The external consultants may be followed up by an internal “mentor” controlling the quality of the work done. This arrangement was introduced because the firm had some negative experiences with the use of external consultants in the past.

6.2.4. Collaboration with KISA providers

The aggregate analysis of the CIS survey in a previous chapter shows that software firms get ideas to innovation from various sources, and that they collaborate with many actors in the innovation processes undertaken. Customers are by fare the most important cooperation partner of software firms. However, suppliers of equipment, material, components and data programs are the second most important source of information and expertise of software firms followed by consultancy firms. Software firms may potentially get important knowledge intensive service activities through the collaboration with both suppliers of technology and by consultancy firms. The findings of the CIS survey, however, show a declining tendency of cooperation activities between software firms and consultancy firms. In 2001 only about 20 percent of the firms report such collaboration. Other potential KISA suppliers, like universities and colleges, public or private non-profit research institutes, commercial laboratories and R&D enterprises are of very low importance to software firms.

Despite the aggregate results of the innovation survey the majority of the firms interviewed have experienced an increase in the number of collaborating KISA partners the last five years and many report to have developed a closer relationship to the suppliers with whom they collaborate. This might be a natural part of the development of the software firms. Newly established firms and young firms naturally conduct almost all services in-house and may gradually consider externalising certain activities to outside suppliers. One of the firms holds that the increase in the number of partners is mostly related to a general increased activity level of the firm.

On the other side the interviews reveal a group of large software firms reporting a reduction in the number of collaborating KISA partners the last five years. Some of the firms hold that they prefer to have a few large, loyal and quality assured KISA partners compared to many suppliers as has been the case in the past. Other firms hold that the difficult market situation has forced the firms to cooperate less with KISA providers. However, the positive effect from this is that the quality of the externally provided knowledge intensive service activities according to some of the firms is improved and to a cheaper price than before the downturn in the IT market.

All the firms interviewed report to collaborate very closely with its external KISA providers, however, the nature of the close collaboration varies. In some of the firms the consultant never works alone, always in cooperation with employees of the firms. The KISA supplier is tightly involved and becomes part of the business.

6.2.5. Summary

Most of the software firms interviewed seem not to have an outspoken strategy regarding internalisation or externalisation of knowledge intensive service activities. The majority of the firms emphasise that core activities of the firms naturally take place internally in the firms. Services that are considered to be of medium or low importance to the core business of the firms are more easily externalised to service suppliers outside the boundaries of the firms. The KISA are either provided solely by external suppliers on behalf of the firms or interactively and jointly by internal and external providers in cooperation.

There are several motives depicted for choosing a predominantly internalisation strategy. The motives emphasised by the software firms are e.g. that firms want to keep core activities in-house, that the firms want to have the entire control of the outcome of service provision, that internal resource or competences are perceived better than external and that limited financial resources prevents the firms from acquiring external KISA.

Likewise there are various reasons for choosing an externalisation strategy regarding the provision of KISAs to firms, and the reasons for internalising service activities in one company may be used for externalising service activities in another. This is particularly the case regarding the size of the firm and the situation of limited resources. The motives for externalisation of KISA are amongst others cost reductions, limited resources, both financial and human, increased focus on core activities and thereby externalising the rest, risk dispersion, knowledge diffusion about the firm, flexibility as well as access to important experience and competences.

By producing the knowledge intensive service activity internally the firm has full control over the KISAs provided and thereby also the quality of these service activities. When acquiring knowledge intensive service activities from external suppliers on the open market there is a much greater uncertainty involved regarding the quality of the service offered.

The problem of evaluating quality is fundamentally difficult in all kinds of service provision. Due to the intangibility of the service product it is not possible to judge the actual quality of the service in advance of the service provision. Another characteristic of most service production is the adaptability of the services to the customer, which makes the valuation of the service a subjective matter, not an objective consideration. The choice of service provider is thus often based on the reputation of the service provider. On the other hand some firms put much effort into the choice of KISA supplier. Using informal or more formal methods to evaluate the quality of the external KISA provider, however, the focus on the individuals actually doing the job seems to be of great importance to the software firms.

Most of the software firms interviewed informally evaluate the external services performed. Many of the firms state that there are no formal procedures or clear parameters for assessing the quality of the knowledge services provided by the external supplier. Quite a few of the firms mention that the ultimate parameter of good quality of knowledge services is re-purchase of a service activity.

Of the more formal evaluation procedures one firm reports to perform analyses of the projects undertaken and the assessment of external services provided are part of these project analyses. Another firm emphasises the “consultancy board” of internal employees responsible for the follow-up of external consultants as a formal way of assessing the quality of the knowledge activity performed and provided.

Software firms may potentially get important knowledge intensive service activities through the collaboration with both suppliers of technology and by consultancy firms. Despite the aggregate results of the innovation survey the majority of the firms interviewed have experienced an increase in the number of collaborating KISA partners the last five years and many report to have developed a closer relationship to the suppliers with whom they collaborate. On the other side the interviews reveal a group of large software firms reporting a reduction in the number of collaborating KISA partners the last five years. All the firms interviewed report to collaborate very closely with its external KISA providers; however, the

nature of the close collaboration varies. In some of the firms the consultant never works alone, always in cooperation with employees of the firms. The KISA supplier is tightly involved and becomes part of the business.

6.3. Possible roles of external KISA on innovation

External KISA suppliers may play different roles regarding the influence on innovation and core competences in firms (Miles, 2002). The nature of external knowledge intensive service activities provided to customer firms may e.g. be

- informative
- diagnostic
- advisory
- facilitating
- turn-key and
- managerial

Playing an *informative role* (i) the service provided by the external KISA supplier may alert the customer firm of scientific, technological or other innovation related possibilities or trajectories. The services may be based on analysis of underpinning literature, of competitor strategies or of regulatory developments.

Regarding the *diagnostic role* (ii) of external KISA suppliers the service provided may be composed of clarification of the nature of a problem so that the customers' innovative strategies may be focused more effectively on the search for good solutions. The firms' interaction with the KISA providers in problem definition provides opportunities for mutual learning and even co-production of innovations.

The external KISA providers may also play an important *advisory role* (iii) to innovation in customer firms. By offering advisory services the KISA suppliers may reduce risks of adopting innovations by using their knowledge of alternative possibilities, prior experience, best practise etc.

Further the external KISA providers may *facilitate* (iv) innovation in customer firms. By engaging external KISA providers firms may reduce risks of implementing innovations because the need for learning by doing internally is potentially reduced. The external knowledge intensive services represent opportunities to learn from a wider knowledge base than provided in-house and may open up for experience solutions tried out elsewhere.

The same is the case in relation to *turn-key services* offered (v), where services are included as a part of a ready-made service solution.

Finally, external KISA suppliers may offer services related to *management of services* (vi) in customer firms. These services reduce the need of the customer firms for detailed knowledge of the service, freeing internal resources to concentrate on core competences (though sufficient knowledge to ensure appropriateness of service provision is still required). The management services offered by external KISA providers increase the customer firms' opportunities to benefit from scale economies, which is often the case in the software sector.

Most external suppliers of KISA may provide a bundle of such services as a package (ibid, p. 11). Many of the knowledge intensive service activities considered in this study thus have features that concur a great deal with the roles depicted above. Below we have focused particularly on KISA areas where the software firms report considerable interaction and cooperation with external providers of knowledge intensive service activities, most often considered to be of medium importance to the software firms. This mix and match of competences and diffusion and interchange of knowledge is particularly evident in the areas of marketing and sales services, training services as well as recruitment services. However, we also consider the KISA areas where software firms mainly choose an externalisation strategy, namely in relation to legal service activities and accountancy or economic services activities.

In relation to marketing and sales services these KISA areas may include more than one of the roles depicted above. For one thing the marketing and sales knowledge intensive service activities may play an *advisory* role to innovation in the software firms. By offering their advisory services these KISA suppliers may reduce the risks of adopting particular solutions by using their knowledge of alternative possibilities, prior experience and best practise. Providers of marketing and sales activities use knowledge and competence developed in close interaction with many customer firms to advise software customer firms in these service areas. The external providers may themselves often innovate in methods in searching for, synthesising and presenting relevant information (Miles, 2002) and new methods and procedures may, consciously or not, accrue to the customer firms through the advisory KISA.

Like marketing and sales services suppliers of recruitment service activities also have an *advisory* role to play regarding its customer firms. The recruitment service suppliers use their past experience in appointment of personnel to avoid hiring wrong person to the customer firms.

Marketing and sales services, thus, may also play a *facilitating* role to innovation in software firms. The external KISA providers are in this situation often engaged in order to reduce risks of implementing innovation, because the need for learning-by-doing internally is not considered to be very important. The external marketing and sales KISA providers are brought in so that the software firms have the opportunity to learn from their particular and wider base of knowledge. The solutions may be tried out in other firms, but requires particular adaptation and adjustments to the firms in question. The suppliers may, however, innovate in the service they supply (more than just incremental adjustments) as well as in the methods and processes they use to produce the innovation presented to the customer firm.

As providers of marketing and sales services providers of training services may also *facilitate* innovations in their customer firms. Engaging a provider of training services allow the customer firms not to go through learning-by-doing internally, and may access the knowledge and hopefully be able to appropriate this knowledge so that it turns into new competences internally in the software firm. The customer firm has the opportunity to learn from a wider knowledge base than provided in-house.

KISA providers may offer management of services to customer firms. When KISA providers play this role the customer firm does not have to have detailed knowledge of the particular service internally. This fits well with the knowledge intensive service activities of legal services and accountancy or economic services. The software firms do not consider these activities to be of high importance to the firm, and therefore they externalise these activities to

external suppliers. The firm does not want to acquire the knowledge about the activities to build up internal competence and therefore the external suppliers may manage the service entirely without much interaction about the content of the service with the customer firms. The motive for externalising the services is solely to get the job done. In playing the managerial role to innovation in customer firm the contribution of the external supplier is fairly limited.

Table 6.3: Possible roles of external KISA to innovation

	Informative	Diagnostic	Advisory	Facilitating	Turn-key	Managerial
Marketing and sales			X	X		
Recruitment			X			
Training				X		
Legal						X
Accounting						X

6.3.1. Knowledge transfer and learning from KISA providers

How the cooperation between the software firms and the KISA providers actually takes place, the quality and forms of collaboration, is of pivotal importance to the degree of impact the externally provided knowledge intensive service activity might have on internal activities in the software firms. Through the service activity collaboration and interchange of knowledge, and ideas between external providers and internal personnel takes place. One of the hypotheses of the project is that the KISAs provided by external actors contribute significantly to the learning processes internally in firms, and thereby to innovation processes in a wide sense. Innovation is here understood as "…new ways of doing things in the way of economic life…"[25] including all kinds of substantial renewal activity such as product, process, organisational, marketing, design as well as strategic and management innovations. By the mix and match of services and the inherent learning processes taking place external KISA providers are thought to have substantial impact on the way firms conduct renewal and innovation activities inside the firms.

Asking the firms of the survey what knowledge and learning is obtained by the use of external knowledge suppliers some of the firms hold that this varies according to the actual intentions behind the purchase of the knowledge services. In many cases the intention of engaging an external KISA supplier is solely to get a job done. The firms need a function to be filled and use external resources when internal resources are not available. In such circumstances the firms most often have no wish of appropriating internal competence in the field of question.

In other instances the firms explicitly want to acquire the knowledge and by internal learning processes turn this into competences of internal staff. The intention is often to internalise the knowledge intensive service production altogether. One firm expresses that when purchasing consultancy services the firm has as an outspoken policy that these external services are to contribute to internal competence development. The main objective of obtaining such services is that the firm shall be self-sufficient regarding the production of such services. Sales training is one area mentioned by software firms where they have an explicit intention to acquire knowledge and hopefully develop internal competence and innovation capability. They want this particular sales knowledge to be part of the culture of the firm. One firm holds that to make a particular kind of knowledge part of the culture of the firm, however, requires

[25] Quote Joseph Schumpeter

continuity, and therefore the firm wants sales service activities to be internalised in the software firm.

Only one of the firms interviewed feels that the knowledge transfer from the use of external consultants is limited. The firm holds that such knowledge transfer is difficult first of all because the external KISA providers shield their knowledge from the customer firms. Secondly the external consultants are not genuinely engaged in transferring real knowledge into the customer organisation. The service provider is primarily engaged in solving the contracted task for the customer without any further knowledge transfer and thereby the possibility of influencing innovation in any way is very limited.

Related to the possible roles that external KISA suppliers may play for learning presented in the previous section the activities playing a facilitating role seems to be the most important. We found that this is particularly so in relation to marketing and sales as well as training service activities. In these situations the external KISA suppliers facilitate learning in customer firms by displaying knowledge from a wider knowledge base than the customer firms have access to on their own. The customer firms have consciously and strategically chosen not to provide the service activities internally in the firms (or at least not having the critical mass of internal activities), to be able to build competences through learning-by-doing internally, but rather chosen to cooperate and interact with external KISA providers to learn and acquire the knowledge needed from a wider knowledge base.

When external KISA providers play a managerial role the possibility to contribute to learning in customer firms seems to be rather limited. This is the case in relation to legal and accounting or economic KISA. When firms choose to externalise the activity entirely and does not have detailed knowledge about the particular service internally the external providers have cannot expect to have much influence on internal matters in the customer firms. The motives for engaging external KISA in a managerial role is not to learn, but to execute a necessary, but not by fare not critical function or task to the firm.

6.3.2. Contribution of KISA providers to innovation in customer firms

Amongst the firms interviewed there is a mixed perception about the contribution of KISA suppliers to innovation in the software firms. As pointed out above in many instances the intention of engaging external KISA providers is not to internalise the knowledge provided by the external provider, and thereby to build or enhance innovation capability and competence inside the software firms. The intentions of software firms may perhaps more often be that they want a function to be filled and a job to be done. This should be kept in mind when considering the contribution of external KISA providers to innovation below.

Many of the firms answer positively to KISA providers' contribution to innovation processes in a wide sense. Some firms report that KISA providers contribute indirectly, and enhance that all knowledge obtained contributes to innovation in the firm. Another firm hold that KISA suppliers contribute to trigger the curiosity of individuals in the firm. Others hold that KISA providers definitively contribute in more direct ways. The high degree of specialisation in software firms makes impulses and ideas from outside the firms very important, some firms express. One firm holds that it consciously tries to "suck out" knowledge from external resources without having to pay for the knowledge. Likewise external impulses are held to be of great importance to the internal software "factory" of programmers, project managers and product developers.

Some firms feel that by performing the knowledge intensive service activities the KISA suppliers do not contribute to general innovation processes in the firm, neither in the form of product, process, organisational, market development innovation or any other forms of possible renewal or innovation activities. As highlighted above consultants are often brought into firms because of lack of internal capacity, not for innovation particularly. One could in this case, however, claim that external KISA may indirectly contribute to innovation, in that they free internal resources so that they can be devoted to core business and to the improvement of products and processes internally. One firm holds that the innovation happens *before* the external KISA supplier is invited into the firm, and adds that the external service suppliers are often too preoccupied by delivering the contracted services and "to sell what they have in the suitcase" to be able to think innovatively on behalf of the firm. However, external KISA suppliers may contribute with a specific service delivery important to the innovation processes in the software firms.

Of the various forms of innovation mentioned quite a few of the firms hold that external KISA suppliers contribute mostly to product and process innovation (e.g. new working methods), as others focus more on KISA providers' contributions related to organisational (e.g. management and organisational development) and market development innovations.

A general and important trend is that many of the firms acknowledge that external KISA providers indirectly often contribute to changes in firm behaviour by introducing new methodologies and new ways of doing things. By performing the knowledge intensive service activities internally in the customer firms the KISA providers often display new working methods, and new ways of thinking and acting is thereby dispersed and picked up in the customer organisation, either deliberately or more unconsciously.
The knowledge intensive service providers hereby contribute to *general* learning processes within the software firms and make the firms change their behaviour in some ways. However, when asked in the survey the majority of the firms do not recognise these processes to be directly contributing to innovation. These contributions to changed firm behaviour may, however, be seen as important foundations for further renewal activities and the introduction of new and innovative ideas to the software firms.

In relation to e.g. management training, sales training and marketing and public relations software firms hold that external KISA providers contribute specifically with new working methods and ways of doing things. One firm holds that the internal personnel responsible for public relations, an internal knowledge intensive activity, have in fact changed their behaviour fundamentally after the firm purchased external knowledge services from a large, professional PR agency. Another firm has expectations of an ongoing process related to sales and marketing that by using an external KISA supplier in this field the firm itself will change its approach regarding the definition of market segments. Yet other firms emphasise the impact of new methods and ways of thinking brought into the software firms by external management training services.

6.3.3. Summary

External KISA suppliers may play different roles regarding the influence on innovation and core competences in firms, which are informative, diagnostic, advisory, facilitating, turn-key and managerial.

Most external suppliers of KISA may provide a bundle of such services as a package. Many of the knowledge intensive service activities considered in this study thus have features that concur a great deal with the roles depicted above. Below we have focused particularly on KISA areas where the software firms report considerable interaction and cooperation with external providers of knowledge intensive service activities.

The marketing and sales knowledge intensive service activities may play an *advisory* role to innovation in software firms. Providers of marketing and sales activities use knowledge and competence developed in close interaction with many customer firms to advise software customer firms in these service areas. The external providers may often innovate themselves in methods in searching for, synthesising and presenting relevant information (Miles, 2002), and new methods and procedures may, consciously or not, accrue to the customer firms through the advisory KISA.

Marketing and sales services may also play a *facilitating* role to innovation in software firms. The external marketing and sales KISA providers are brought in so that the software firms have the opportunity to learn from their particular and wider base of knowledge. Training services may also *facilitate* innovations in their customer firms. Engaging a provider of training services allow the customer firms not to go through learning-by-doing internally, and may access the knowledge and hopefully be able to appropriate this knowledge so that it turns into new competences internally in the software firm.

Some firms hold that the knowledge and learning obtained by the use of external knowledge suppliers varies according to the actual intentions behind the purchase of the knowledge services. In many cases the intention of engaging an external KISA supplier is solely to get a job done. In other instances the firms explicitly want to acquire the knowledge and by internal learning processes turn this into competences of internal staff.

Related to the possible roles that external KISA suppliers may play for learning presented in the previous section the activities playing a facilitating role seems to be the most important. We found that this is particularly so in relation to marketing and sales as well as training service activities. When external KISA providers play a managerial role the possibility to contribute to learning in customer firms seems to be rather limited.

Many of the firms answer positively to KISA providers' contribution to innovation processes in a wide sense. KISA suppliers may contribute to trigger the curiosity of individuals in the software firms. In more direct ways KISA suppliers contribute to innovation since many firms feel that the high degree of specialisation in software firms generally makes impulses and ideas from outside the firms very important. Other software firms feel that KISA suppliers do not contribute at all.

As the analysis above shows that external KISA providers are used in many ways and for different purposes. The objectives and intensions for externalising knowledge intensive service activities, engaging external KISA providers, vary. Whether external KISA may have an impact on learning and innovation or not is mostly dependent on what the intensions of the firms for externalising the activity are. In many instances the intensions are not to learn from the external provider, and then it cannot be expected that external KISA providers contribute to innovation activity in customer firms. But in some instances they may contribute significantly. This is particularly the case when the external KISA providers, through their deliveries, change the working methods and way of doing things by their customer firms.

7. The software industry as supplier of KISA

7.1. Knowledge intensive business services (KIBS)

While chapter 6 studies the use of knowledge intensive service activities in innovation activity in software firms, this chapter analyses some aspects concerning the role of the software industry as a provider of knowledge intensive services to other firms and industries[26]. The interest attached to the software industry as a "knowledge supplier" rests on the fact that the literature often states that Knowledge Intensive Business Service (or KIBS) firms (such as software firms) are an important part of the knowledge base that firms draw on when innovating (Daniels and Bryson 2002, Hertog 2002, chapter 4). The interactive innovation model (cf. chapter 2) conceptualises innovation activity as a complex learning process in which firms step-by-step build up competence in-house, but also often acquire technical and market-relevant knowledge from external players (e.g. Asheim and Isaksen 1997).

7.1.1. The roles of KIBS in innovation processes

Miles (2003) holds that the increased interest in KIBS since the mid 1990s reflects increased insight about KIBS firms as important players in innovation processes. In the literature KIBS firms are perceived to be important sources of information, advice and specialised knowledge for customer firms and organisations in both the private and the public sector. Thus, the KIBS sector is important in stimulating learning and innovation processes in other firms and organisations. KIBS is seen as "innovation agents" (Metcalf and Miles 2000), reflecting the capacity of the sector to transfer knowledge to and stimulate their clients to innovation. Firms located close to a whole series of KIBS services may be benefited compared to firms with less access to such services because much collaboration between KIBS suppliers and clients include knowledge which is difficult to codify. However, these viewpoints often found in the literature are insufficiently confirmed by strong empirical evidence.

Thus, KIBS firms are seen as important collaborators in innovation processes of their clients. KIBS firms often develop services and new knowledge in co-operation with clients, and frequently solve problems and challenges for their clients (den Hertog 2002). E.g. software firms employ pilot customers for feed-back and information and to test new solutions. Thus, the quality of new software depends to some extent upon the quality of relations and cooperation between customers and the software firms. Cooperation may result in a two-way learning process (Wood 2002:5). Feedback from clients is important information and signals for the innovation process in KIBS firms. KIBS firms also learn more about characteristics and challenges in specific industries when collaborating with clients. At the same time KIBS firms contribute with new ways of doing things to their clients.

den Hertog (2002:238-239) distinguishes between three ways KIBS firms may stimulate innovation activity in clients. Firstly, KIBS firms may be *facilitators* of innovation in supporting client firms in their innovation processes as specialist consultants. The customers lead the innovation projects, while the KIBS firms contribute with highly specialised knowledge. Secondly, KIBS firms may be *carriers* of innovation transferring existing innovations (as for instance specific software solutions) from one firm or industry to another.

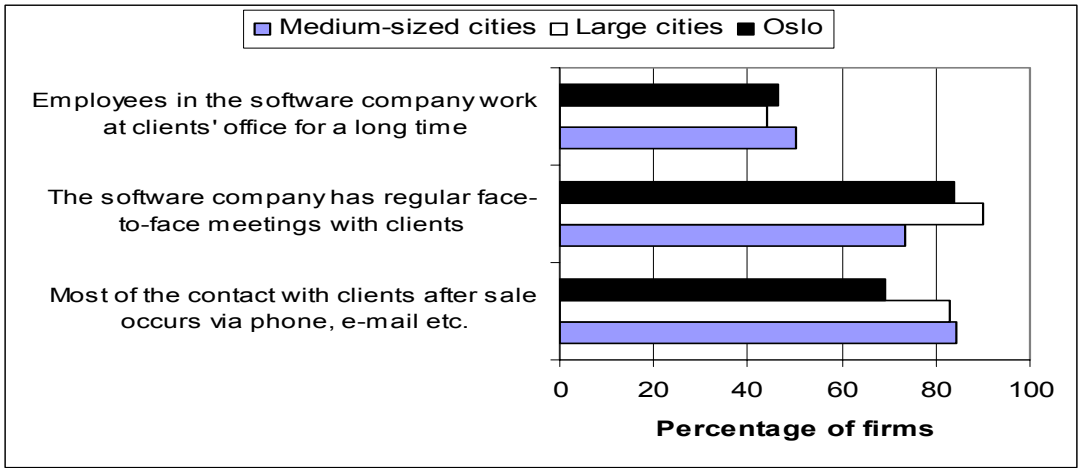
[26] Studies of the software industry as a supplier of KISA is not a part of the OECD TIP project, but included in the Norwegian part of the project.

The KIBS firms may not have initiated the innovations in question, but they have gained deep knowledge about them by introducing such innovations to different kinds of clients. At last, KIBS firms may be *sources* of innovation if they initiate and develop innovations internally, thus often in close collaboration with its clients.

7.2. Some empirical studies of software firms as "innovation agents"

Related to the software industry research shows that firms in the software sector require close contact with clients in order to be innovative and build innovative capacity[27]. The figure below reveals that 50 percent of the software firms work extensively at clients' offices, and most software firms have regular face-to-face meetings with their clients. The figure also indicates that face-to-face meetings with clients are particularly important in the tender, sales and contract phases. After a sale most software firms, particularly firms outside Oslo, continue to collaborate with clients by phone, e-mail etc. Software firms very often negotiate new contracts or develop new solutions based on signals from clients (Isaksen 2004). Thus, much activity takes place before contracts are signed. In the in-depth interviews of this KISA study managers of software firms valuate contact with clients to be the by far most important external factor in sustaining the competitiveness of software firms (cf. chapter 6). Thus, software firms make use of information from clients in their own innovation process.

Figure 7.1: The contact with clients during a project by software firms in different types of regions



Source: Telephone survey 2002

Why then do firms buy knowledge intensive services from software firms? Table 7.1 shows how software firms themselves answer this question, based on the same telephone survey as used in Figure 7.1. Software firms hold that their customers first of all want to obtain relevant,

[27] Figure 7.1 is based on a telephone survey to "knowledge based firms" conducted in June 2002. The survey gave 800 answers from of various types of firms, of which 269 were software firms. The software firms of the survey had five employees or more, and were located in three different types of regions: the Oslo area, other large cities (Bergen, Stavanger and Trondheim), as well as medium-sized cities (which include a large number of city regions with in between 20,000 and 200,000 inhabitants). The firms surveyed employ about 20 percent of the number of employees in the total population of firms in the software industry in Norway. The firms were randomly sampled. More than 2,300 firms were contacted to obtain 800 answers, i.e. the response rate was 34. We do not know the characteristics of the firms that did not wish or did not have the time to partake in the survey.

special competence which they may lack themselves. Often, the customers of software firms recognize that their products, services or particular production processes etc need to be changed. The customers may also have ideas on how to execute these changes but the software firms often have the necessary competence to put the new ideas into practice. Further, according to Table 7.1, customers of software firms may lack the sufficient capacity related to the introduction of new products or services and / or may have a strategy of buying these kinds of services from external actors.

Table 7.1: Software firms' assessment of why customers buy their products / services in stead of developing them themselves. Average score (1= irrelevant and 6 = large importance). (N = 269)

	Customers lack relevant, special competence	The customers lack capasitiy	The customers' strategy is to buy these products/services from external actors	The customers need strategic advice	The customers have good experiences from from using consultants	Includes time limited projects
Software firms	5.2	4.7	4.5	4.3	3.9	3.8

Source: Telephone survey 2002

The answers in the table above correspond with impressions from the in-depth interviews of software firms analysed in chapter 6. The software firms claim to contribute to the innovation activities of their clients. Software firms may for instance do consultancy work which contributes to the development of new products and services of their clients, software firms may contribute to process innovations and organisational change, such as e.g. improving the routines for case handling in public organisations, and they may contribute by improving the economic management of client organisations. Some software firms are important suppliers of portals, internet and web solutions, which leads to increased use of ICT-solutions. Software firms must to some extent convince customers of the efficiency gains following an investment in new software solutions. Customers need a long term profit (also) from their investments in software and ICT, such as reduced costs, more efficient case handling, improved supply chain management etc. Software firms want to "sell their customers innovative", i.e. to stimulate innovation activity in firms so they may demand new software solutions in the future.

It is not surprising that software firms insist on being important to the innovativeness and competitiveness of their customer firms and organisations. Software firms "survive" by convincing customers that investments in new software and ICT solutions are profitable. But how do the customers assess the contribution by software firms to innovation and competitiveness?

The telephone survey also included 200 firms other than software firms and other KIBS firms. The 200 other firms partaking in the survey belong to industries which are perceived to be "knowledge intensive", for example pharmaceuticals, other high technology manufacturing, and telecommunication. 106 of these 200 firms had used consulting companies the last three years[28]. The firms were asked to assess to which extent the consulting companies had contributed to their innovation activity. On a scale from 1 (low degree) to 6 (high degree) the customers assessed the importance of the consultants with scores between 3.6 and 1.7 on a set of variables. The consulting companies seem to contribute most in their client firms by introducing new competences to the customer firms, by developing core competence in the firms, and by giving advice in how to get information on new technological trends. However,

[28] The survey asked about the firms' use of consulting companies in general (and not only the use of software firms).

overall consulting companies are evaluated to be of medium to low significance for the innovation activity of their customer firms[29].

7.2.1. Summary

The software industry acts as a knowledge base and as a supplier industry of knowledge intensive services to firms in other industries and public sector organisations. The software sector provides both standardised and tailor-made solutions which contribute in changing the working methods of customer organisations, developing new routines for case handling, improved client contacts etc. The knowledge and competences offered by the software companies is embedded in the software, but much knowledge follow the software program as training, advice, installation and support, as knowledge intensive service activities. To some extent new software solutions build on knowledge that the clients have, but which is systemized by the software firm.

[29] The assessment made by both software firms and the customers are subjective, focusing on their own contribution for the innovation process.

8. The role of public policy

8.1. Policy instruments targeting the software industry

This chapter concentrates on government policies and programs for the software industry, with a particular focus on key industry-specific policies and programs enhancing the supply, quality and demand of knowledge intensive service activities (KISA) in the software industry. The main question to answer is whether government innovation policies have recognised and targeted KISA and supported their development. Therefore we will identify the government measures that seek to influence the supply, demand or quality of KISA and investigate the scale and scope of the existing measures[30].

Norway has very few policies and programs directed particularly at KISA; only a few directed at the software industry in particular or even the ICT industry more generally. Therefore we will also present more general policies and innovation related programs open to all firms and see whether these include support for enhancing the supply, quality or demand for knowledge intensive service activities in firms in general.

8.1.1. The innovation policy system

At various levels the actors of the national system for the shaping and execution of innovation policy influence the innovation activity of the economy. By offering funding, counselling, advise and networks the public (and some private/hybrid) innovation policy actors presented below in a variety of ways offer KISA services to innovating firms.

The national system for innovation policies in Norway consists of many actors. At the government level the responsibility for innovation and R&D is spread on a variety of ministries. Most ministries fund R&D but the main actors are:

- The Ministry of Education and Research
- The Ministry of Trade and Industry
- The Ministry of Local Government and Regional Development
- The Ministry of Health
- The Ministry of the Environment
- The Ministry of Defence
- The Ministry of Fisheries
- The Ministry of Agriculture

The Ministry of Education and Research, the Ministry of Trade and Industry and the Ministry of Local Government and Regional Development have the main responsibility of shaping national innovation policy. The shaping of the Norwegian R&D policy is based on the so called “sector principle” where each ministry is responsible for promoting and financing research and innovation activities within its respective area.

[30] The data in this paper is based on the web sites of the various agencies responsible for the policies or programs, phone calls to persons responsible for the programs as well as the EU commission Trend Chart database for Innovation (www.cordis.lu/trendchart)

The Research Council of Norway (RCN)[31] has the superior responsibility for the national research strategy in Norway and is administering almost one third of public research financing funds.

The Norwegian Industrial and Regional Development Fund (SND)[32] is a central institution for public financing of industry and regional development in Norway. The most important financing ministries of SND are the Ministry of Trade and Industry and the Ministry of Local Government and Regional Development.

SIVA – The Industrial Development Corporation of Norway[33] is a state-owned, but independently operating enterprise established to promote business opportunities and to increase employment. SIVA operates within three areas: real property, development activities and investment/financing.

Technological Institute (TI)[34] is a private foundation receiving public support to offer small and medium-sized firms relevant expertise to improve the knowledge, productivity and profitability of Norwegian firms. TI offers counselling and development services, training, expertise and technology transfer programs as well as laboratory testing and certifying services.

VINN – The counselling institute in Northern Norway [35]- is a private institute offering advise and contract research within many technical and economic-administrative areas to firms in that part of the country. The foundation receives public support for parts of its activities.

The Public Advisory Service for Inventors (SVO)[36] is a public agency offering advice and scholarships for inventors. The office supports patent applications and building of proto types.

A real property based initiative within the innovation area in Norway is the **science parks**[37]. Traditionally the role of science parks was to act as service organisations and real property administers but now they are more directed towards incubator activity and innovation assistance. Many of the science parks have their own commercialisation units or firms.

The Norwegian Trade Council[38] is a foundation promoting export of Norwegian goods and services to foreign markets. Offering counselling and advice the council assists firms and the Norwegian government regarding international technology cooperation.

The foundation Norwegian Design Council[39] is financed by the Ministry of Trade and Industry. The council offers company advice and has its own projects. The main goal of the council is to promote the use of good design in market oriented product development and market communication of Norwegian firms.

[31] www.forskningsradet.no
[32] www.snd.no
[33] www.siva.no
[34] www.teknologisk.no
[35] www.vinn.no
[36] www.svo.no
[37] www.fin.no
[38] www.eksportnett.ntc.no
[39] www.norskdesign.no

8.1.2. KISA typologies of policy measures and government programs

The participants in the OECD KISA focus group have agreed on grouping the policy measures and government programs using the following categories:

1. Research and development programs and technologies for ICT services
    - Research and development programs
    - Access to new technology
2. Infrastructure underpinning innovation capability
    - ICT innovation
    - Foresight
    - Knowledge and technology diffusion
3. Innovation capability in firms
    - Innovation management
4. Knowledge and mobility of human resources
    - Training
    - Inwards mobility
    - Industry associations
5. Standards and regulations
6. Global marketing and exporting
7. Intellectual property protection
8. SMEs: Entrepreneurship and development
    - Entrepreneurship
    - SME development
9. Commercialisation of new products

As mentioned above there are few policies and programs directly targeting the software industry or even the ICT industry in Norway. Even less focus is put on policies and programs directed particularly at the supply, quality and demand of KISA in the software industry in particular.

Generally there is a much larger number of broad innovation related programs covering several industries and sectors than particular sectors or industries in Norway. These general innovation programs include innovation funds, programs supporting business establishment based on new technology or research or general innovative business establishment as well as innovation and R&D enhancing programs. Additionally there are innovation-related financial measures directed at all sectors such as tax allowances and seed capital funds.

Below the various programs, both targeting the software and ICT industry particularly and the more general innovation related programs, are presented according to the categorisation agreed upon by the KISA focus group. First, however, we will present the more general ICT policy initiatives in Norway at a national level as well as the only KISA relevant policy initiative at SND (agency) level.

Policies focused on the ICT sector

At the overall national level the Norwegian government has worked out a collective plan for public ICT policy named “eNorway 2005” (“eNorge 2005”). The eNorway 2005 plan is the superior IT policy of the government from 2002 to 2005. Within various sectors additional

political plans for the IT sector have been or will be worked out, plans further elaborating the eNorway 2005 plan.

In the eNorway plan the government depicts three superior goals for its ICT policy;

- The development and use of information technology is to contribute to value creation through increased innovation and competitiveness in industry.
- Information technology will be used to create efficiency in the public sector and offer new and improved services to the users and lastly
- All citizens should be able to take advantage of the possibilities of information technology, and IT should contribute to preserve and further develop the Norwegian cultural heritage, identity and the Norwegian languages[40].

To be able to reach the main goals of the plan the Government will place effort within 5 main priority areas:

- The creation of favourable framework conditions for eNorway through updated regulations, good economic arrangements and preparations for increased innovation and research within the field of IT.
- The availability and security of information systems, services and net is important. The Government will impel the development of broad band and electronic signatures.
- Securing the supply of competent manpower.
- Increasing the supply of attractive content adjusted Norwegian circumstances.
- The creation of a modern public sector which is cost effective, as well as offering new and better services to its citizens.

For each priority area the Government has particular objectives and prioritised initiatives[41].

Inherent to the e-Norway strategy is the initiative of a publicly initiated electronic market place for public procurement, "Program for public electronic trade"[42]. The program was established in 1999 by the Ministry of Labour and Administration and will continue out 2003. The program is to include public procurement in local communities, regional county council districts and by the State.

One of the main goals of introducing electronic procurement systems in the public sector is that in this way the public sector in general can be an important stimulant for increased electronic trade and business activity also in the private sector. Through framework agreements the Government will request design and development of IT products and services contributing to increased user friendliness and accessibility for groups with particular needs. An important task of the program is to impel the handling of procurement issues, organisational, legal and technical challenges.

SND has for several years had a special focus on knowledge intensive business services (KIBS) within the so called "district political area" in Norway. Acknowledging the KIBS sector as a growth sector representing attractive job opportunities for high educated employees as well as the recognition that these services have an important role to play in business development, SND has since 1999 funded projects focusing on the development of such knowledge intensive competence, services, concepts and networks. A proportion of the regional development grant of SND is allocated to fund KIBS firms, however other SND funding is also provided to knowledge intensive business services. The KIBS priority area of

[40] Nærings- og handelsdepartementet (2002) E-Norge 2005 (Department of Trade and Industry)
[41] For an overview of these objectives and initiatives: www.enorge.dep.no
[42] In Norwegian: "Program for elektronisk handel i det offentlige": www.ehandel.dep.no

SND is an important example on how government support has tried to target the main issues of this OECD KISA study, knowledge intensive service activities. It is a general priority perspective accompanying the existing SND innovation related and competence enhancing support mechanisms.

At a disaggregated level there has, however, been a cooperation project between the regional SND offices in the districts of Trøndelag, the county council districts of North and South Trøndelag, the National Institute of Technology (TI) and the National Institute of Technology in Trøndelag Ltd. focusing on KIBS firms in that region. This project is presented under the category "Innovation capability in firms" below.

1. Research and development programs and technologies for ICT services

Below the more targeted innovation programs or initiatives in Norway are presented. Some are focused on the software or ICT industry, some are targeting technology based or knowledge intensive firms, but most of them are general innovation related programs aiming at firms in all business sectors[43].

Research and development programs

The **user-driven R&D programs** of the Research Council of Norway are based on the assumption that firms which are willing to take part in publicly financed R&D programs shall have decisive influence on the organisation, control, management and implementation of relevant programs and projects. The idea behind the concept is that the firms are most suited to define business needs and that the companies to a greater degree will find possibilities for success and growth, however in a close cooperation with universities, colleges and R&D-institutes.

The target groups of the user-oriented programs are all types of firms, but with a particular focus on SMEs. The companies participating in these programs are to take part in initiating, financing and governing the R&D projects. The firms shall prioritise how the funds are to be used and must in average obtain 60 to 65 of the capital needed. The user-driven projects amount for in between NOK 600 and 700 million per year.

User-driven research has been a successful instrument to support business R&D in Norway. The main conclusions from an evaluation[44] in 1997 are, however, uncertain about the economic results and the profitability of the user-driven programs. Nevertheless there are great positive effects to be seen from investments in competence building and network activity. The programs have most probably contributed with a fair social return but it is claimed that the additionality of the user-oriented programs is too low as is the risk-taking projects of the total project portfolio.

[43] It could be said that as long as the supply, quality and demand of R&D services are in some way included in the program then it should be counted as a KISA related measure, but we have chosen not to do that. All research programs would then in principle be enhancing the supply and quality of R&D services. We have chosen to focus on the programs that seek to enhance the supply, quality and demand of KISA services to or from other firms or organisations.

[44] Hervik og Waagø (1997) "Evaluering av brukerstyrt forskning" ("Evaluation of user-oriented research"), BI and NTNU, Oslo/Trondheim

Another study of user-driven research[45] shows that the programs are important to the firms. Half of the firms expect economic results after two years and 40 of the firms claim that the user-driven projects would not have been effectuated without the support of the Research Council of Norway. The firms also claim that the public support lead to larger and more risk-taking projects.

Many of the programs below presented in this overview belong to the user-driven R&D programs.

The generic taxation scheme **SkatteFUNN** is a general tax incentive for all companies with the objective of stimulating an increase in R&D investments in the business sector in its present form starting up in 2003. Companies may deduct costs of investments in in-house as well as R&D commissioned from R&D institutions; however applications must be accepted by the Research Council of Norway in advance.

SMEs (companies with less than 250 employees) get a tax reduction of 20 of total project costs. Applicants owned by 25 or more by companies larger than 250 employees as well as companies larger than 250 employees themselves get a tax deduction of 18.

Branch oriented IT (BIT) started up in 1989. From the start the main goal of the program was to increase the competitiveness and profitability of small and medium sized businesses through the development and implementation of common IT solutions at branch levels through a close cooperation between branch organisations and suppliers. Gradually the focus has turned more towards electronic business. The goal of BIT is to contribute to internal electronic business in value chains to increase the competitiveness of SMEs. Therefore an important aim is the spread of solutions in individual branches. The BIT program follows a business driven cooperation model including e-solutions in value chains as well as tools for effective use of ICT at the firm level.

The program supports ICT providers in a role as intermediaries for innovation in client firms, acting as KISA suppliers. The BIT program comprises the development of integrated ICT solutions adapted to firms in particular business sectors. Through competence and organisational development effective use of new ICT solutions should be obtained. Software suppliers provide relevant core competences and knowledge (KISA activities) into the BIT projects. The software provider enhances the user firms' absorptive capacities for the new ICT based solution. The BIT program therefore targets both the supply of and the demand for KISA.

SND administers the BIT program. In 2002 the budget was NOK 25 million. SND cooperates with branch organisations, pilot firms and software suppliers in this program. The branch organisations coordinate the activities vis-à-vis the relevant branches. The pilot firms develop new IT solutions to be implemented of other firms in the relevant branch.

According to SND attempts to measure the effects of BIT performed in 2001 show a very good spread of the IT solutions in the branches that have finished the development of branch solutions. Good effects have also been obtained in the pilot firms. The measurements show both rationalizing effects and strategic effects. The rationalizing effects include better basic

[45] Bræin et al (2000) Møreforskning, Yearly study of user-driven research in the Research Council of Norway (RCN) based on data from the RCN database PROVIS, 1997-

data and routines, better control of production and logistics as well as better statistics and prognosis. The strategic effects include better marketing, customer service and continuous competence increase.

The program period of the **ICT program** is from 2001 to 2008. The program addresses the Norwegian ICT sector as such but is also focussing on the promotion of innovative and efficient use of ICT in business and social life in general. The program therefore indirectly supports both the supply of and demand for KISA. The ICT program stimulates the interaction between leading technology environments and innovative users. The target groups of the program are to be found where ICT is a central technology to realise products and services, primarily firms within electronics, instrumentation and measurement techniques, software, telecommunication, micro technology, net(work) based services as well as multimedia and language technology. Reflecting the structure of the ICT sector the program addresses and services SMEs and entrepreneurs. The program supports cooperation amongst SMEs, cooperation between SMEs and knowledge environments and between SMEs and larger companies.

The ICT program supports R&D projects with considerable technological risk and correspondingly high potential for value creation, but also considers project support if necessary to obtain satisfactory technology diffusion and collaboration in a sector characterized by many small units. Particular focus is put on projects involving start-ups and projects where an international R&D cooperation is a central element. The program is administered by the Research Council of Norway and had a budget of NOK 60 million in 2002.

The **IT Funk program** started up in 1989. The superior objective of the program is to increase physically disabled people's accessibility to new technology and through this to increase their accessibility to the society in general. To reach this goal IT Funk contributes to the development and diffusion of effective methods and tools for research, development and the introduction of IT-based solutions available and useful for people with various kinds of handicaps. The program therefore supports the supply of KISA. IT Funk will promote companies' development and delivery of IT solutions available to all, supplemented by special solutions for disabled if necessary. IT Funk is administered jointly by RCN and SND and has a program period from 2002 to 2006. The budget from 2001 was NOK 6, 5 million.

The **PULS program - Services, Commerce and Logistics** aims to be an important factor in the development of a competitive service industry in Norway in general. The program is not focused on the ICT sector as such but supports general R&D based innovation and innovation processes in networks of cooperating service firms, as well as the development of better and more efficient logistics and transport services, competence development and internationalisation. The program is administered by the Research council of Norway and has a program period going from 2002 to 2010. The budget of 2002 was NOK 45, 7 million.

OFU ("Public Research and Development Contracts"[46]) started up in 1968. The OFU scheme is a subsidy measure administered by SND, where the role of SND is to relieve the risk of R&D in firms and to act as releasing agent of an OFU project. The OFU measure is not focused on the ICT sector as such but gives Norwegian businesses in general unique opportunities to cooperate with various public departments to develop as a supplier in society.

[46] In Norwegian: "Offentlige Forsknings- og Utviklingskontrakter", OFU

The result of the contract may give the firm increased market access within the public sector nationally and internationally. On the other side by active use of OFU contracts the public may contribute to build up the product spectre and technical competence of Norwegian firms. Additionally the scheme is to contribute to make public administration more effective.

An OFU contract is a binding contract between a public department and a Norwegian firm where the firm undertakes to develop and deliver a new product or solution to the department. An assumption in the OFU program is that there should be a public procurement need that cannot be met in a satisfactory way through existing solutions. The product or solution must be developed and produced in Norway. In 2001 the total budget of the OFU scheme was NOK 96 million.

The **IFU** scheme ("Industrial Research and Development Contracts"[47]) is a targeted subsidy measure for the development of SMEs as suppliers for larger firms localised within or outside Norway. The scheme stimulates close development cooperation between a demanding customer firm and one or more supplier firms. The advantages of such cooperation for the supplier firm is increased competence, access to a larger market and networks as well as obtaining a solid reference. For the customer firm the access to specialised competence and lower development costs may be some of the advantages.

As the OFU contract the IFU contract is a binding contract, however the contract is made between two firms. The supplier firm is to develop a product, a process or a service needed by one or both parts. A prerequisite of the IFU program is that the supplier firm(s) is a SME (less than 250 employees) and larger firms cannot own more than 25 of these SMEs. The cooperation as such should be based on developing a new business relation between the partners. The product, process or service developed should represent a substantial effort within its product area and a market beyond the pilot customer should be made probable.

The public support for an IFU project is maximum 35 of the project costs and maximum NOK 3 million per year. In 2001 the budget of the IFU scheme was NOK 80 million. For 2000 SND states that for both the OFU and the IFU measures together the total amount of funding for the ICT sector in particular was NOK 43, 9 million.

The OFU and the IFU schemes were evaluated in 2000[48] and the evaluation concluded that the measures had been successful in the light of obtaining its basic objectives and to secure value for money. This general positive assessment should be seen in connection with particular aspects of these measures, including the specific participant profile of the measures (what kinds of firms participating in the schemes) and changes in the portfolio firms over time.

[47] In Norwegian: "Industrielle Forsknings- og Utviklingskontrakter", IFU

[48] Staude M. et al (2000) "Til beste for de beste – En evaluering av offentlige og industrielle forsknings- og utviklingskontrakter" ("To the best for the best – An evaluation of public and industrial research and development contracts"), STEP-report R-02/2000, Oslo

2. Infrastructure underpinning innovation capability

ICT Innovation

There are no particular programs aiming at innovation particularly in the ICT or software industry. The programs presented below are generic programs open to all industries.

HØYKOM is a grant scheme for developing broad band communication. The program has a program period from 2002 to 2004. The budget of the program for 2002 was NOK 53, 5 million, but the applicants must obtain at least matched funding in the projects granted support in the program. The main objective of HØYKOM is to stimulate the use of services and content requiring broad band as well as strengthen the competence related to broad band. The grants are to support learning about the use of broad band, to develop effective guidance services, to exploit information networks, to communicate experience and to make possibilities visible. The target groups of the program are diverse, but there is a particular focus on the health sector and regional and local public administration and services in general. It is a wish that colleges, consultancies and other competence environments in a direct and indirect way will contribute to the initiatives of the program. An adjacent program, HØYKOM School (budget in 2002 was NOK 48 million), has partly overlapping target groups with HØYKOM, but focuses more on stimulating the development of broad band in schools. Regarding content and service production other actors may apply for grants, e.g. cooperation constellations between companies and public actors.

Due to lack of available private capital the first of the regional **Seed Capital Funds** (Såkornfondene)[49] were established jointly by the Ministry of Trade and Industry and SND in 1997. The seed capital funds (now 5 funds) are fully privately owned funds. The government invests risk capital by contributing with 50 of the capital base of the funded companies by offering liable loans through SND. SND follows up the liable loans and acts as a coordinator and network builder. Additionally SND is represented in the boards of the seed capital funds. The objective of the seed capital instrument is to enter innovation projects in an early phase with owner capital, competence and networks. After equity issues the capital base of each regional seed capital funds is NOK 100 million[50]. Additionally the regional funds have a loss fund of NOK 12, 5 million.

Norway also has a national seed capital fund called the **START fund** ASA, starting up in 1998. The START fund is a private company with 18 private shareholders belonging to considerable business and financial networks. The goal of the START fund was through long-term ownership to develop the portfolio companies into international winners. The START fund targets knowledge and technology based firms with a unique business concept and potential for international growth. The fund focus particularly on firms within areas characterised by major structural changes or within areas with great technological dynamic, e.g. within the convergence technologies of internet/telecommunication and within the life sciences. SND offers NOK 160 million in liable loans to the funded companies. The START fund has a capital base of NOK 320 million.

[49] The five seed capital funds are: Såkorninvest Innlandet, Såkorninvest Sør, SåkorninVest, Såkorninvest Midt-Norge and SINAS – Såkorninvest Nord AS.
[50] The exception is the Såkorninvest Innlandet which has NOK 60 million in capital base.

Foresight

There are no particular programs or schemes directed to give strategic guidance and assistance in priority setting, either generic or particular for the ICT or software industry, in Norway.

Knowledge and technology diffusion

Most innovation related programs in Norway have knowledge diffusion as one important objective in the programs. However, there are no programs or schemes directed solely to the diffusion of knowledge or technology within the ICT or software sector.

3. Innovation capability in firms

Innovation management

The competence program **"Innovation in KIBS"** is a cooperation project between the regional SND offices in the districts of Trøndelag, the county council districts of North and South Trøndelag, the National Institute of Technology (TI) and the National Institute of Technology in Trøndelag Ltd.[51] focusing on KIBS firms in the region. In the period between 2001 and 2002 twenty KIBS firms participated in this (pilot) program and another nine firms are participating in the period 2003-2004[52]. The goal of the program is increased competitiveness and profitability amongst the participating KIBS firms. The target group of the program is established knowledge intensive firms within the branches of accounting, auditing and graphical services, media, ICT and other consultancy services (including economy, agriculture, fish farming) as well as firms in general with a high degree of turnover related to service production.

There is a common frame of the services offered to the firms participating in the KIBS program, but there are possibilities of tailoring the services offered to individual firms. Within a period of 12-14 months the participating KIBS firms are offered four specialised meetings (2-day) and theme specific meetings, 50 hours of counselling aid, a tool kit for strategy development particularly adapted to KIBS firms, a project platforms/web site where information, news, archive and profiling is posted as well as a network of competence firms.

The educational content of the services offered focuses on innovation and rethinking according to five main business areas (KISA areas): strategy, market development, human capital management, service development (including customer satisfaction, relation strategies etc) as well as information and communication technology (internet, e-commerce, production commerce, distribution, market etc).

The FRAM program started up in 1992 and the present program period of the program goes until 2005. The program is administered by SND. In 2002 the program had a budget of about NOK 40 million.

FRAM supports basic learning in SMEs (firms with 1-30 employees), particularly within the areas of management and building up of company strategies with the objective of making the firms more competitive. The goal of the program is a profitability improvement of last year's

[51] http://ti-trondelag.no/kift/sider/generell.php
[52] The KIBS program will be expanded with the two regions/county council districts of Rogaland and Telemark.

operating revenues in 75 of the participating firms. The program explicitly targets managers of SMEs.

In the early 1990s the Research Council of Norway has great success with a program called BUNT, a technology driven program targeting firms' abilities to find and use new technology developed in other companies or research institutions. However, the focus of the BUNT program became increasingly directed at management training than the direct use of science and technology and SND was given the task of developing a follow-up program, the FRAM program.

The FRAM program starts up with an analysis of the present situation in the company. The analysis is then used as a basis for developing a strategic action plan consisting of activities for the firm to accomplish during the 15 month program duration. In between 8 and 10 firms in the same region meet 6 times to discuss results and experiences within all areas of the value chain, but with a particular focus on management. In between these meetings particular consultants with management experience follow up the defined company activities.

In 1997 the FRAM program was evaluated[53] and the evaluation showed that many firms reached the goal of the program of profitability improvement and that many firms reported to have achieved increased knowledge and competence. However, the profitability improvement did not differ from a control group of firms not participating in the program. Nevertheless the evaluation recommended extending the FRAM program because other studies showed that there was a need for development of strategic thinking and company management in firms.

The **ENT program** - Establishment with New Technology started up in 1991. Technological Institute (TI) takes care of the practical administration of the ENT program and TI employees function as consultants for the participating companies. SND, however, is responsible for application approval. In 2001 ENT had a budget of about NOK 8 million. To reduce the risk of entrepreneurs the ENT program offers start-up companies financial support in terms of counselling. The entrepreneurs receive advice in the early development phase of products, processes or ideas. The program is organised in three phases following the development of a start-up from evaluation of the idea, through a pre project to the company establishment with commercialisation of a product.

Another innovation management and technology program focusing particularly on the region of Northern Norway – **The NT-program** – started up in 1987. The present program period goes from 2000 to 2003. The NT-program supports innovation in this part of Norway by obtaining capital, give advice and develop company networks and knowledge institutions. The NT-program is administered by SND and the budget of 2002 was NOK 24 million. There is no particular focus on ICT companies but the main objective of the program is to make new and already existing technology based firms more innovative.
Several evaluations have been undertaken regarding the NT-program[54]. The main conclusion from the last evaluation, representative for the conclusions of the previous evaluations, is that there is an evident need of a selective instrument in this part of Norway.

[53] Nesheim, T. et al (1997) Evaluation of the FRAM program in SND, SNF report 84/97, Bergen
[54] Arbo, P and Gulowsen, J. (1992), NT-programmet som bidrag til industriell omstilling i Nord-Norge (The NT-program as a contribution to industrial change in Northern Norway) NORUT Samfunnsforskning rapport SF 032-4059. Isaksen, A et al (1996), Nyskapning og teknologiutvikling i Nord-Norge. Evaluering av NT programmet, STEP report 1/96. Isaksen, A, Asheim, B.T. and Remøe, S.O. (1999), SME policy and the regional

The **MOBI program** – "Mobilising R&D related innovation", itself being an umbrella program for several other programs[55], belongs to the user-driven program umbrella. MOBI started up in 2001 succeeding the previous BRO program. The program period of MOBI goes until 2009. The main objective of MOBI is to promote learning, innovation and value creation in companies. Many firms experience barriers for innovation, e.g. too high risk, lack of relevant expertise and knowledge about where such expertise may be found, as well as lack of capital, and MOBIs ambition is to reduce the number of barriers and the effects of these. The main strategy of MOBI is to carry out programs and R&D projects focussing on the interaction between industry, R&D environments and innovation political institutions as well as regional innovation. The total budget of MOBI for 2002 was NOK 52, 3 million.

Another user-oriented program, **Value creation 2010 (VS 2010) –** "Company development through broad involvement", is a cooperation program between the Research Council of Norway, the Norwegian Federation of Trade Unions (LO), the Confederation of Norwegian Business and Industry (NHO) and SND with a program period from 2001 to 2010. The Research Council of Norway has the administrative responsibility of the program. The main objective of VS 2010 is to increase the value creation in industry in general, not just the ICT sector, through stimulation of company cooperation with research institutions in relation to organisational development, innovation and renewal activity. An important focus is that employees must be involved at a broad scale in the learning, development and innovation activities of firms. The budget of VS 2010 in 2002 was NOK 21,3 million.

4. Knowledge and mobility of human resources

There are no particular policies or programs targeting knowledge or mobility of human resources in either firms in general or the software or ICT industry in Norway.

5. Standards and regulations

There are no particular policies or programs targeting standards and regulations in the software or ICT industry in Norway.

6. Global marketing and exporting

The objective of **the International Technology Cooperation** scheme administered by the Trade Council of Norway is to strengthen the international competitiveness of Norwegian firms, by stimulating technology transfer from abroad, mapping the marketing possibilities for technology developed in Norway and establishing networks and alliances between Norwegian and foreign firms. The target groups are various public institutions, universities and other research institutions as well as firms. The budget of the international technology cooperation program in 2002 was NOK 20,5 million.

The Trade Council of Norway offers an Export and technology program for small and medium sized companies called **the SME program**. The objective of the SME program is to

dimension of innovation. The Norwegian report, SMEPOL report nr. 5. Pettersen, P. G. (2000), Evaluering av NT-programmet, NORUT and Ernst&Young

[55] NHS Næringsrettet høyskolesatsing (Industry oriented focus on colleges) , TEFT (Technology communication from research institutes to SMEs) and finally ARENA-Regional Innovation Pilots (common commitment between the Research Council of Norway and SND).

promote growth in SMEs, preferably R&D intensive companies with a potential to succeed in international markets. The program had a budget of about NOK 17 million in 2002. Through advisory services and assistance in the fields of marketing and technology SMEs should be enabled to enter into new international markets, introducing new products in existing foreign markets or entering into marketing or technology development partnerships abroad. The program is, however, in the process of being phased out.

The Entrepreneurship program also administered by The Norwegian Trade Council focuses on innovation, renewal activities and technology development. The objective of the program is to contribute to a successful internationalisation process of newly established and innovating firms in general, not ICT firms in particular. The entrepreneurship program is to contribute to the commercialisation of the products of these firms. There is much focus on the input of export competence and market knowledge to the firms. The budget of the entrepreneurship program in 2002 was around NOK 12 million.

7. Intellectual Property Protection

There are no particular programs targeting intellectual property protection in the software or ICT industry in Norway.

8. SMEs: Entrepreneurship and development

Entrepreneurship

The Incubator program started up in 2000 and is administered by SIVA (Selskapet for Industrivekst) – The Industrial Development Corporation of Norway. The objective of the program is to stimulate the establishment of new companies with growth potential, and by this contribute to the development of strong regional and local environments for value creation.

An incubator is a development environment for firms in the start-up phase located inside an established competence centre. The incubator offers the start-up firms physical premises, technical infrastructure, counselling and advice regarding company start-up. Additionally the incubators allow firms admission to a wider network of competence and services, e.g. R&D institutions. Each incubator gets an annual grant from SIVA of NOK 800 000. The total budget of the incubator program in 2002 was NOK 20, 5 million.

In addition to the Incubator program an **Incubator grant** scheme was started up in 2001 and is administered by SND. The main objective of the Incubator grant is to stimulate increased establishment of competitive, future oriented and innovative firms contributing to innovation and business renewal. The grant is reserved start-ups with a high knowledge and technology level expected to have a large potential for value creation, a high degree of risk as well as offering products or services with a potential for introduction at international markets. The incubator grant includes financial support, follow-up of the companies and training. The incubator grant will only be granted persons or firms in an incubator, but belonging to an incubator does not necessarily give the right to incubator grant. The budget of the incubator grant in 2002 was NOK 19 million.

See also the Entrepreneurship program administered by The Norwegian Trade Council (under the category Global Marketing and Exporting)
SME Development
See also the SME program above also administered by The Norwegian Trade Council (under the category Global Marketing and Exporting).

9. Commercialisation of new products

The research based innovation program – **FORNY** – started up in 1994 and the current program period goes until 2010. FORNY is a common effort of SND and the Research Council of Norway regarding national and regional innovation systems and is particularly directed towards not yet born companies. The program addresses both R&D environments, firms with R&D activities as well as public enterprises with R&D activities. The main objective of FORNY is to increase the value creation by commercialising knowledge intensive business ideas with great potential. The goal is to refine R&D results to commercial activity. The most important instruments of FORNY are stimulation of ideas, commercialisation assistance, verifying and early capital. The budget of FORNY in 2001 was NOK 45,5 million.

See also the Entrepreneurship program administered by The Norwegian Trade Council (under the category Global Marketing and Exporting).

8.1.3. Summary

In this survey of policies, agencies and measures targeting the supply, quality and demand for knowledge intensive services in Norway we have chosen to focus on the selected software industry (or ICT industry), not on the national innovation system as a whole.

In general there are few policies targeting the software industry or even the ICT industry in Norway directly and even less focus is put on policies directed particularly at the supply, quality and demand for KISA in the software industry in particular.

However, at the national level a collective ICT plan is developed by the Norwegian government (e-Norway 2005). The government has defined particular priority areas for this strategic plan with specific objectives and particular initiatives. The prioritised areas include creating favourable framework conditions in the field of IT, improving the availability and security of information systems, services and net, the development of broad band and electronic signatures, the supply of competent manpower as well as supply of content adjusted to Norwegian conditions and lastly the creation of a modern public sector through the use of IT. In an indirect way the policy therefore focuses on enhancing both the supply and demand of KISA.

Included in the e-strategy is a publicly initiated electronic market place for public procurement, where the goal is that the public sector can be an important stimulant to increased electronic trade and business activity in the private sector. This national policy affects the Norwegian ICT industry, including the software industry, by defining important focus areas in the years to come and builds up demand for KISA.

Additionally, on agency level the Norwegian Industrial and Regional Development Fund (SND) has for several years had a special focus on knowledge intensive business activities

(KIBS), acknowledging the KIBS sector as a growth sector with an important role to play in business development particularly in rural regions of Norway. The KIBS focus of SND as such is a general priority perspective accompanying the existing innovation related and competence enhancing support mechanisms of this organisation. However, in particular regions or county council districts a particular KIBS program has evolved over the past few years. The KIBS program focus on developing the competitiveness and profitability of KIBS firms. The program seeks to develop various KISA areas of the regional KIBS firms, such as strategy and market development, human resource and customer management and relations as well as ICT technology development.

Focusing on particular government schemes or programs the Norwegian survey shows that relatively few programs are solely developed to enhance the industry specific innovation in the software and ICT sector in Norway. Most of the ICT directed programs identified are categorised as research and development programs.

Important industry specific programs directed towards the ICT industry in general and software sector in particular is *the ICT program* of the Norwegian Research Council. Likewise *the Branch oriented IT program (BIT)* of the Norwegian Industrial and Regional Development Fund (SND) and the jointly administered program *IT Funk* are particularly directed towards innovation and business development in the ICT and software sectors. All these programs stimulate the supply of KISA in the software industry.

The program perhaps most directly supporting software firms in the role as knowledge intensive service providers to users is *the Branch oriented IT program (BIT)*. In this program the software suppliers are crucial in the development of integrated software solutions to firms in particular business sectors. The program is aimed at enhancing the both the supply and demand of KISA.

However, generally there is a much larger number of broad innovation related programs covering several industries and sectors than particular sectors or industries in Norway. These general innovation programs include innovation funds, programs supporting business establishment based on new technology or research or general innovative business establishment as well as innovation and R&D enhancing programs. Additionally there are innovation-related financial measures directed at all sectors such as tax allowances and seed capital funds.

8.2. The use of policy instruments by survey firms

In general more than half of the software firms interviewed had not at all used public measures related to the firms' most important innovation the last three years. Some of the firms report to have applied for funding within the R&D tax deduction measure FUNN (now replaced by Skattefunn) without success. Another two firms have applied for financial support in SND, one of the firms even twice, both ending up with refusals. Quite a few of the other firms have not at all bothered to use limited time and resources to go through the application process for public money.

Of the firms that have in fact taken advantage of public measures for the funding of the most important innovation the last three years the various forms of public support mentioned range from the general tax incentive measure called FUNN (now Skattefunn), the New Technology

program for firms in the region of Northern Norway (NT-programmet), the Public Research and Development Contracts program (OFU – Offentlige forsknings- og utviklingskontrakter) as well as indirect funding from a ministry through another partner in the project. Additionally one firm participates in a R&D related network administered by the interest organisation of the Norwegian ICT sector called ICT Norway in cooperation with the Research Council of Norway.

Of these instruments there are two firms that have applied for both the tax deductive schemes FUNN or Skattefunn as well as participated in Public Research and Development Contracts, which indicates that these particular measures are amongst the most suited to assist and support firms in the software sector in Norway.

The firms have various experiences regarding the use of public measures, both positive and negative. The firms that have benefited from the FUNN measure evaluate this measure very positively, claiming that FUNN was an easy way to get public support. The easiness of appropriating public funding stands in great contrast to the main attitude of the firms of the survey. The majority of the firms have a rather negative impression of the system of public instruments in Norway as a whole.

The main objection to the system is that it is very time and resource consuming. It is held that the public support system is too bureaucratic, and one firm feels that the system has a predetermined contact network which decides who gets support. The firm has the impression that particular firms "have a straw down into the funds". Being part of an international industry group itself the firm feels that it is not even considered properly by the public agencies administering the innovation funding sources. Another firm holds that there is too little money behind the advertisement of public funds, particularly in the case of Public Research and Development Contracts. Some firms report that the instruments in themselves are good, but the amount of money finally received by this means is almost not worth it. It seems like a waist of time and is rather disillusioning to go through the bureaucratic process of obtaining rather limited funding through the public support system.

Some of the firms are more positive towards the public support system. Although being rejected twice by SND one firm expresses a wish of using the public support system to get more tightly involved with the top level of academic professional environment for development cooperation. Another firm participating in an ICT Norway administered network in close collaboration with the Research Council of Norway emphasises the perceived positive elements of this network. The participation in such networks is very important for SMEs which are usually forced to think of constant cost reductions. Network collaboration of such kinds not being totally necessary, firms do not have the possibilities to prioritise such activities. One of the most important support mechanisms related to the firms' participation in such collaborative networks is therefore that ICT Norway and the Research Council of Norway fund board and lodging of the firms participating in the network conferences and gatherings. Without the public support the firms would most probably not have partaken in the networks. It is of particular importance that firms participate in such networks, the firm holds, because Norway is a small country and thus firms have to collaborate regarding the development of non-competitive tasks such as application directed, more basic approaches common to many firms of the software sector.

One of the most interesting findings related to the firms' attitudes towards the public support system and innovation enhancing instruments is that many of the firms are ambivalent to

public involvement and support in general. On the one side, one firm holds, it is positive to public initiative, but on the other side the feeling is that firm innovation should not be the responsibility of the public. There is a danger that the real benefits of the public support are too low and that thus public funding is wasted. Other firms support this view. They have a general negative attitude towards the public innovation support system holding that it not right to support commercial products with public funding. This is based on a feeling that the assignment of the public support is random, and that this influence on competition amongst the software companies. Public support to innovation creates a skewed competition in the market, the firm holds. Supporting the view of public funding creating distortion of competition another firm also emphasise that the focus of public support is wrong. The focus of public support should be on creating beneficial external conditions and open competition. The firm reports that this is a problem they do not dare to point out to the public support system.

9. Policy implications: the role and impact of KISA within the software industry

In this chapter we reconsider the main findings of the KISA software study in order to analyse relevant policy implications. The report focuses on how innovation activities occur in the software industry, the use (and production) of knowledge intensive service activities and its possible influence on innovation activity of software firms. The ultimate goal of the KISA project, however, is to come up with new ideas to public policymaking. This chapter briefly sums up key results from the software study before discussing some tentative policy implications.

9.1. Main findings

9.1.1. Innovation characteristics

The report reveals that Norwegian software firms are very innovative, also as regards more radical innovations new to the market. Innovation activity rests first of all on internal resources and endeavours, and on long-term building up of competence inside firms. The most important innovation activity in software firms is thus internal research and development activities. Also demanding customers, external suppliers of machinery and equipment as well as more direct suppliers of knowledge intensive R&D service activities seem to be important for innovations in software firms.

Various barriers to innovation are found in the software sector. The barriers are important in discussions of policy implications as software firms themselves provide knowledge intensive services to customer firms and organisations and may thus influence innovation processes of the customers. Then it is important that software firms are innovative in themselves and not greatly hindered by the innovation barriers. Hence, counteracting innovation barriers in the software sector may be seen as a main policy challenge.

One of the more important barriers emphasised by software firms is the lack of innovation financing. Some software firms hold that scarcity of money or low willingness to invest in innovation from external investors is one of the most important hindrances to innovation. Most of the firms in the KISA survey have financed their most important innovation the last three years through a combination of internally generated funds and external financing sources, such as public support and customers. During the last two years the general economic development has been rather negative for many firms in the software sector. The difficult economic situation of many software firms might indicate that public innovation funding has an important role to play in order to overcome innovation financing barriers in periods of economic downturns.

Another barrier to innovation mentioned by Norwegian software firms is the lack of qualified personnel for development work and innovation activity. Some of the firms producing and selling standardised software products in international markets hold that it is also particularly difficult to find people with good sales and marketing competence.

Finally many software firms hold that the markets of Norwegian software firms are “too small”. In some software segments firms emphasise that there are too many competing

software producers in particular niche markets. It could be claimed that software firms "think too small" by adjusting themselves towards small, national market segments only, and therefore have too limited customer groups to experience good returns on investments made. One of the challenges related to this barrier might be to support the commercialisation of these niche products into international markets.

On the other side some software firms hold that a limited Norwegian software producer market is what impedes innovation in the sector. Other studies and analyses than this KISA study must be considered to evaluate this hypothesis, but if verified, policy would have to focus more on supporting start-ups and the framework conditions of firms in the software sector.

9.1.2. Evaluating quality

The study shows that the service component of software firms varies considerably. Some firms have a very low service component, but the majority of firms states that more than half of the costs of a software delivery may be ascribes to services like implementation / installation, adaptation / integration, consultancy, user-support and training. Software services are in general important knowledge intensive services provided by the software firms to customer firms and organisations. A major problem seems, however, to exist in evaluating the quality of knowledge intensive services.

Generally the markets for knowledge services is characterised by a high degree of information asymmetry between providers and customers. The provider of a knowledge service has by nature more information about the particular area in question than the potential customer. For the potential service customer it is therefore in advance difficult to evaluate the quality of the service product offered by external providers of knowledge intensive services, like those offered by software firms. Software firms on the other hand face the same problem while purchasing knowledge intensive services from other external KISA providers, not being able to evaluate the quality of the services offered and thereby the results of the service provision in advance.

9.1.3. The use of (internal and external) KISA

One of the main topics of the OECD KISA study has been to investigate software firms' use of knowledge intensive service activities, provided both internally and externally to the firms, and its possible effects on innovation activity of software firms.

This report reveals that Norwegian software firms consider research and development activities as the most important KISA, and that these activities are mostly provided internally. Other important KISA activities also mostly provided in-house are project management and the development of strategy and business plans. Likewise, software firms hold that some activities considered of medium importance are also provided mainly internally in the firms. These are the activities related to the development or introduction of new information technology systems for internal use as well as organisational development and team building.

On the other hand, some service activities are reported to be mostly handled by external KISA providers, i.e. operational services such as legal services and accountancy or economic services. These activities are considered to be outside the core business of the software firms.

Finally, as regards some activities the software firms report considerable interaction and cooperation with external providers of knowledge intensive service. In these cases a mix and match of knowledge and competences of internal and external experts is expected to be high. The mix and match of competences and knowledge services is particularly evident in marketing and sales services, training services and recruitment services. These are most often considered to be of medium importance to the software firms.

9.1.4. Effects of external KISA

External KISA providers are used in many ways and for different purposes by software firms. The objectives for externalising knowledge intensive services vary between software firms. To which extent external KISA affects learning and innovation is also mostly dependent upon the intensions of the firms for externalising the activity. In many instances the intensions are not to learn from the external provider, and then it cannot be expected that external KISA providers contribute to innovation activity in customer firms. But in some instances they may contribute significantly, particularly when the external KISA providers, through their deliveries, contribute in changing the working methods and ways of doing things in their customer firms. According to this study, this is in particular the case as regards management training, sales training and public relations activities. In addition, software firms use important feed-back and information from customers when developing new software solutions.

9.1.5. Policies and measures

In general there are few policies directed at the software industry specifically or the ICT industry more generally in Norway. Even less focus is put on policies targeting the supply, quality and demand of knowledge intensive services in the software and ICT sector.

Important industry specific programs directed towards the Norwegian ICT industry in general and the software sector in particular is *the ICT program* of the Norwegian Research Council. Likewise *the Branch oriented IT program (BIT)* of the Norwegian Industrial and Regional Development Fund (SND) and the jointly administered program *IT Funk* are particularly directed towards innovation and business development in the ICT and software sectors. Also the PULS program of the Norwegian Research Council is important to service firms, software firms included. The PULS program offers a different type of networking than the other programs. All these programs stimulate the supply of KISA in the software industry.

Generally there is a much larger number of broad innovation related programs covering several industries and sectors than those targeting particular sectors in Norway. Additionally there are innovation-related financial measures directed at all sectors such as tax allowances (Skattefunn, previously named FUNN) and seed capital funds.

The firms of the KISA study have various experiences regarding the use of public measures, both positive and negative. The few firms that have benefited from the FUNN measure evaluate this measure very positively, claiming that FUNN was an easy way to get public support. However, the majority of the software firms partaking in the study have a rather negative impression of the system of public instruments in Norway as a whole. It should be emphasised that the sample of the KISA survey is too limited to make anything but tentative conclusions. The main objection to the system is that it is very time and resource consuming. It is held that the public support system is too bureaucratic. Some firms report that the

instruments in themselves are good, but the amount of money finally received by this means is almost not worth the effort of applying. It seems like a waist of time and it is rather disillusioning to go through the bureaucratic process of obtaining rather limited funding through the public support system.

However, many of the software firms are ambivalent to public involvement and support in general. Firstly, firms hold that firms' innovation activity should not be the responsibility of the public. Firms believe that the assignment of the public support is random, and that this influence on competition amongst the software companies. Thus, public support to innovation creates a skewed competition in the market. Therefore, secondly firms hold that the focus of public support should be on creating beneficial external conditions and open competition.

9.2. Policy implications

The ultimate goal of the KISA project is to come up with new ideas to public policymaking. In this sub section, we present a tentative framework for organizing discussions of policy, and discuss some more specific policy proposals. This framework will be the starting point for discussing policy instruments also in the two other case studies in the KISA project, i.e. health care and aquaculture. Thus, the framework will hopefully be revised and improved during the remaining parts of the KISA project.

At first we must emphasise that the objective of policy targeting KISA, provided either internally or externally, is to improve the innovation capability, competitiveness and efficiency of private firms and public organisations. The focus on knowledge intensive service activities is not an aim in itself; it is a mean to achieve the objective of more innovation, competitiveness and so on. Thus, as regards the software industry, the means could be to stimulate increased use of software solutions by firms and organisations as a trigger of innovations in client firms. More generally, the means may be to stimulate knowledge intensive service activities inside all types of firms and organisations, based on the idea that KISA are central ingredients in the innovation processes of these firms and organisations.

Further, to increase the use of software, or KISA in general, policy can try to influence the users of software solutions, or the users of knowledge intensive services. That is, policy can stimulate the *users* to demand and utilize such services. Another group to influence may be the *producers* of software or of other knowledge intensive service activities, in order to improve the supply and quality of these services.

Such arguments lead to the framework in Figure 9.1 (below) as a point of departure for discussing policy issues. The target groups are providers of knowledge intensive services in general, or KISA inside any kinds of firms. As regards this study the software industry is important because the industry produces knowledge intensive services for other industries. The figure distinguishes between supply-side and demand-side policy categories, and also introduces a policy category aimed to stimulate networking and cooperation between providers and users of knowledge intensive services.

Supply-side policy includes the creation of favourable conditions for the development of the software industry or of such providers of knowledge intensive service in general. Supply-side policy may also include stimulating knowledge intensive service activities inside firms and organisations, as KISA are seen to be important in innovation processes of all types of

organisations. Demand-side policy, on the other hand, includes supporting the use of software solution or external knowledge intensive services by firms and organisations in general. Increased use of such services is seen to be important in innovation processes. Network policy consists of bringing together providers and users of knowledge intensive services, so that an interactive mix and match of activities may occur and give impetus to mutual learning and possible innovation on both sides.

Figure 9.1: A framework for discussion of policy implications from the KISA software study

Targets of policy tools	Stimulate supply and quality of KISA	Stimulate networking	Stimulate demand for KISA
Internal KISA in all types of firms and organisations	Stimulate KISA internally in firms and organisations	Support cooperation between internal users and providers of knowledge intensive services	Stimulate / support the demand for internal KISA from internal users of knowledge intensive services
External KISA providers to all types of firms and organisations	Create favourable conditions for the development of independent providers of KISA	Support cooperation between external providers and internal users of knowledge intensive services	Stimulate demand of firms and organisations for external knowledge intensive services
The software industry (as external KISA provider industry)	Create favourable conditions for the development of a nation's software industry. Create awareness among software firms of their role as provider of KISA.	Stimulate cooperation between software firms and external providers of knowledge intensive services (to software firms)	Stimulate the use of (new) software solutions by firms and organisations, as a mean to increase innovation and competitiveness in customer firms and organis.

9.2.1. Supply side

To encourage the supply of knowledge intensive services in general one would have to improve the prerequisites for developing *internal knowledge intensive service activities* as a way to enhance innovation in all firms. This study reveals that firms may procure KISA from both internal and external sources. Therefore the KISA supply side measures may on the one hand be directed towards encouraging further development and strengthening of various forms of internal KISA in all firms.

On the other hand supply side tools may target specialised KISA suppliers as such, and improve the conditions for the development of *external suppliers of knowledge intensive services* and activities. In this report it is most pertinent to focus on the software sector as a provider of knowledge intensive services for the development of internal innovation capabilities and strengthening innovation activities in other firms.

In order to strengthen internal knowledge intensive service activities of firms, policy may target the following areas:

- Strengthen innovation incentives of all firms
- Improve supply of qualified personnel

Strengthen innovation incentives of all firms

Incentives to enhance innovation capacity in firms have traditionally consisted of measures such as direct grants and subsidies through various R&D and innovation enhancing programs

and measures or indirect support through favourable tax treatment of R&D (and innovation) expenditures.

Norway has indirect innovation-related financial measures directed at all sectors such as tax allowances and seed capital funds to encourage R&D and innovation in firms. Additionally there is a large number of broad innovation related programs covering several industries and sectors rather than particular sectors or industries. These general innovation programs include innovation funds, programs supporting business establishment based on new technology or research, programs supporting general innovative business establishment as well as innovation and R&D enhancing programs. The general innovation programs are developed to enhance the innovation capabilities in firms, which includes important knowledge intensive development activities.

The possible knowledge intensive service activities undertaken in firms in relation to innovation capability building are diverse and the existing policy measures often have narrow R&D-biases. To be able to support the supply of internal KISA in its full broadness it would be important to also stimulate the development of other internal knowledge intensive service activities important for innovation like for instance marketing, sales and training related to innovation activities. It is also important to improve the internal innovation culture in firms to develop learning organisations, which must be built up from within the firms. KISA areas besides R&D will be treated in more detail in other sections below.

Lack of qualified personnel

Much focus has been put on short and long-term policy initiatives to overcome mismatches in supply and demand of workers with IT skills, and in particular, software specialists. As shown in this study software firms experience the lack of qualified personnel as an impeding factor to innovation. To support the supply of KISA from the software industry the government may contribute by improving the quality and extent of the education of IT personnel in Norway. Additionally the government may introduce more flexible arrangements for foreign experts to be allotted working permits to work in the Norwegian IT-sector.

Strengthening the quality and extent of the IT education will not only support the supply of software personnel to the software sector per se, but also benefit firms in other sectors of the economy. Improved IT proficiency will in general make it easier for firms in other sectors to employ relevant and competent IT personnel, and thereby strengthen one part of their internal supply of KISA important for developing internal innovation capability.

However, the challenge of possessing the right internal competence and qualified personnel in software firms goes beyond the problem of lacking IT competent personnel. Software firms also emphasise the need to strengthen a broader spectrum of business competences, including management, marketing and sales activities in order to trigger their innovation activity. Marketing competence is important for the prosperity of all firms in the long run, and new and innovative ways of marketing may be just as important to firms as technical and other types of innovation.

9.2.2. Demand side

Demand side policy tools may stimulate the general demand for knowledge intensive services as external input into all types of firms and organisations. Such measures may facilitate

demand and use external KISA in general in innovation processes, and the development of internal innovation capabilities. On the other hand demand side measures may target and encourage the demand for software products and services specifically.

Specific demand side policy tools for promoting knowledge intensive service activities of firms and organisations, and thereby stimulate innovation capabilities of users are:

- Stimulation of purchase of external KISA
- Incentives for the demand and use of software
- Government procurement of software
- Internationalisation

Stimulating purchase of external KISA in general

Innovation is a complex and multifaceted activity. Nonetheless, policymaking has traditionally focused on strengthening the ability of firms to conduct R&D internally or to commission R&D-services from external providers. However, the study shows that other knowledge intensive service activities are also important to innovation and innovation capability development in firms and organisations, business competences such as strategic management, marketing, sales, recruitment, training and legal (including patent entitlements) activities. Weak competence or limited qualified personnel to perform any of these activities internally may hinder the total innovative performance of firms and organisations.

In situations of limited internal competences and resources one possibility is to externalise the entire innovation activity to external providers. The activity will be executed, but the customer organisations will most probably not acquire the skills and competence to develop internal innovative capabilities in this area any further. Another possibility may be to purchase services from an external supplier with the intention of acquiring the particular skills through interactive learning activities with the external KISA provider. If the activity at present is of central importance or of future importance the firm or organisation should perhaps be encouraged to purchase and internalise this activity. Implicit in such a proposal is the view that the supply of knowledge intensive services and the interaction and learning through common knowledge intensive service activities is important in strengthening the innovation capabilities of firms.

Government action may be to conduct in-depth analyses to reveal what types of knowledge intensive service activities that are of particular importance in order to develop innovative capability in various industrial sectors of the economy as well as of firms in different stages of development. E.g. newly established firms may need to develop a broad set of business competences, while more mature firms may rather require the strengthening of competence in KISA areas such as marketing and sales.

Incentives for the demand and use of software

By facilitating software purchase in particular, governments may encourage further use and thereby the demand of software products in the private sector. Increased use of software products is not a mean in itself, but new software solutions may be one element in, for example, new ways of organising activities of firms and organisations. Tax incentives (reduction) for software purchases may be one area of relevance in stimulating software purchase. Other government incentives for encouraging the demand and use of software may include special grants or program funding for software development related to other industries

in the economy and the diffusion and use of these software solutions amongst firms in these other industries. In Norway one software related program (the BIT program) is particularly targeted at the development of specialised software solutions for various branches in the economy. The BIT program is in fact targeting both the supply and the demand side of software. Thereby the program targets KISA in both suppliers (software firms) and client organisations (firms and organisations which start using specifically designed software programs).

Government procurement of software

Government procurement has traditionally been an important tool shaping the computer and software sectors. However, an OECD study indicates that government procurement measures seem to be less influential now that the software industry has grown much larger, more mature and more complex[56]. Governments are nevertheless major purchasers of software products, and often seek to rationalise government activities by the use of new ICT tools.

An ICT plan has been developed by the Norwegian government (e-Norway 2005). Included in the e-strategy is a publicly initiated electronic market place for public procurement, where the goal is that the public sector can be an important stimulant to increased electronic trade and business activity in the private sector. This national policy affects the Norwegian software industry by defining important focus areas in the years to come.

By acting as an influential, demanding customer the government may influence the development of innovative and radical software solutions directed towards efficiency improvements of a range of public sector areas in Norway. One measure of particular interest in this connection is the OFU program (Public R&D contracts). The general aim of the OFU program is to give Norwegian firms the opportunity to develop themselves as suppliers in cooperation with demanding public departments and agencies.

Acting as an important and demanding customer the government also interact and learn from important KISA suppliers. This may stimulate renewal culture and innovation capability formation internally in the departments and agencies of the public sector itself at all levels.

Internationalisation

One of the main challenges for innovation in software firms in Norway and a possible role for government intervention may be to help software firms to bring their products to larger (international) markets. One of the real challenges to innovation in the software sector is to support firms in their commercialisation of good niche products, particularly when introducing the products into international markets. Public procurement, as discussed in the previous paragraph, could be one possible way of promoting nationally developed software products on international markets. Norwegian software products developed for public use nationally could to a much larger extent be introduced and marketed on international markets, not only to the public sector in other countries, but with adaptations also for other potential use. Even related to the public sector in other countries substantial adjustments would have to be made. However, the public sector actors being large and demanding customers and super users of the software products would be of great marketing help to launch specialised software products on international markets.

[56] OECD DSTI/ICCP/IE(2000)8/Final

9.2.3. Stimulate networking

Supply side and demand side policy will also stimulate more cooperation between providers of knowledge intensive services and firms and organisations using knowledge intensive services. Thus, policy instruments aimed at promoting increased use of external knowledge intensive services in firms' innovation processes will certainly lead to more collaboration. Nevertheless, we will put forward two specific policy tools aimed at stimulating networking:

- Use of proactive broking (in a narrow and broad sense)
- Development of quality standards

Proactive broking

Broking is to bring together supply and demand. Broking is a well-known instrument in innovation policy, in a narrow sense exemplified by the TEFT programme (Technology diffusion from research institutes to SMEs)[57], now part of the MOBI program. The main objective of TEFT is to increase nation-wide contact and collaboration between less R&D-intensive small and medium-sized enterprises (SMEs) and the five largest polytechnic research institutes in Norway. The idea is to develop the ability of SMEs to become frequent customers of the research institutes. Achieving this objective is the task of (ten) county-based technology attachés which function as brokers, or as organisers, animators or coaches in the innovation processes of SMEs. Thus TEFT is particularly concerned to lower barriers to co-operation between national R&D-institutes and SMEs, and in that way strengthening industry-science relationships.

A TEFT-type of instrument *may* also be a way to increase the interaction between KISA providers and users. Thus, brokers may assist firms and organisations in identifying their needs of innovation and, in particular, point to the possible needs for developing various types of internal knowledge intensive service activities to increase innovation capability. The brokers may also assist firms and organisations in bringing in external KISA. Generally, SMEs, in particular, often find it difficult to identify and articulate their own support needs, for example their needs of bringing in knowledge intensive services to promote their innovation activity. This highlights the potentially valuable role of brokers in offering diagnostic and evaluation support above all to SMEs. The broker instrument may be directed towards several possible innovation barriers such as low technological competence, lack of qualified personnel and business competences such as the lack of market research competence and narrow strategic vision, depending on the specific barriers in individual firms or organisations. Brokers may be particularly relevant to stimulate firms and organisations with low innovative capacity and a low level of knowledge-intensive service activities to start a process of building innovative capabilities to become more innovative.

An alternative approach would be to strengthen the role of the public support system in creating functional and permanent networks of firms and organisations - broking in a broader sense than the broking instrument sketched above. One could think of a more broad scoped KISA network program where the objective would be to bring together various types of firms and organisations, small, medium and large, public and private, engaged in different types of knowledge intensive service activities (R&D is the traditional KISA, but just as well other KISA (public as well as private competences) such as management and administration,

[57] Isaksen, A. and S. O. Remøe (2001), New Approaches to Innovation Policy. Some Norwegian Examples. *European Planning Studies*, 9, 3: 285-302.

marketing, design, organisational development, training and recruitment, system competences etc).

The focus of the network program would be on the exchange of experiences related to knowledge intensive service activities amongst the network participant organisations. The network could focus on how to cooperate and learn from each other by communicating good KISA practises from various settings and the objective of the network could be the building of innovative capacity in the firms and organisations participating in the broad network program. One possibility would be to seek already existing value networks or clusters to develop these learning arenas for knowledge intensive service activities.

Development of quality standards

Most technical standards are de facto. In contrast, *de jure* (organised, common) standardisation has proved difficult because it is a slow process, contrasting the rapid technological process that characterises the software industry.

However, standards are just as important in services as in technology, mostly related to the quality of the service products offered. In particular this has implications for firms and organisations supplying knowledge intensive services to other firms and organisations. As highlighted above the market for knowledge services is characterised by a high degree of information asymmetry between the providers and customers, and an inherent problem of the customers is therefore to evaluate the quality of the knowledge-services offered.

The role of the government could be to encourage, develop and implement common quality standards on services related to KISA in general and thereby also software services more specifically. A question is whether it is desirable to develop a certifying system of personnel and services making it possible for customers ex ante to evaluate the knowledge services and activities offered. This would perhaps be one step towards improving the cooperation between providers and users of knowledge intensive services.

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Appendix 1: Firms of the survey

Firm	Address	Contact person	Telephone	Web site
Electric Farm ASA	PB 4351 Nydalen 0402 Oslo	Nils Petter Liljedahl (MD)	23 14 53 50	www.electricfarm.no
Fronter AS	Kongensgt. 24	Jon Dammann (MD)	24 14 99 99	www.fronter.no/norway
IFS Norge AS	Skysstasjonen 11 1371 Asker	Kjell A. Andersen (MD)	66 90 73 00	www.ifsworld.com/no
Mintra AS	Storgata 1 0028 Oslo	Ivar Viktil	24 15 55 00	www.mintra.no
Finale Systemer AS	Tromsø, men Oslokontor	Ola Odden	77 66 54 60	www.finale.no
Hiadata AS	Storgata 62 2609 Lillehammer	Oddbjørn Vassli	71 19 14 00 90 13 58 33	www.hiadata.no
Profdoc AS	Lysaker torg 15 1325 Lysaker	Øyvind Ødegård	21 93 63 70	www.profdoc.com
SuperOffice ASA	Drammensvn. 211 0213 Oslo (Unitorbygget)	Guttorm Nielsen (Dev. dir)	22 51 70 00	www.superoffice.com
Trolltech	Waldemar Thranesgt. 98 0175 Oslo	Eirik Aavitsland	21 60 48 00 (94) 920 35 499	www.trolltech.com
Linpro	Waldemar Thranes gt. 98B 0175 Oslo	Dag Asheim (not present) Kirsti Ånstad (stand-in)	22 87 11 80 404 14 404	www.linpro.no
Computas AS	Vollsveien 9, Lysaker	Jostein Skjørberg	67 83 10 00	www.computas.com
Agresso AS	Gjerdrums vei 4, Nydalen	Jon Jacobsen	22 58 85 00	www.agresso.com/norway
Software Innovation AS	Philip Pedersens vei 1, Lysaker	Anders Volckmar (Group manag)	23 89 90 00	www.software-innovation.no
TietoEnator Consulting AS	Økernvn. 145	Petter Larsen	22 076 000	www.tietoenator.no
EDB Business Partner AS	Gullhaug torg 4 A, Nydalen	Øyvind Grepperud	23 32 45 00	www.edbasa.no
Visma Software AS	Biskop Gunnerus gt. 6	Bjørn Ingier	23 15 80 80	www.vismasoftware.no