



# Is It Working? Working from Home At Statoil, Norway<sup>1</sup>

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Statoil a.s., Den norske stats oljeselskap, made home PCs, private ISDN connections and Internet access freely available to virtually all of its about 18,000 employees worldwide in 1997. The goal of this unprecedented initiative was to improve information technology (IT) skills of Statoil employees in preparation for competition in the emerging knowledge economy. Statoil management taught that availability of PCs at home could create a natural learning environment for employees to acquire IT skills during their leisure time. Although the initiative has resulted in improvement of employee IT skills, as predicted, it has also brought about many emergent outcomes including a rapidly growing working from home practice at Statoil. This practice, in turn, has surfaced the need to rethink organizing principles and human resource policies at Statoil. In this paper, the authors describe evolution and outcomes of Statoil's working from home initiative. Combining insights from Statoil's initiative and the broader virtual work literature, they argue that working from home is an essential part of the knowledge strategy of firms. They propose a framework that conceptualizes working from home strategy in terms of administrative efficiency and knowledge effectiveness at individual and team or task unit levels. They summarize managerial and technical challenges brought about by each strategy. © 1999 Elsevier Science Ltd. All rights reserved

tors since the 1960s. Statoil has also expanded into international gas and petrochemical markets over the last decade. As of early 1999, Statoil has operations in 26 countries and employs about 18,000 people around the world. Figure 1 depicts the major international exploration and production portfolio of Statoil.

Statoil is in the midst of transforming itself into a global energy group to avoid becoming obsolete when the Norwegian continental shelf runs out of oil reserves in the first quarter of the next century. One of Statoil's goals is to increase its annual operating profits to 25 billion Norwegian kroner by the year 2002 (see Table 1).

According to Harald Norvik, until recently the chief executive, 'value creation and growth are the keys to the future of Statoil.' Recognizing that business transformation, value, and growth are driven by IT in the emerging knowledge economy, Statoil has invested significantly in its IT infrastructure, IT skills, and explored IT-enabled work forms in recent years. In this article, the authors discuss Statoil's home PC and working from home initiatives and their outcomes. This article is based on a systematic case study of these initiatives with a view to develop conceptual insights and managerial implications. Sidebar 1 summarizes our approach and methodology whereas sidebar 2 provides a timeline of events in the working from home initiatives.

## Statoil Case Description

### Background

Statoil has been a major player in the development of Norwegian continental shelf and oil and gas sec-

### Sidebar 1. Our approach and methodology

In March 1998, we conducted four video interviews with members of Statoil's working



**Figure 1** Statoil Operations Around the World

**Table 1** Statoil Financial Highlights (Norwegian Kroner in millions)

	1998	1997	1996	1995	1994	1993
Operating revenue	106,709	124,726	106,981	86,517	84,070	81,340
Operating profit	7015	17,042	18,234	13,590	14,741	12,712
Profit before taxation	4705	13,989	17,924	14,689	16,900	11,980
Net profit	271	4311	5281	5265	5379	3394

Source: Statoil annual reports.

from home project group. These interviews allowed us to understand the project background, prepare our interview guide, and determine our sampling strategy. In April 1998, we selected 30 participants out of a pool of 546 participants in the working from home project, as potential informants for our study. We sent an e-mail to invite them to take part in a phone interview about their working from home experiences. Twenty participants responded positively. The rest indicated that they had not yet started working from home. All correspondence and interviews were carried out in English. Only one participant declined the interview due to lack of adequate knowledge of English.

We completed a total of 28 telephone interviews from April through October 1998. Each took an average of 45 minutes. All interviews were tape recorded and transcribed. One of the authors participated in project group meetings, experienced working from home himself, and talked with some participants informally to probe their

experiences with working from home. He also translated relevant documents (e.g. meeting agendas, internal communications, working from home surveys, etc.) into English. This enabled the authors to triangulate different sources of data.

We analyzed the interview transcriptions, documents, and field notes, and wrote up a chronological description of the working from home initiative. We shared this write-up with members of the project group. They confirmed our account of events with some minor suggestions that we incorporated into the case where appropriate. We then conducted a within case analysis using an iterative explanation-building process (Yin, 1994).

## IT Infrastructure

During the 80s, Statoil's IT infrastructure was based on mainframe systems. The IT department developed

most applications in-house, but it lacked a customer oriented service culture. There was lack of standardization across the organization because business units had different IT solutions even when their requirements were similar. Geir Pettersen, a vice president, who served as the CIO until 1995, remarked 'The IT department lived in its own ivory tower for many years, working for its own internal means instead of working for its customers.' However, things changed during the 90s. Mr Pettersen went on, 'I got in there with the aim of bringing a customer perspective into the [IT] organization. We started to become more supportive of organizational needs. We became more applications-oriented rather than hardware-oriented. We did quite a few things in the way we organized ourselves. We used business process reengineering, introduced workflow processes, changed budgetary responsibilities, put more people out in support functions in various organizational units, and modernized the whole IT infrastructure. A big step was the introduction of *Lotus Notes*® packages as the main working platform for administrative support and use. We also took the first initiative to introduce SAP as a common support system.' Lotus Notes databases and standardized electronic document management systems were used to support teamwork whereas SAP systems were used to implement common administrative work processes for better and faster administration. While migrating its IT infrastructure from mainframe systems into Windows NT based client server systems, Statoil also flattened its organizational structure. Figure 2(a) Figure 2(b) depict organizational charts of Statoil in 1990 and 1998 respectively.

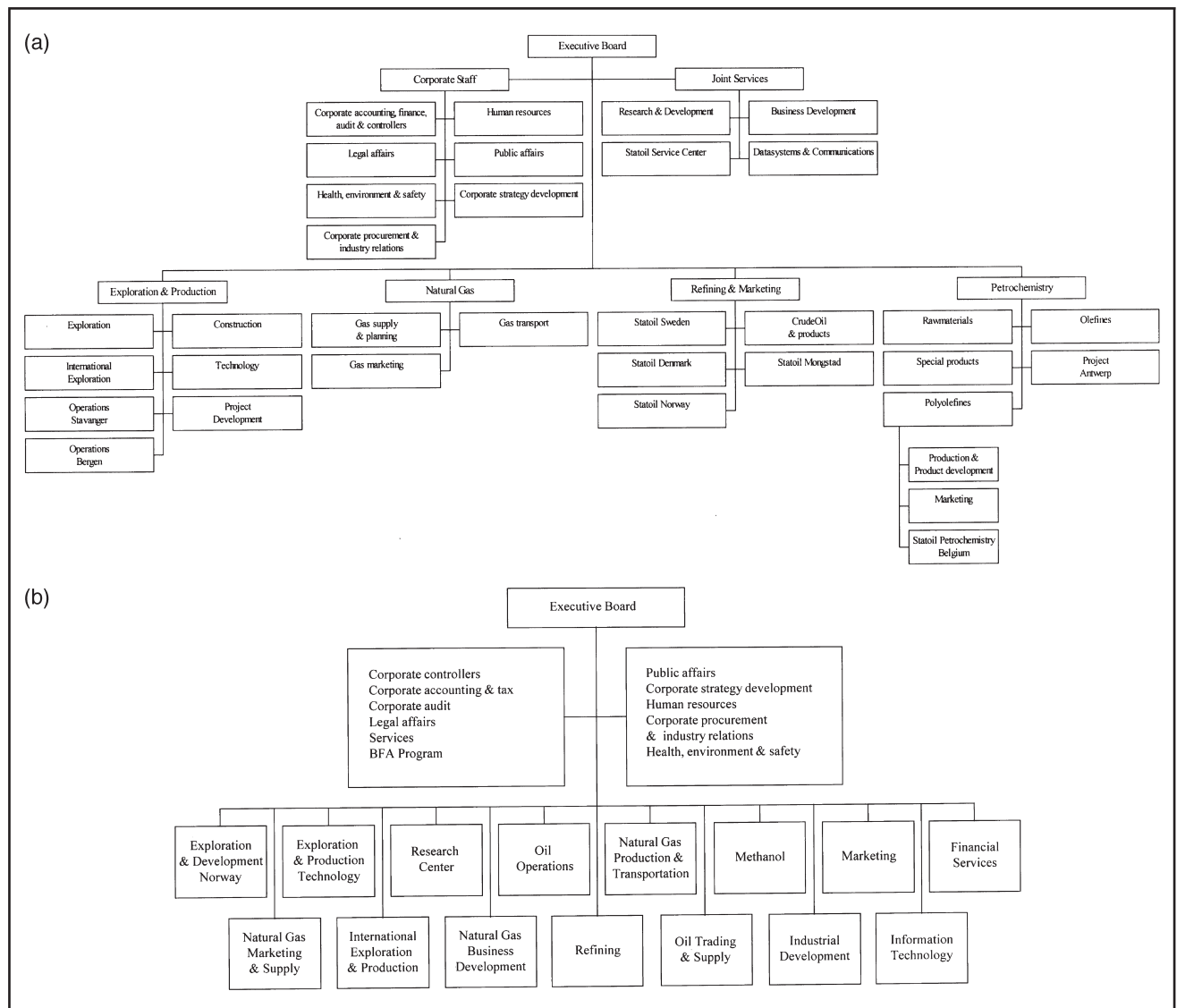
#### Sidebar 2. Timeline of events in the working from home initiative

Time frame	Events
Pre-1996	Ad hoc working from home practices: senior managers and employees use laptops and dial-up connections to work from home.
1996	Statoil decides to make home PCs available to all employees to enhance their IT skills.
Late 1996	Statoil announces that every employee, who agrees to undertake training in use of computers, the Internet, and Statoil's standard office software, is entitled to a home PC, and Internet connections over ISDN lines. Virtually all employees (99 per cent) accept the offer.
July 1997	Installation of about 13,000 home PCs and ISDN lines are completed.
Fall 1997	Employees start demanding

	access to Statoil network from home. IT department selects WinFrame as the technical solution for working from home.
October 1997	IT department launches a pilot project (phase-I) to test the WinFrame technology with about 20 users.
December 1997	Evaluation of the phase-I: Extremely positive user feedback. Statoil decides to offer WinFrame to 500 employees, run the second phase of the trial for 3 months, and evaluate outcomes systematically.
March 1998	546 employees from about 40 departments are nominated for participation in phase-II. All nominees receive WinFrame connections. Project group surveys participant intentions to use WinFrame to identify whom should receive the post-trial evaluation survey.
Mid March 1998	Pilot project — phase-II starts.
Mid June 1998	Phase-II ends.  Evaluation survey is administered on 159 employees who had intended to work from home systematically.
Fall 1998	IT department gets ready to sell the WinFrame solution to willing departments. IT department investigates ways of scaling up the WinFrame solution. HR negotiates working from home policy with unions.

#### Exploring New, IT-Enabled Work Forms

During the mid-90s, Statoil explored and experimented with various projects dealing with new ways of working. In 1996, one of the projects, 'office of the future (OF),' aimed to develop flexible office solutions that would enhance teamwork, information sharing, and to provide flexible work forms. Information sharing was problematic because employees kept private paper-based archives in their offices. Kristine Abelsnes, manager of the OF project, remarked, 'They are not supposed to be private archives, but many times they are.... We decided to try out a flexible office solution for moving from paper-based to electronic, digital work...' The idea was to replace fixed offices with shared workspaces, equip them with standardized and networked computers, and to make the requisite information avail-



**Figure 2 Evolution of Statoil's Organization Structure in 1990s. (a) Statoil's Organization Chart in 1990; (b) Statoil's Organization Chart in 1998. Sources: Statoil Internal Documents**

able online to the extent possible. This would allow individuals and teams to move around the company without having to carry any documents because they could sit in any flexible office, log on to the network, and access the information they need. All they would need to carry was a mobile phone. Ms. Abelsnes commented, 'We feel that this solution will make information more available to everyone. It will partly reduce the amount of private archives that people keep in their offices.'

The OF team also wanted to explore 'working from home.' Ms Abelsnes explained 'as we went along, we were also interested in trying out working from home... The prime motivation was to create flexible working solutions for people. We wanted to see how working from home would fit in with the flexible office solution and if people would like it.' In the past, senior managers and engineers had been able to work from home using portable PCs and dial-up connections to Statoil. However, these were ad hoc

working from home solutions offered only to senior staff. The OF team wanted to test out the concept systematically as an integral part of the flexible office initiative. However, the human resources (HR) department opposed the idea. During the ad hoc working from home practices, the HR had become aware that labor unions would bring up issues about working from home such as number of hours worked from home, overtime compensation, quality and safety of work environment at home, insurance, etc. The HR ruled out the practice or even exploration of working from home at Statoil until it reaches an agreement with the unions on a working from home policy. Thus, the OF team was not able to experiment with the working from home concept in 1996.

### Enhancing IT Skills

Later in 1996, Statoil decided to make home PCs available to all employees in order to enhance their



IT skills. Mr Pettersen explained, 'The home PC initiative came into being as a proposal from various parts of the company during the formulation of some targets for the year 2000. Our CEO asked, "Well, what will be our ambitions for the next millennium, and what will it take to meet those ambitions?" One of the suggestions was to make home PCs available to employees in order to get them to become more proficient and prepared for a world that we all knew was coming... Many of our employees, especially those working offshore on our platforms for oil and gas installations, were not accustomed to using IT in performing their work on a daily basis. We felt the need to familiarize them more with the use of IT. We found that one way to do this is to make PCs available to everybody.'

Following this decision, Statoil made an offer to all its employees that entitled them to receive a multimedia PC, a printer, an ISDN connection, and a free subscription to the Internet, all for use at home. PCs came with Windows 95® and Statoil's standard office software from Lotus®. In exchange, employees were required to undertake a training program in their non-work time to learn how to use the computer, the Internet, and Statoil's standard office software. Nearly all employees (99 per cent) accepted the offer.

The implementation was swift. Statoil commissioned Telenor, the Norwegian Telecommunications Company, for installing the PCs and ISDN lines in the homes; and ISI, a consulting company, for administering the training program. Rollout of about 11,000 PCs and ISDN lines in Norway, Sweden, and Denmark was completed within six weeks. This was the biggest and fastest operation of its kind in these countries. During the summer of 1997, a total of 13,000 Statoil employees around the world received their home PCs and networked. This unprecedented home PC initiative created an IT infrastructure that goes beyond Statoil offices to reach into the homes of employees across nearly all of the countries where Statoil has operations.

## Working from Home Initiative

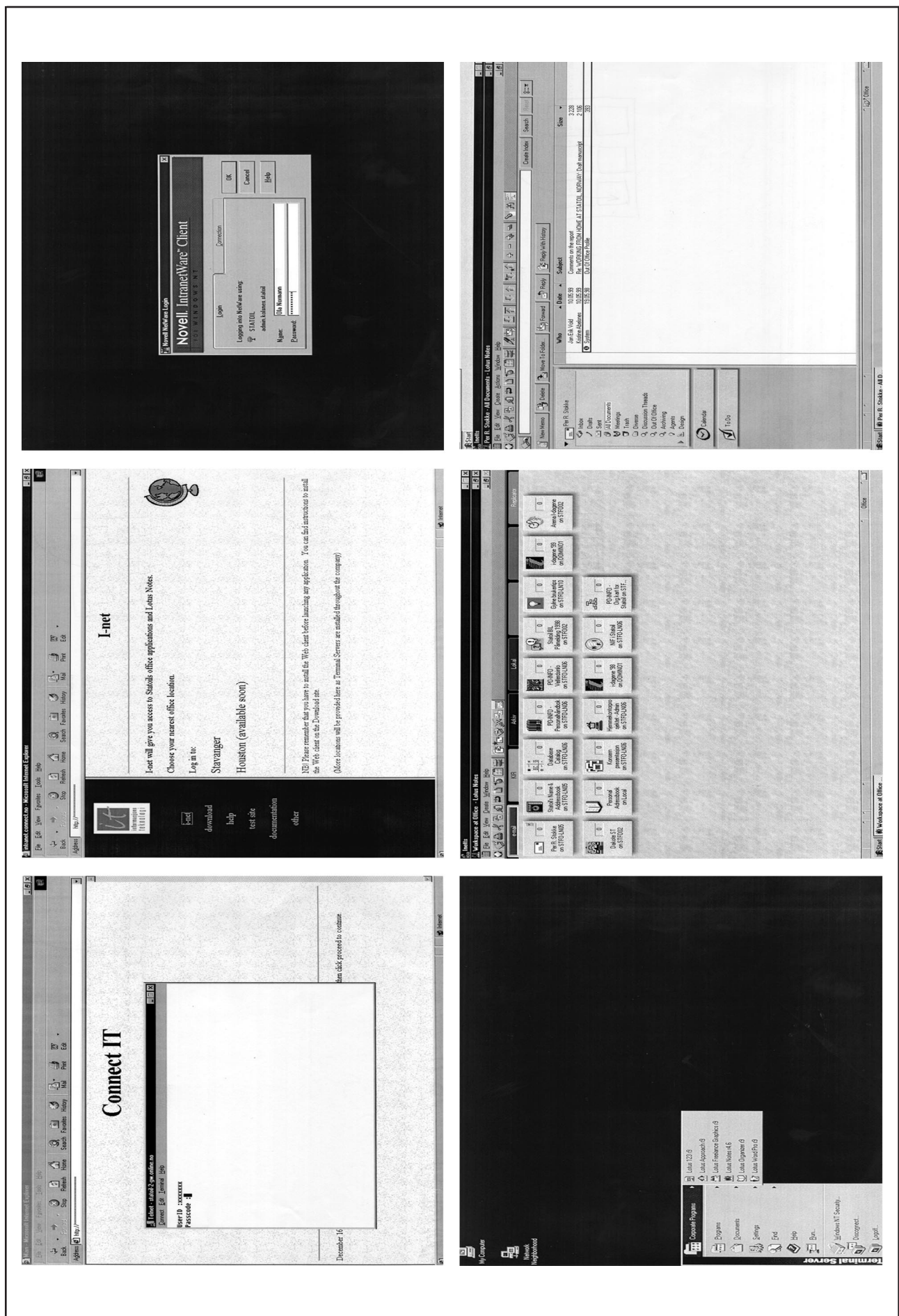
Soon after receiving the home PCs, many employees began requesting connections to Statoil to access their e-mail and work from home. Ms Abelsnes explained, 'When the home PCs were installed, a lot of people approached the IT department to say, "Well, this is very good, but we would like to be able to connect to Statoil's network as well."' Availability of PCs and high bandwidth ISDN lines at homes and the demand for working from home would have serious implications for the IT infrastructure and new forms of working. The HR department was reluctant to allow employees to work from home via home PC connections. They were concerned that employees might perceive this as a conscious decision by Statoil

to penetrate into private lives of employees and to make them work from home during their leisure time. However, the IT department saw the demand as an opportunity to develop a standard working from home solution, and then sell it to all interested departments.

## Selecting the Technology for Working from Home

Despite some understandable opposition from the HR, the IT department started exploring technical solutions for working from home. Ann Kristin Olsen, an IT professional responsible for IT infrastructure product and services, reported, 'We needed a solution for the home PCs... We wanted a solution that works better than the dial-up solution...' WinFrame® technology from Citrix® met their needs: WinFrame is a client-server system software that enables clients to access Windows applications from virtually any type of network connection. Statoil uses WinFrame to connect home PCs to its Windows NT® networks through a secure interface over ISDN-based Internet connections. In a typical session, an employee uses the home PC to connect to the Internet, enters a password to go through Statoil's firewall, and then accesses the WinFrame server. All applications run on the WinFrame server. The WinFrame client on the home PC acts as a graphical display terminal. It takes mouse and keyboard inputs and sends them to the server. The server takes screen shots (frames), compresses and sends them back to the client. Hence, the WinFrame solution enables employees to gain access to all applications installed on the WinFrame server (e.g., Lotus Notes e-mail; collaboration and information databases; Lotus SmartSuite applications; and Mainframe) from home through the same interface that they use at the office. Figure 3 depicts some screen shots taken from a home PC. The first row of pictures illustrates how home PC users connect to the WinFrame server at Statoil via the Internet. The second row of pictures shows the user interface as experienced by home PC users in accessing applications on the WinFrame server. WinFrame also enables IT professionals to deploy, manage, and support the applications from a single point.

Ms Olsen explained why they preferred the WinFrame solution, 'You don't have to distribute applications into the home PCs — for instance the Lotus Notes client or Smart Suite applications — because all of them reside on the WinFrame server. All you need on the home PC is the WinFrame client, Internet access, and TCP/IP. So, it is very simple to distribute the solution. That was the main reason for choosing the WinFrame solution. All other solutions that we looked at and the dial-up solutions that we already had, required a Statoil configured PC with a lot of products and applications on it. The WinFrame solution was cheaper than the dial-up solution.'



**Figure 3 Screen Shots from the Home PC**



### **Pilot Testing Working from Home — Phase I (October – December 1997)**

After selecting the technology, the IT department started a pilot project to test it, and invited Ms Abelsnes to manage the project. She accepted the offer because her OF team was already interested in exploring working from home. They also invited the HR department to become involved in the project. According to Ms Abelsnes, 'the HR suddenly became very interested because they knew that when they started negotiations with the unions the questions of compensation, insurance, and things like that would be raised. They would have to come up with some answers pretty soon.' Jan-Erik Vold, an HR representative reported, 'the home PC initiative has had very much impact on working from home at Statoil. For the first time, we started having some structured discussions with the unions about this kind of work... We wanted to go on with the pilot project to gain experience. That way [by showing how employees feel about it], we may have the acceptance from the unions to go ahead [with working from home].'

A project group was formed to oversee the project. It had representatives from the IT and HR departments, and the OF project. According to Ms Abelsnes, 'the objective was to try working from home as a new work form; to get some experience, see how it works, how it affects the way employees work and communicate with their managers and co-workers.' She was hoping that participants would work at home during regular office hours some days of the week or parts of the days instead of working from home as a supplement to regular office hours. About 20 volunteers were selected from the IT and document services departments to participate in the pilot project.

After running the pilot for about one and a half months, the project group evaluated experiences to date. Ms Abelsnes reported, 'Most of the participants, actually, all of them were very much happier. They thought it gave them great flexibility, they worked more effectively, and they could plan their workdays better when they worked at home. The family loved it too. The only thing they did not like was that it was a bit harder to draw the line between private life and work life. Other than that everything was just glorious.' However, the project group interpreted these outcomes with caution. Ms Abelsnes stated, 'We thought this is too good to be true! It cannot be all that good!'

### **Pilot Testing Working from Home — Phase II (March – June 1998)**

The project group thought that the outcomes of the pilot might have been due to the euphoria about working from home. Participants had used this opportunity for only one and a half months. Therefore, they thought that the concept would need to

be tested more systematically. In early 1998, the IT department extended the pilot into a second phase in which the WinFrame connection would be offered to about 500 employees and run for three months to test how the technical solution performs under an increasing number of users. This extension provided the project group with an opportunity to examine outcomes of working from home with a larger sample and over a longer period of time. They brought Ann-Merete Haaland, a social anthropologist, into the group to develop an evaluation survey to be administered at the end of phase II. Ms Haaland reported, 'we are going to look at human behaviors around working from home. We are going to use the evaluation survey to decide [whether and] how we are going to practice working from home in Statoil.' The project group also allowed our research team to conduct an exploratory case study of the working from home initiative for gaining more insights into the working from home practice and understanding its outcomes. As described in Sidebar 1, the project group allowed us access to its members, meetings, documentation, and participants of the working from home trials.

### **Selecting Participants**

The IT department invited all departments to nominate candidates for participation in a three month working from home pilot. Participation was voluntary. The IT department would provide all necessary software whereas the departments would pay for communication costs over ISDN lines. About 40 departments nominated a total of 546 participants (see Table 2).

Our assessment was that nominations were made on a 'need to work from home' basis. Mr Pettersen stated, 'we selected people who do a lot of traveling, people who work a lot outside the office.' A department manager reported, 'we decided that most of the managers and engineers who use PCs intensively during working hours should have the opportunity to work from home instead of going to work in the evenings or weekends.' Employees with babies also received priority. A civil engineer reported, 'Having a little baby, it was a necessity for me to stay home to take care of the baby. My boss and I realized that the possibility of working from home would allow me to leave the office early and still do some work at home.'

By March 1998, all 546 participants received their WinFrame connections. The project group sent out an electronic memorandum to participants to ask how much they intended to use the WinFrame connection per week. Table 3 presents the options given and the number of participants selecting each option. The project group was hoping that the majority of participants would want to work from home systematically one or more days a week (category 4). However,

**Table 2 Distribution of Participants by Department**

Departments	Number of participants	Percentage
Information Technology	125	22.89
Exploration and Production Technology	92	16.85
Oil Operations	51	9.34
Natural Gas Marketing and Supply	46	8.42
Oil Trading and Supply	26	4.76
Natural Gas Production and Transport	25	4.58
Marketing	18	3.30
Natural Gas Business Development	15	2.75
Exploration and Development Norway	14	2.56
Corporate Strategy Development	12	2.20
Better and Faster Administration project	11	2.01
Research Center	11	2.01
Corporate Accounting and Tax	11	2.01
Other departments (25)	89	16.30
Total	546	100.00

**Table 3 Pre-trial Intentions of Participants in using the WinFrame Connection**

Categories	Number of participants
1. I will participate in the project to test out the technical (WinFrame) solution	200
2. I will use the WinFrame connection primarily to do minor work such as doing my e-mail outside of regular work hours	175
3. I will use the WinFrame connection to work from home some days or parts of days as I need, but otherwise to do minor work such as doing my e-mail outside of regular work hours	150
4. I will use the WinFrame connection to work from home systematically, and I intend to work from home one or more days a week	9
Total	534

as Table 3 indicates only nine participants intended to do so. Ms Haaland commented, 'We were a bit disappointed. What would we do now?' The project group decided to go ahead with the second phase, but to administer the evaluation survey only on those participants who intended to work from home systematically during regular office hours (categories 3 and 4 in Table 3).

## Evaluating the Technical Solution

In general, participants were satisfied with the technical solution. Although some of them initially had difficulty in logging on to Statoil's servers, technical glitches were resolved pretty quickly. Ms Olsen reported, 'from the IT perspective, the main reason for running this pilot was to see how the technical solution actually works with a lot of users on it... It has been extremely stable. I mean, I've been working on the infrastructure for some years, and I've never seen a new product that has been working as stable as this.' Participants were able to access from home many of the databases and application software that they need. A gas dispatcher reported, 'I can't reach all programs. But, I can reach the programs that I mostly need.'

Some participants cited response time as a limitation of the technical set-up. A mechanical engineer explained, 'First of all, there is quite a tedious log-on procedure, and then, it takes time to access databases because it goes through the Internet connection. The system is not as quick as it could have been.' Although home PC connections were slower compared to the speeds achieved at the office, participants who work in Norway did not see speed as a significant barrier. However, speed was perceived to be a significant barrier in Statoil offices outside of Norway. For example, Heljar Ballo, IT manager at Statoil Germany reported, 'I have used it very little because the technical solution was not good enough here in Germany. We connect first to [Statoil] Norway via the Internet, and then back to our server here over [Statoil's] internal network. The response time has been very bad. I think that is mostly due to German telecom. Internet solutions here in Germany are too slow. When I spend ten minutes to log onto the system, I get a little bit fed-up.'

Ms Olsen explained that expanding the geographical coverage of WinFrame is a challenge, 'Today, everyone who runs the WinFrame solution needs to access the server here in Stavanger. It is rather silly if you are using it in Germany, UK, Asia, etc. We need to implement this infrastructure all over our network. Implementing it in a safe and secure way without losing the functionality we have today will actually be a challenge because we need gateways to the Internet, firewalls, and everything.' Another IT professional summarized, 'The technical issue is to be able to verify whether the WinFrame solution can be scaled up to the whole company...'

## Evaluating the Outcomes

The project group administered the evaluation survey on participant categories 3 and 4 at the end of the second phase. 127 out of a total of 159 respondents



**Table 4 Demographics of Respondents of the Post-trial Evaluation Survey**

Characteristics	N	Percentage
Gender	127	
Female	32	25
Male	95	75
Age	127	
Less than 35	23	18
Between 36 and 50	84	66
Greater than 50	20	16
Education	127	
High school or equivalent	11	8.7
College or equivalent	38	29.9
University or equivalent	74	58.3
Other	4	3.1
Position	125	
Non-manager	60	48
Manager	65	52
Compensated for overtime	113	
No	95	84
Yes	18	16
Children less than 6 years old	121	
No	72	60
Yes	49	40

Source: post-trial evaluation survey.

returned the surveys (80 per cent response rate). Table 4 presents demographics of the respondents.

Table 5 summarizes WinFrame usage patterns and home office conditions whereas Table 6 presents responses to survey questions tapping the outcomes of working from home. As Table 6 indicates, participants perceive that their managers, co-workers, and families have positive attitudes towards working from home. They feel that they have better contact and cooperation with managers, co-workers, and external contacts (e.g. suppliers, vendors, customers, etc.) when they work from home. Although they perceive their workload to be the same as in the office,

**Table 5 Description of Usage and Home Office Conditions**

Questions	N	Percentage
How long have you had a home office?	125	
6 months or less	87	68.5
Between 7 and 10 months	18	14.2
More than 10 months	20	15.7
How much on average do you work from home per week?	124	
4 hours or less	71	57.3
5–9 hours	31	25
10–14 hours	15	12.1
15 hours or more	7	5.6
When you work from home, do you work full day or part of the day?	112	
Part of the day	86	76.8
Full day	26	23.2
Do you have a separate room for your home office?	119	
No	41	34.5
Yes	78	65.5
Do you have the necessary equipment at home to do your job?	113	
No	22	19.5
Yes	91	80.5

Source: post-trial evaluation survey.

they feel that they can plan a workday more easily and work more effectively at home. However, participants feel that drawing the line between work and private life becomes more difficult when they work from home.

### Does the Place of Work Matter?

Working from home has been used primarily as a supplement to rather than replacement of regular

**Table 6 Outcomes of Working from Home**

Scale ranges	Survey questions	Mean	Std
1: very negative	Family attitude towards home office	3.87	0.70
5: very positive	Manager attitude towards home office	3.80	0.65
	Co-worker attitude towards home office	3.41	0.60
1: much worse	Contact and cooperation with colleagues now versus before home office	3.07	0.51
5: much better	Contact and cooperation with managers now versus before home office	3.05	0.33
	Contact and cooperation with external contacts (e.g., suppliers, vendors, customers)	3.15	0.60
1: much lighter	Workload now as compared to what it was before the home office	2.97	0.77
5: much heavier			
1: much less	Difficulty of planning the workday at home versus office	2.16	1.0
5: much more	Effectiveness of work at home versus office	3.65	0.79
	Difficulty of drawing the line between work and private life now versus before home office	3.38	0.70

Source: post-trial evaluation survey.

office hours. A finance manager reported, 'I don't work at home during the day. I only use it in the afternoon to expand my working hours.' A marketing manager explained, 'I had no thought of working at home on a full-day basis. My motivation was to be able to work on the long list of e-mail messages from home instead of having to spend an extra hour or two at the office to work through my incoming e-mail, and to be able to leave the office at a normal time.'

Participants have difficulty in working from home during regular office hours because current work organization in their departments emphasizes collocation and face-to-face interactions with co-workers. Kjell Dalseth, vice-president of the tax department explained, 'in the tax department, we are discussing matters in face-to-face meetings. It would be difficult to have discussions with colleagues if they worked from home. They wouldn't be available for meetings at short notice. We have discussed whether our staff should work from home... The need for internal discussions and the need to be available in meetings at short notice make it difficult to spend too much time in the home office. We think that it's more creative and efficient to work together in the offices. That's the conclusion, at least so far, within our department.' Another manager explained, 'In the gas sales department, we set up guidelines saying that you could spend, sort of a core time at work [9 a.m. – 3 p.m.] to be available for meetings, etc., and then you could work from home outside of that core time.' Many participants who hold managerial positions reported that they had to be at the office during regular work hours. One of them explained, 'I have to be available for discussions and meetings... I need to see people. I need to talk face to face. As a manager, you can't just stay at home.'

Lack of social interactions was another reason for avoiding work at home during regular work hours. The finance manager explained, 'I don't want to work at home during business hours. I think it is very lonely to work at home all day. I want to work at the office because of the social contact... I don't think that doing e-mail all the time can replace the personal contact.' A financial comptroller summarized the general expectation of participants, 'I would like to have working from home as an option. I think working from home can be used in combination with working at the office. Say, I have some work to do. I can just finish a bit earlier at the office, and then I can continue at home in the afternoon. So, it leaves me with more flexibility. That's how I hope this can work in the future.'

### Types of Work Performed At Home

Our interviews indicate that the WinFrame connection allows participants to perform three types of work at home: (1) coordination of work; (2) staying

current with developments at work; and (3) reading, writing, reflection, and thinking activities that require concentration in peace and quiet.

E-mail is the major mode of communication at Statoil. On average, our informants receive 35 e-mails and spend two hours on e-mail per day. They use e-mail for planning, delegating, coordinating, and executing their work activities. A geologist explained, 'I receive a lot of e-mails from my boss, people in the department, or people offshore. When I come to work in the morning, there's a lot of e-mail I have to take action on. So, I start off by checking what I need to do.' The WinFrame connection allows participants to do these activities from home, and hence speeds up the process of responding to important issues, as explained by the marketing manager, 'I always check my e-mail box and see if I have anything urgent. Normally, I do the most urgent e-mails from home and leave the rest for the morning [at work].' Being able to coordinate work via e-mail in advance of the workday is critical especially for managers. A department manager explained, 'I'm very busy during the day in meetings. I use the home PC to read and answer e-mail that I cannot do during the office hours. It allows me to be better prepared for the coming workday. If I'm traveling, I can go in and read my e-mail and keep my workplace up.' Mr Pettersen agreed with this view, 'for many of us, much of the office hours are spent either traveling or in meetings. So, it's an advantage to have the possibility to do any other work from home.'

Participants, who work shifts or do extensive traveling, use the WinFrame connection to stay in touch with work. A platform manager explained: 'I am a platform manager. There are three people sharing the same job because we are working shifts... We work two weeks on the [offshore] platform, one week in onshore offices, and then we are off-duty for three weeks. We often have a need for coordinating our views when we have a problem [on the platform]. If the guy on the platform wants to hear views of the other two guys, he just sends the background information to the home PC; we read through it, and just give a quick yes or no, agree or disagree.' The gas dispatcher, who also works shifts, expressed a similar motivation; 'I work day, evening, night, and also weekend shifts. Therefore, I have a lot of [off-duty] spare time. Sometimes, I'm off for seven days. That is a long time if you can't follow what's going on at work. So, I use the WinFrame connection to read e-mail and Lotus Notes databases to see what's going on at work.'

Many of our informants stated that they prefer to work from home when they need to concentrate in peace and quiet. An IT project manager explained, 'When I work at home, I discover that I can sit down quietly, and work for two hours intensively without being interrupted. I get almost no phone calls; and I can work efficiently. Here at work, a lot of people are

coming by to ask questions, to ask for help, and discuss stuff. So, I can't work for more than 10 or 15 minutes. I am interrupted all the time.' A chemical engineer echoed this sentiment, 'since I became a sector manager, I've got a lot of disturbances because of so many phone calls, and people coming into my office every day. It is very difficult to concentrate if I am trying to write something. So, that is easier to do at home.' The geologist reported, 'my normal working day is rather hectic. It is very difficult to concentrate on a task during the day. So, I normally take that kind of task home. My general feeling is that I concentrate better [at home].' The civil engineer summarized, 'I use the home office for writing, putting together a presentation, or thinking, or trying to crack some issues, or to understand some issues...'

### **Blurring Boundaries between Work and Private Lives**

As a technician put it, 'managing the separation between work life and private life is a problem' due to the mere availability of the WinFrame connection. The geologist reported, 'the WinFrame connection has made my mailbox more accessible than it was before. It's tempting to go in and check e-mail... If I see that there is something to take action on, I do it!' An engineer reported, 'there is kind of a spiral of more, and more, and more work. I see the risk of getting engaged in this spiral because it's so much easier to just get in the system and check your e-mail... Sometimes, I force myself to disconnect.' Another engineer illustrated the problem with his own experience, 'I was thinking of reading e-mail before or after seeing a television program or doing my exercise. When I read e-mail at night, there might be some problems in one of those e-mails, and I think about that when I go to bed. So, I cannot relax the way I need to relax. I know there is always e-mail that I can read. I just don't do that anymore because I can never relax.' A manager warned, 'if you are really crack on the home PC, it can easily take almost all of your spare time.' The geologist suggested, 'You shouldn't let the work steal all of your private time. I think you need to find a balance between work and time off.'

### **Is It Working?**

In general, participants were happy with the overall benefits of the working from home possibility. As one manager put it, 'obviously, it occupies more of your off-duty time, which it did not before. You are, sort of, tightly connected to work — thinking all day. But, if you weight advantages against disadvantages, I think, the sum is plus.' 97 per cent of survey respondents stated that if Statoil offers working from home as a possible work form, they would like to take advantage of it. Our informants predicted that work-

ing from home would become more widespread at Statoil in a few years. The gas dispatcher stated, 'It is quite a new experience. But it is a good experience. I think that in the future probably everybody is going to use it.' A computer engineer predicted, 'I think that eventually everyone, who wants, will have this kind of access.' Mr Pettersen reported, 'I think it will come more and more. But, I think we need to take the time to see how we can best utilize it, and how we can combine it with working in the office. As our organization flattens out, and as we organize according to work processes, and also in teams, we not only need to have electronic contact with people, but also physical contact for certain types of work and discussions.'

Members of the project group made similar predictions. Ms Abelsnes stated, 'Statoil will not force people to work from home. My expectation is that it will make it available to people who want it. But, I don't think that working from home will be a right for employees. It will be up to the departments to decide whether or not their employees should get it.' Vold echoed this view, 'My position, without talking to the unions about this, is that we will really have working from home as a new way of working at Statoil. It will not be a project any more. It will be an accepted way of working. My position, and the HR position, would be that it is not a right for employees to have the working from home possibility. It should be up to the departments to decide if their employees should have this opportunity. I want every manager to have his own discussion within his department to see if working from home could support their business. If it supports their business, then it is OK for employees to work from home.'

### **Challenges Ahead**

As our data collection came to a conclusion in Fall 1998, Statoil was getting ready to make a decision on the future of working from home as a new work form. From the IT perspective, the challenge was to scale up the WinFrame solution across the geographic span of Statoil. From an organizational point of view, the challenge was to integrate working from home into existing ways of working at Statoil. From the HR perspective, the challenge was to reach an agreement with unions on a working from home policy clarifying issues such as number of working hours at home, payment for overtime work, provision of office equipment to homes, insurance coverage for work at home, and coverage of communication costs.

### **Redefinition of Work in the Knowledge Economy**

Statoil's home PC initiative is distinctive in two ways. First, Statoil has pioneered an innovative approach



for enhancing IT skills of its employees by launching this initiative. The home PC has allowed employees to play games, navigate the Internet, communicate, and perform information processing activities in their non-work time. Hence, it has enabled employees to naturally acquire IT skills that they can leverage in their work. Our interviews indicate that home PCs have already enhanced IT skills of the employees. For example, an IT manager stated, 'I would absolutely say that we do observe the improvement in IT skills... After we got these PCs at home, I have seen a very rapid development in the IT knowledge among our employees.'

Second, through the home PC initiative, Statoil has in effect created a new work infrastructure that extends into the homes of its employees. This gives Statoil the opportunity to tap into skills and expertise that are otherwise unavailable due to time and location dependencies of work. By making state of the art technologies available at home and providing employees with the possibility to work from home, Statoil can attract best talents into its human capital (Stewart, 1997). For example, John Browne, CEO of BP Amoco plc, remarked, 'By allowing us to stay on the leading edge, distinctive technologies of all kinds help us attract and retain the most talented people' (Prokesch, 1997). As discussed below, Statoil can potentially utilize this new infrastructure in improving its administrative efficiency and leveraging its knowledge assets effectively. By enhancing the IT skills and expertise of its employees and building an infrastructure that makes work location independent, Statoil not only enhances its ability to compete in the

emerging knowledge economy but also creates an organizational capacity for transforming its business.

### Working from Home: Where Does IT Fit In?

In the industrial economy, the locus of work was the factory floor because value and growth came from productivity increases in production work, i.e. highly structured and repetitive work activities that have tangible inputs and outputs. In the information and knowledge economy, value and growth no longer come from production work but from knowledge work, i.e., unstructured, non-repetitive, complex problem identification and solution activities that result in innovative products and services or creates new ways of exploiting markets (Drucker, 1991). Hence, the locus of work has shifted into the office. But now, IT infrastructures, such as the one being developed by Statoil, free the employees from time and location constraints of the office in conducting value adding administrative and knowledge work activities. They can now work during or after regular work hours at office, at home, or at any location within the reach of the extended IT infrastructure. Consequently, the locus of work and the traditional boundaries between work and private lives become blurred.

The Statoil case indicates that working from home may be a planned or emergent knowledge management strategy of a firm. By combining the literature on virtual work with insights from the Statoil case, we developed a framework for conceptualizing the

		ROLES	
		Role as an individual	Role as member of a team or task unit
GOALS	Knowledge effectiveness	Leverage subject area expertise of the individual; enhance knowledge as a corporate asset.  Benefits: operating efficiency and effectiveness.  Technologies: home PC, access to the firm's network, and real time collaboration technologies such as videoconferencing.  (III)	Enhance process effectiveness; truly leverage enterprise expertise.  Benefits: enhanced business performance  Technologies: availability of home PC, access to the firm's network, and real time collaboration technologies such as videoconferencing is extended to a critical mass of users across geographic span of the firm.  (IV)
	Administrative efficiency	Extend the workday; provide flexibility.  Benefits: individual job satisfaction.  Technologies: home PC, dedicated or dial up access to firm's network.  (I)	Speed up the process; reduce travel costs.  Benefits: operating efficiency.  Technologies: availability of home PC and access to firm's network is extended to a critical mass of users across geographic span of the firm.  (II)

**Figure 4 Working from Home as Part of Firm's Knowledge Strategy**

working-from-home strategy. As illustrated in Figure 4, firms can use working from home to enhance administrative efficiency and/or knowledge effectiveness of their employees at individual, team or task unit levels. Below, we describe different types of working from home strategies, their benefits and technology requirements.

*Individual administrative efficiency (cell I):* Individuals use working from home as an extension of the workday to complement their individual work. This type of working from home enhances individual efficiency by allowing individuals to better juggle their work and private life priorities, catch up with the workload, and eliminate the need to commute to the office for overtime work in the evening or weekends. Hence, it contributes to job satisfaction, professional development and success of individuals. Here the goal is productivity of employees rather than reduction of real estate costs observed in the majority of home office projects (Davenport and Pearlson, 1998). Depending on their personal preferences related to lifestyle employees may want to forego office politics and interruptions for working in the more relaxed environment of the home (Olson, 1987). This allows the firm to retain talented and knowledgeable employees by offering them flexible work forms. For example, Richard Karl Goeltz, vice chairman of American Express, states, '...we might be able to attract people with proven records of success who can't or won't move to our office sites' (Apgar, 1998). The enabling technologies are home PC; dedicated or dial-up access to the firm's computer networks; an extra phone with voice mailing and call transfer functionality; and other office equipment such as fax machine, printer, etc. The technology setup at home tries to emulate the set-up at the office in terms of access to e-mail, databases, and other software at comparable speeds and through a similar graphical user interface.

*Administrative efficiency in teams or task units (cell II):* A critical mass of employees uses working from home as an extension of the workday to complement their work. They use the technology to overcome time and space barriers to staying in touch with work and coordinating work activities. By using remote connections to the office, they are able to plan, coordinate, delegate, and execute their work activities from home outside of regular work hours. Collectively, they speed up the work processes and increase operating efficiency of the firm. The technology requirement is the same as in the first cell, but the setup needs to be extended to a critical mass of employees across the geographic span of the firm. Telemedicine is a good case in point for this type of remote work although it has not diffused into the homes of physicians or patients yet. Medical institutions use telemedicine to streamline referral processes and efficient delivery of care within an integrated health delivery network (IHDN). For example, physicians at community hospitals use telemedicine

to connect to academic medical centers in the IHDN to get second opinions on their patients before making diagnosis or treatment decisions or referring them to the academic medical center (Tanriverdi and Venkatraman, 1999).

*Individual knowledge effectiveness (cell III):* Individuals are able to contribute their expertise to tasks and activities inside a firm by collaborating on knowledge-intensive activities; participating in new product development, customer complaints handling, and problem-solving etc. Here, time and physical location are not constraints. Individuals can choose the most appropriate time and place that maximize their operating efficiency and effectiveness. They can work from home during or after regular work hours to concentrate on creative reading, writing, and problem-solving activities in peace and quiet. The benefit is increased operating efficiency and effectiveness. For example, 87 per cent of IBM employees participating in a 'Mobility Initiative' stated that their personal productivity and effectiveness in the job have increased significantly (Apgar, 1998). By using this form of remote work as part of regular tasks (electronic teams) or for tapping into subject area expertise of outsiders, the firm can leverage its knowledge assets and gain operating efficiency and effectiveness. Richard Karl Goeltz, vice chairman of American Express, states, '...We can draw from a broader pool of people because our employees can be in many locations' (Apgar, 1998). Since much of individuals' expertise may be in tacit form, the technology set-up in the first cell may need to be supplemented with collaborative technologies (e.g. videoconferencing) that facilitate sharing of tacit expertise (Henderson *et al.*, 1998).

*Knowledge effectiveness in teams or task units (cell IV):* A critical mass of individuals is able to collaborate on knowledge-intensive activities regardless of their physical location. Their virtual interactions overcome physical location barriers to knowledge exchange, interactive problem-solving and joint decision-making. The firm can truly leverage its enterprise expertise, enhance its processes, and improve its business performance. For example, BP Amoco created a *virtual team network* by using desktop interactive video communications via ISDN lines, Lotus Notes databases, and whiteboards that can be shared by multiple users. This network connects together experts in offshore platforms and offices in continental USA, Alaska, the UK, Asia, and Latin America. It allows BP Amoco to leverage knowledge and expertise of its employees in solving problems in its oil fields (Storck, 1997). After deployment of this network, person-hours in solving problems declined due to increased virtual interactions among land-based drilling engineers and offshore rig crews. Virtual interactions also contributed to a reduction of the number of helicopter trips to offshore oil platforms. In construction projects, rework was reduced because the *virtual team network* enhanced virtual collabor-

ation among designers, fabricators, construction workers, and operations people. A refinery shut-down was avoided because technical experts at another location were able to use the *virtual team workstations* to examine a corrosion problem remotely (Prokesch, 1997). By this remote work capability, BP saved \$50 million in its Schiehallion oil field alone (Currie, 1998). Technology requirements for this type of remote work are similar to those in cell III. However, availability of the technology should be extended to a critical mass of employees, and to key business partners and customers across the geographic span of the firm (Davidow and Malone, 1992). For example, BP Amoco extended its *virtual team network* to its partners (e.g. Shell in the Gulf of Mexico) and subcontractors (e.g. Brown and Root in the North Sea) in order to leverage their knowledge effectively in its operations (Prokesch, 1997). However, such technologies should be used for supplementing rather than replacing face-to-face interactions among team members altogether because they may lose some intangibles during their virtual interactions when they do not have the opportunity to meet face-to-face on their tasks (Sproull and Kiesler, 1992).

#### Working from Home At Statoil: Administrative Efficiency or Corporate Differentiation?

Statoil's working from home initiative has been an emergent, bottom up outcome of the home PC initiative. By responding to employee demand and creating the technical infrastructure for working from home, Statoil has mainly enhanced administrative efficiency, and to some extent knowledge effectiveness, of some of its employees. As Figure 5 depicts, Statoil started in cell I and it is currently moving into cell II in our framework. Statoil have not yet moved into implementation of working from home at team or task unit levels. While participants feel that they work more effectively at home, as indicated in Table 6, they cannot utilize this opportunity fully. Since traditional work forms at Statoil emphasize co-location and face-to-face interactions, when they work from

home participants have difficulty in maintaining virtual interactions and virtual co-presence with their colleagues at the office. Therefore, the majority of them use working from home as a supplement to work at the office rather than using it as an alternative work form that enhances business performance. Statoil needs to discover ways of integrating face-to-face and virtual interactions within teams and task units for exploiting the real potential of working from home and differentiate itself from competitors. Statoil can move into the third and fourth cells in our framework by offering working from home to a critical mass of users across its geographic span and integrating it with its broader IT-enabled initiatives such as the 'office of the future' and 'better and faster administration' projects. As the experience of BP Amoco with virtual team network concept suggests, the need for physical presence and face-to-face meetings at the office or at offshore platforms could be reduced if home PCs were supplemented with videoconferencing, electronic whiteboard, and groupware technologies.

#### Appropriate Types of Work and Employees for Working from Home

Our interviews indicate that currently employees who benefit most from the working from home possibility are those who need to stay in touch and coordinate work remotely since they travel or work shifts or those who need peace and quiet to work on creative activities. Managers who spend regular work hours in meetings or on travel use the home PC connection to plan, decompose, and e-mail tasks to their staff from home, in advance of the workday, so that the staff can carry on the work without their assistance. Employees who are often distracted at the office use the home office for concentrating on creative activities in peace and quiet. Given the current difficulty of integrating face-to-face and virtual interactions, we believe that until that integration happens, working from home will be most appropriate for employees whose tasks are relatively less dependent on others, and hence, portable to home.

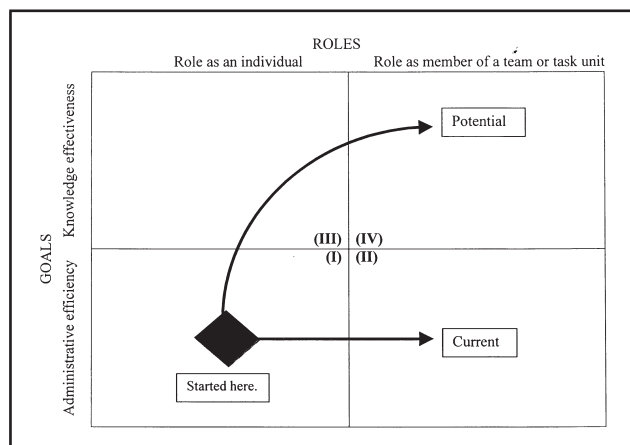


Figure 5 Mapping Statoil's Current Initiative

#### Evolution of the Technical Infrastructure for Working from Home

By connecting home PCs to its servers over ISDN lines and providing the WinFrame interface, Statoil extended its enterprise IT infrastructure into the homes of employees. This set-up makes location of work (office versus home) transparent to employees in accessing IT resources of the company. Reliability of the extended IT infrastructure during the pilot projects provided some evidence for proof of this concept. However, the pilot set-up had WinFrame servers only in Stavanger. Although employees were able to access the network from outside of Stavanger through the Internet, they experienced significant



delays. Making direct ISDN connections to WinFrame servers in Stavanger could solve this problem, however, cost would be prohibitive due to long-distance calls. Therefore, meeting the technology requirements of cells I and II requires Statoil to scale up the technical solution as well as the associated organizational support services across its geographic span. Moving to cells III and IV of the framework would require supplementing the technical solution with collaborative group support technologies (e.g. videoconferencing).

### Administration of Working from Home Practice

Despite initial reluctance of the HR, the home PC initiative moved working from home into human resource policy agenda of Statoil. Realizing that IT transforms how people work and impacts on human resource policy, the HR decided to collaborate with the IT department during the working from home pilot projects. We expect the impact on work processes and behaviors to intensify as Statoil scales up its working from home practice, and continues its efforts to fully exploit potentials offered by IT. Therefore, we believe that Statoil should institute a strategic community with members from HR, IT, corporate strategy, and other relevant departments and unions for administering exploration and institutionalization of IT-enabled work forms and associated human resource policies. Such strategic communities have proved to be effective in managing large IT infrastructures and creation and sharing of organizational knowledge among the stakeholders involved (Storck and Hill, 1999).

### Lessons for Other Settings

BP Amoco's virtual team network initiative was innovative in that it extended the scope and functionality of its IT infrastructure and enabled BP Amoco to leverage its expertise across its global operations without having to transport experts. Home PC and working from home initiatives of Statoil are innovative in that they extend the IT and working infrastructures of Statoil into homes of employees. This is not a simple extension that offers dial-up modem connections and text-based interfaces to a privileged set of senior employees and in a restricted geographical area. High-bandwidth ISDN connections and the graphical user interface enabled by the WinFrame® technology equip home PCs with capabilities of PCs at the office. These powerful home PCs are available to nearly all 18,000 employees of the company. We believe that Statoil's extended IT infrastructure provides a new work infrastructure that minimizes time and location constraints on working, learning, and innovation. It provides a *cyber ba*, a place of interaction in a virtual world instead of real space and time, that fosters knowledge sharing and

creation across the organization (Nonaka and Konno, 1998). As John Browne, the CEO of BP Amoco, notes, these innovative technologies and working platforms enable oil companies to attract the best talents, who are critical to their success in the knowledge economy, 'If we aren't regarded as leading edge, why would a graduate join us instead of Microsoft or Intel? We need the most talented people in order to build a distinctive organization' (Prokesch, 1997).

Although the Statoil case has unique qualities, several lessons can be drawn from the case for other settings. First, the unprecedented scale of Statoil's home PC initiative indicates that companies, which rely on the market for finding IT-competent employees, may be at a disadvantage compared to companies like Statoil, which proactively invest in IT skills of their employees. Second, providing employees with home PCs may create a playful learning environment for them to acquire IT skills that they can also use in their work. Making working from home voluntary may increase the chances of acceptance by employees. Third, extending the IT infrastructure into employee homes and making location of work (home versus office) transparent may enable firms to increase administrative efficiency and knowledge effectiveness in their current business and to become leaders in the knowledge economy. However, real potential of these extended infrastructures cannot be achieved unless firms institute new organizing principles that integrate virtual and face-to-face interactions. Finally, since IT continues to drive new work forms, HR and IT departments need to collaborate in exploration and exploitation of IT-enabled work forms and in development of relevant human resource policies.

### Acknowledgements

The authors gratefully acknowledge the support provided for this study by Boston University Systems Research Center and Statoil, Norway. The views and analysis presented in the study are those of the authors except for the views directly attributed to the interviewees of this study, which are quoted verbatim.

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1. and Commentators Thomas H. Davenport, Lee Sproull and John Storck

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## Case Commentaries by Experts in the Field

### Commentary 1

Thomas  
Davenport

First, the Statoil management team should be commended for their willingness to invest in and experiment with new ways of working and using information technology. I hope that their adventurousness was not the cause of recent turmoil within the company; I believe that had more to do with oil field investments than personal computer investments.

Beyond that, I see three key points that are illustrated by this case study and discussion. First, it shows how little we know about alternative work environments. Secondly, it suggests that how we want to work in

the future is intimately related to how we want to live in general. The third message involves the difficulty of creating broad policies on work arrangements.

Unfortunately, the Statoil managers had little research or insight to draw from in dealing with the very important question of how information technology can facilitate work at the individual level. Do individuals work more productively when they work at home? Do they lose touch with their office environments over time? Do virtual teams work more, less, or equally effectively than co-located ones? We know virtually nothing of the answers to these questions, and what we do know is probably highly idiosyncratic. That is, we have no reason to believe that previous experience applies to a Norwegian oil company. Practitioners have a great need for insights on these issues, and academics and researchers should be attempting to supply them at a faster pace.

Second, it's clear that the managers and knowledge workers at Statoil are using their home computers in a manner similar to those in many US-based organizations I've observed. The technology is being used to add to the office work day rather than to serve as an alternative to it. For several different reasons, employees often don't feel comfortable staying away from the office for long periods or even full days. In such cases they may extend their work hours into their home hours. There is clear evidence that the work hours of managers and professionals in the US are increasing, and increased information coupled with home or portable technologies must surely be a factor. It seems likely that workers and families will begin to resent this intrusion into the home and limit home IT use to extend the work day. Some companies, e.g., Hewlett-Packard, are beginning to try to discourage weekend e-mail access, for example. The Statoil employee who decided not to access e-mail before bedtime will, I believe, be a bellwether of attitudes to come.

Finally, the Statoil case illustrates the difficulty of creating company-wide policies for employee work arrangements. Whether or not home PC use, for example, succeeds for an individual employee is dependent upon such factors as:

- ❖ The employee's home situation with regard to young children, room layouts, etc.;
- ❖ The employee's ability and desire to work alone at least part of the time;
- ❖ The nature of the task in terms of need for social interaction vs. quiet contemplation;
- ❖ The ability of the employee's supervisor to supervise his or her work without direct contact.

Given all these diverse factors, it seems to be impossible to establish broad, blanket policies that