

# **Knowledge-based IT & software**

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## Preface – why a $\beta$ release?

Reports are meant to inspire discussion – hence, this “beta” release, indicating that this is not meant to be the final word on the Norwegian IT industry and its role in Norwegian society, but more a description, analysis and foundation for discussion about the industry’s future.

This report is, purposefully, not heavy on statistics. This is partly because others already produce those, but mostly because trying to say something definite with numbers about the IT industry is an exercise in definitions – how to draw the line between IT and telecom, IT consulting and regular technical or managerial consulting, IT products and IT services? Rather, I have followed a strategy of studying companies, typical and important, describing their trajectories drawing conclusions based on theory, patterns, interview data and, yes, some numbers. This has allowed me to capture some of the richness of detail and the speed with which the industry changes.

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I hope the following can contribute to the discussion about the future of the Norwegian IT industry, and, perhaps more important, the discussion about what role IT should play in Norwegian society.

## Executive summary, with policy implications

This report describes and analyzes the Norwegian IT industry, focusing on two categories of companies: Those that provide information technology as a product largely developed by themselves, and those that provide information technology services – mostly by taking foreign technology and making it available to Norwegian companies and organizations.

Contrary to Norway's classic knowledge hubs – petroleum, maritime, seafood – the Norwegian IT industry, though large, profitable, and knowledge-based, does not see itself as a hub and does not act like one. With a few exceptions (Horten, Trondheim) the Norwegian IT industry is overwhelmingly located in the Oslo area: Along Akerselven, in the City centre, at Skøyen, Lysaker and Fornebu. Few Norwegian IT companies paint on a global canvas, and those that do tend to be acquired by large international companies when they reach a certain size or maturity – growing out of Norway, as it were. In some cases, the companies continue and thrive in place, usually when they address a very specific global (GE Vingmed) or local (Visma) need, in others, they gradually disappear, subsumed into the acquiring organization (FAST into Microsoft development center Norway, Tandberg becoming a unit of Cisco, Trolltech becoming and part of Nokia and then sold to a Finnish software company).

The IT industry's main contribution to Norwegian society comes in two flavors: Firstly, it provides a group of companies (the large IT service providers and consultancies) with a body of knowledge on how to develop and implement information technology in Norway, increasing the country's productivity through smart use of administrative and customer-facing systems. The relatively large size of the consulting industry and the extensive use of consultants both by the public sector and the larger companies ensures that the scarce knowledge of IT development and implementation both can be nurtured and rewarded as a core activity inside specialized organizations, and also makes sure that this knowledge is available in a more flexible form than the rather rigid hiring and firing practices of Norwegian working life.

Secondly, the technology provided by the large, international technology providers, by the open source movement, and by administrative software providers ensures an available infrastructure for entrepreneurs in almost any industry: Few, if any, new startups today do not spend time on systems development as a major activity. Furthermore, extensive use of IT lowers the bar for starting new companies, both in terms of their relationship to the public sector, in their mobilization of resources, and in their access to markets. Thus, IT is, at the same time, a competitive arena and a coordination facilitator – an industry as well as an enzyme – in terms of increasing Norwegian innovative performance, productivity and competitiveness.

*We have to distinguish between IT as an industry and IT as an enzyme*  
Petter Merok, Microsoft

### ***Knowledge creation and dissemination***

Knowledge comes into the IT industry from three main sources: From foreign technology providers, from companies' own development work, and from academic research in Norway. The latter transfer mechanism happens largely through the production of graduates from computer science and engineering programs – the single-most scarce factor in the industry, underscored by practically anyone interviewed. Academic research in itself, with a few, celebrated examples such as Simula (University of Oslo) and search technology (from NTNU), is not tightly integrated with the industry. Companies are often started by students from the engineering schools and computer science departments, but faculty involvement is largely missing – with a few important exceptions – after the companies are formed. This is partially because contributing to industry goes against the culture of many academics – the universities and colleges do not recruit faculty with entrepreneurship in mind – and partly because company-specific knowledge quickly outruns the more general academic knowledge as soon as development speeds up.

### ***Industry challenges***

The IT industry provides a general purpose technology (Basu and Fernald 2008), where value creation is more visible in the industries that use it than in the technology industry itself. The industry is largely located in Oslo, finances its R&D out of own funds or general tax refund programs, and does not to a large degree partake in more long-term research funding. It is an industry where everyone competes and collaborates – there are few, if any, long-term collaborative patterns. The IT industry scores relatively low on several cluster dimensions, in particular knowledge dynamics.

The industry needs to raise its profile in order to do better recruitment and increase its chances to enhance value creation, by *jointly* documenting and exemplifying how it creates value in the Norwegian society. In order to attract talent outside the traditional male, engineering-oriented candidate pool, the industry would benefit from trying to portray itself as urban, cool and interesting – a career choice not just for the technically inclined but for the ambitious and culturally dexterous candidate. Lastly, the industry needs to address the thorny problem of improving productivity – in particular, decision making productivity – in the public sector, by collectively taking a more proactive stance not just on technology direction, but also recommend actions to increase organizational efficiency and goal effectiveness.

### ***Public policy implications***

Public IT policy can be divided into policies directed towards the industry, and policies directed towards the use of information technology in public administration and public service companies.

Policies towards the IT industry have been characterized by a quite fruitful neglect: The industry has not (despite entreaties from its interest organizations) been offered much help, nor had many restrictions from the government. This is not necessarily a problem – the industry does not need much public help, since it is used to continual technology-driven change and regularly transforms itself.

A productive public policy of IT in Norway would need to recognize that value creation from IT happens outside the IT industry; that Norway is a very small country which does not necessarily need big systems (but can benefit from simplification of procedures and structures) The IT industry is best supported by addressing the problems felt by the industry (in particular, the talent shortage) rather than forcing it to respond to relatively short-term political interests such as focus on particular technologies or geographical distribution.

The biggest opportunity for value creation with IT in Norway lies in increasing the productivity in public administration and service provisioning. Procedures and structures are still modeled on paper as a medium and geographical distance as a hindrance. While strides have been made in improving the interface between the public and the government, much remains to be done in the back office.

Norway's challenge is to convert the enthusiasm with which the population adopts new technologies into an equally strong enthusiasm for government and business to adopt their processes and services to the new technology. Let the final recommendation for the government then be that a post of Minister of IT is created, empowered to reorganize, automate and digitize all aspects of public service provisioning, with a goal of making life better for every citizen and with the added benefit of enabling Norwegian IT companies to export the resulting knowledge and technology to countries less blessed with a strong economy and a technologically enthusiastic population.

## Background – the elusive industry

*IT is elusive – it is everywhere, we all use it every day. By extension, we all work in the IT industry.*

The technical term for something we all use, for many different things, is a General Purpose Technology (Basu and Fernald 2008), and the central feature of a GPT is that its impact is in the industries that use it rather than the industries that produce it (though, it should be noted, the productivity impact in the IT industry itself is nothing to sniff at.) In 1996, Quinn et al (1996) observed that software was *the* critical mechanism for organizational improvement. Almost anything new in business or government involves the development, reconfiguration or distribution of software (or, at a stretch, digitally encoded information). Startup companies invariably establish a web page, often as their only interface to the world, manage their business using computers and frequently market their innovations in the form of software or software-enabled services. Digital distribution and market platforms (such as Schibsted's classified ad platform finn.no) have almost completely outcompeted analog platforms (such as newspapers) and are now a major export article for their owners.

25 years ago, owning a computer and using it every day generally meant you were either creating information or fed information into them – in effect, you were in the information technology industry or your job description would identify you as a direct customer of it. IT companies were easily identified – they were named IBM, Norsk Data or Data General and sold a complete package of hardware, software and, to a certain extent services. IT consulting companies could run and/or program your computers, but most businesses had their own IT personnel doing most of the programming, writing bespoke programs on computers owned by the business and situated (sometimes prominently behind glass on the ground floor) in the headquarters building.



### **Norwegian Air Shuttle: IT for competitive advantage**

Norwegian Air Shuttle, a successful low cost airline, is really an IT story – CEO and founder Bjørn Kjos was not a proponent of information technology, but changed his mind after his 2002 CIO hire, Hans Petter Aanby, managed to use IT to first lower cost, then grow the company's market, and then to start a new business.

**Cost:** Norwegian originally sold tickets over the telephone or through agents, with per-ticket transaction costs of more than \$35. In April 2003 the company moved most of its sales to the Internet, purposefully designing a very simple web site. It was one of the first airlines in Europe to have customers print out their own (bar-coded) boarding passes, which simplified check-in and saved boarding time. Eventually, 85% of orders would come over the web, and only 1% through the call center.

**Growth:** Airline prices vary, but it can be very hard for customers to see when it is cheap to fly. Many airlines make it hard for customers to find the cheap flights, but Norwegian went the other way, giving the customers a calendar-based view of flights - with prices. This made it easy for customers to pick the cheapest flights – and drove more customers to book with Norwegian. Eventually the system was sold back to the Amadeus reservation system – and is now used by most airlines in the Nordics.

**New business:** As Norwegian expanded (eventually flying more passengers outside Norway than inside,) the next step was to establish a new business out of their customer base and transaction platform: Bank Norwegian, an Internet bank that went into operation in the Fall of 2007. Drawing on a satisfied customer set, an experienced IT capability and a sophisticated, yet lean architecture, Norwegian figures it can take the transaction growth and reliability demands a banking application requires.

That was then. What does it take to be an IT company today?



## ***The technology-enabled company***

EVO Fitness is a chain of health clubs, started in Oslo in 2009. The company, targeting the experienced fitness enthusiast, offers access to training facilities with very few employees and basic, but attractive equipment. As a member (you can sign up in five minutes, using your cell phone or a web site), you gain access by drag your membership card and entering a code, which opens the door to an attractive gym with wardrobes, showers, cardiovascular and strength training machines. Security is maintained by cameras, centrally monitored by G4S, a security company. Opening hours are 6-23, 7 days per week.

EVO Fitness represents a software-enabled disruptive innovation (Christensen 1997) against the traditional health clubs – it offers a basic service to customers who do not need or want all the services (common classes, aroma therapy, food, motivation, child care) offered by the traditional health clubs. EVO Fitness would not be able to run their operation without IT. Indeed, their information systems, which manages the members and the clubs with little or no human involvement, is seen by their CEO as their main competitive advantage, and jealously guarded.

EVO Fitness is by no means alone in this. During the last 10 years, a number of Norwegian companies have used information technology as a competitive differentiator, in industries as different as newspapers (the electronic newspaper [vgnett.no](http://vgnett.no) outcompeting the traditional newspaper VG), airlines (Norwegian Air Shuttle challenging SAS by using IT to lower costs, expand their market and even launch a new bank), and banking (Skandiabanken, a wholly Internet-based bank, holding the position as the Norwegian company with the highest customer satisfaction for 6 years in a row). IT is vital to

these companies' profits and evolution – but are they IT companies? More importantly – how much of their value creation can be ascribed to IT?



### **ATEA: The financially driven generic IT provider**

ATEA is the biggest IT company listed on the Oslo Stock Exchange, with 4000 employees, 14.6b NOK in revenues in 2009, decent if unexciting profitability – and a very low-key profile. Much like Hewlett Packard and IBM on a global scale, the company does a little bit of everything, primarily providing through reselling basic hardware and software and providing rather standard services through 73 locations in the Nordics and the Baltics.

Standard and Poor characterizes the company as a "a wholesaler with a bit of labor (installation) thrown in", and the company is the largest purchaser of IT hardware and software in the Nordics, and as such a highly sought collaboration partner for the pure technology providers. Its main markets are client sales and services (PCs, mobile phones, printers, this is by far the dominant market), computer center services, mobility (networks and mobile communication) and unified communication. ATEA has more than 23,000 customers, 50% of them in the public sector. It is organized largely on geographical basis.

Much of its growth has come as acquisitions, first in a wave in the 90s, then in the latter 2000s. Little integration taking place – the company has a vast array of web pages of products and services. The acquisition strategy has very much been based on financials – the company seeks out specialized (often in terms of geography) technology providers (based on standard hardware and software), acquires them, and keep the customer interface, technology and salespeople intact.

Much like Orkla, another large Norwegian industrial group, ATEA remains a financially driven corporation, organizing up many small companies and markets by providing a financial and managerial home with some discipline and reliability, perhaps playing the role of its own market for corporate governance in the absence of an active and knowledgeable traditional financial market.

Nobody would call EVO, Norwegian or Skandiabanken IT companies – they are companies exploiting, indeed, deriving much of their competitive advantage from the availability and configurability of information technology. Their business models would not be possible without IT – not just for the technology in itself, but for the way their whole organization is designed to take advantage of it.

But – they are not IT companies.

And that may be the main problem the IT industry faces, in Norway as in any other country. The value created by the technology and its application is accounted for in other industries – only some of the profits are taken in the IT industry itself. After all, it is not IT in itself, but its use, that create value. And since the industry is global, meaning that the revenues, profit and knowledge originate in global rather than national industries, clusters and knowledge hubs – it becomes very difficult to speak of a national IT industry at all. The exception may be the areas of the world that are central to world IT production – USA (with a focus on Silicon Valley, Greater Boston, and minor centers such as Austin, Seattle, and North Carolina), Taiwan, the Indian IT service hubs (Bangalore, Chennai and Hyderabad).

The overriding force for change in the IT industry is technological evolution – new companies are founded on new technologies, grow, and become incumbents which again are challenged by newcomers. The technology itself has developed in response to whatever was the scarce resource at the time (Andersen 2008). In the early days, computers were weak and processing was the scarce resource. As a consequence, the technology was centralized and much effort was spent on writing computer programs that conserved processing resources. The industry was based on mainframe computers (dominated by IBM) in the seventies and early eighties. Then came the PC revolution, with Apple leading the charge and Microsoft becoming the dominant company and standard setter. It lowered the cost of processing, making it cheap enough to spend on graphical user interfaces and code modularity. Computers were connected, first via proprietary client-server standards, then by the Internet, and as the networks got faster and spanned the world, communication became inexpensive. A similar evolution in storage technology has been even steeper.

The most important current development in the global industry is in response to the most scarce resource of all – human knowledge. Since computers and systems now can be developed and managed from almost anywhere in the world, distance no longer matters. Consequently, and rather paradoxically, location matter more than ever before (Cairncross 1997) – and the IT industry will locate where knowledge is.

Computers (and software programs) are seldom discarded because they are worn out. Rather, they are replaced (or evolve) in response to new needs (often driven by advances in technology) and new technology (often developed in response to a new need). As such, the technology industry is more comparable to a field of knowledge, an academic research area, than a clearly defined industry.

But we will leave that for later. What is the Norwegian IT industry like, anyway?

## The Norwegian IT industry

### Historical development

The computer industry in Norway developed with the same pace and mechanisms as the global IT industry. Norway has traditionally been relatively early user of information technology, and has contributed important advances to information technology (object orientation, mobile telephony standards, search technology.) Its IT companies have, however, have been relatively isolated successes.

The Norwegian computer industry started in the 1950s. The University of Oslo acquired a centralized computer which, among other things, was used by Trygve Haavelmo to do the econometric research for which he was awarded the Nobel Prize in 1989.

As anywhere in the world, computers were first used for calculations and optimization, much of it in the nascent field of operations research. Computers were found at the Norwegian Technical University in Trondheim, at the University of Oslo, and at the Defense Departments Research Institute at Kjeller, east of Oslo. At the Norwegian Computing Center, a research facility at the University of Oslo, founded in 1952, the most important contribution to computer science was made by Ole Johan Dahl and Kristen Nygaard, when they in the 1960s developed the specialized computer programming language SIMULA. This innovation, though never commercially successful, was the beginning of the concept of object-oriented programming – and Dahl and Nygaard were awarded the Turing Prize – the equivalent of the Nobel prize for computer science – in 2002 for their efforts.

As computers became less expensive, their main usage shifted from advanced calculations to business process automation. Since Norway is a small country, with few large corporations capable of financing computers, a number of shared data centers were established – Statens Datasentral, Kommunenes Datasentral, and others. These data centers, though normally run on a cost, not profit basis, were the basis of the Norwegian IT service industry. They were instrumental in driving modernization of government and the financial industry – by pooling its transaction processing, for instance, the Norwegian financial industry could implement interbank electronic payments and consumer innovations such as electronic debit cards (initially used for cash withdrawals, then for gas) without having to go through standards wars<sup>1</sup>.

After mainframes came the minicomputer – fridge-sized computers without need for water cooling and a price point affordable for smaller companies, departments and municipalities. Norway gradually became a highly automated country – driven by a small in population spread over a large area, relative wealthy and economically egalitarian (meaning that hiring people for low-level (i.e., automatable) tasks has been relatively expensive). In addition, the country was the right size for



Figure 1 Nord-1 (1968)

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<sup>1</sup> Through the 1980s, there were two competing payment systems, Bankgiro and Postgiro. The latter was folded into the former in the early 1990s.

certain technology capabilities – as one industry executive said in the 1980s, four million people (Norway’s population at the time) can fit on an IBM S/36, but 8 million – Sweden – could not.

The minicomputer was also the technology of the first really successful Norwegian computer company, Norsk Data (ND). The global computer industry during this period was dominated by IBM, with the number two player in each country usually a domestic company – ICL in the UK, Siemens-Nixdorf in Germany, Bull and Burroughs in France (DeLamarter 1986). Norsk Data played this part in Norway. Established in 1967 and selling its first computer, Nord-1, in 1967, the company expanded during the next two decades, becoming the dominant minicomputer maker in Norway and exporting its technology, primarily to universities and research computing centers<sup>2</sup>, but also with substantial markets in newspaper typesetting and military systems. In 1989, Norsk Data was the most profitable and most highly valued (relative to its revenues) minicomputer company in the world.

In 1992, Norsk Data was dissolved, the victim of the next technology evolution: The personal computer. Initially seen as a toy – a classic disruptive technology (Christensen 1997) – the personal computer rapidly grew in performance, attracted independent software developers who liked its open architecture and standardized operating system, and became the dominant computing paradigm during the 1980s<sup>3</sup>. Though there were no important Norwegian PC hardware producers<sup>4</sup>, the new technology became a platform for much software innovation – many of Norway’s established software companies started on the PC, often as vertically oriented administrative systems (Visma), sales management systems (Software Innovation, SuperOffice) or computer security software and services (Norman Data Defense).

The nineties saw the emergence of the Internet, made possible by a standard addressing protocol (HTTP), a simple page description language (HTML), and, eventually, the LAMP<sup>5</sup> architecture, a standard set of open source software which easily implemented the functionality necessary for a dynamic web server. HTTP and HTML was developed at CERN by Tim Berners-Lee as a toolset for sharing academic papers, and a Norwegian, Håkon Wium Lie, made an important contribution by making CSS (Cascading Style Sheets), a widely used standard for page description that allows for a separation of content and presentation on web pages. The Internet enabled a number of important Norwegian companies, such as Opera (which started as a research project to create a browser at Telenor), Trolltech (started by two NTNU students whose ambition was to produce the best programming library in the world), and FAST Search and Transfer, a search technology company founded by an archeologist looking for new ways to store large amounts of visual information. The Internet was seen as an imminent revolution, electronic commerce would shortly replace or at least hurt regular business, and much investment and many eager young people flowed into dot-com companies. Anything with a web address and a business plan got funded.

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<sup>2</sup> CERN was a particularly important customer.

<sup>3</sup> BI Norwegian Business School played a part in this, being the first business school in Europe to require all its students to have their own personal computer in 1987.

<sup>4</sup> Tiki Data briefly produced a number of PCs for the educational market.

<sup>5</sup> Consisting of the Linux Unix-derived operating system, the Apache web server, the MySQL relational database, and one or more of the Perl/PHP/Python programming languages.

Less visible, but equally important for the IT industry, was the transition for the administrative and production systems in most large corporations. These moved bespoke programs written by internal IT departments or consulting companies, to packaged software, known as ERP (Enterprise Resource Planning) and CRM (Customer Relationship Management) systems, which integrated company value chains and allowed electronic data interchange (EDI) with suppliers and customers. Most large companies installed systems from large, new vendors such as SAP, Oracle, Peoplesoft, Baan and others. Visma eventually became the leading vendor of these systems in Norway, but the dominant market share was held by foreign companies. Instead, the need to configure these packages and write specialized software around them led to

a large growth in the computer consulting industry, both for development and eventually for running and maintenance of the systems.

The Internet hype reached a peak and an inevitable fall, known as the dot-com bust, in 2001. Not only did this contribute to (and coincide with) a general economic slowdown, but it also greatly reduced the attractiveness of IT as a field for study. IT programs at universities and business schools experienced a large fall in applicants, a shortfall that is still felt in the IT industry. The main developments in the first decade of the 21<sup>st</sup> century has been the growth and subsequent sale to foreign owners of some successful Norwegian IT companies (Trolltech, FAST, Tandberg, Visma), spinoffs and subsequent sales of IT departments from large Norwegian companies into a more and more consolidated IT services industry, and the emergence of the Internet as a platform for interaction between government, companies and individuals. The Internet now is instantly available



### **Trolltech: A community-based development software developer**

Trolltech (now Qt Software) was started by two friends (Eirik Chambe-Eng and Håvard Nord) who met each other at NTNU and decided to ask their wives to fund them for two years, in 1994, so they could develop “the world’s best C++ library”. This they did – and then managed to evolve this into a full-fledged, cross-platform development environment (QT, pronounced “cute”) and then to sell this to very demanding technical programming groups all over the world. By 1996, they had 8 customers – in 8 different countries. By 2007, Trolltech had sales of 200m NOK, but struggled with profitability.

Trolltech was in many ways a company rather different from other software companies. The two founders were both top managers (either CEO or President, the title switching every year). Secondly, the software was available in two versions: One with a standard license payment, one as open source, i.e., free to use in non-commercial projects. The open-source approach was very popular with developers all over the world, many of whom worked with the commercial version in their day jobs, and then used the open source one for their pet projects. These developers reported errors and suggested improvements, often by extending the software themselves, sometimes getting hired by Trolltech in the process. And the software was updated, over the Internet, every day.

Over time, Qt became the most popular application framework for C++, with a market share of 60% on some technical platforms. The company was truly global – while headquartered in Oslo, it had significant development activity in Brisbane, Australia, and offices in Silicon Valley, Beijing and Munich. In the early 2000s, the company developed an embedded Linux version of its software, Qtopia, which proved popular with developers of applications for mobile phones.

The company was listed on the Oslo Stock Exchange in 2006, and acquired by the Finnish mobile phone company Nokia in 2008 for €109m. Nokia needed development expertise – and access to a community of developers – as software (“apps”) was becoming an increasingly important factor in mobile phone competition. Trolltech continues as the Qt software group (qt.nokia.com) in Nokia, still running a dual-licensing model. The group phases the inevitable challenges of integrating an independent company with a strong culture into a more formal and directed organization, but Qt was gradually becoming the standard development platform for Symbian, Nokia’s mobile phone operating system.

In 2011, following loss of market share for Symbian due to increased competition from Apple’s iPhone and phones based on Google’s Android platform, Nokia announced a strategic alliance with Microsoft to use the newly developed Windows Phone 7 (WP7) as the operating system for new smartphones. In March 2011 Nokia announced the intention to sell the commercial licensing part of Qt to Digia Plc, a Finnish software company.

at all times, not the least because of the emergence of wireless Internet connections (through Wi-Fi and mobile telephony channels) as well as smaller and smaller computers, powerful mobile phones, and tablet computers. The Internet is increasingly the standard platform for finding and disseminating knowledge, buying and selling goods and services, and managing the myriad of interactions one has with businesses and authorities. The technology, in short, is everywhere, and we all use it.

### **Purpose/activities**

IT can be used for cost reduction (by automating), for market extension (by reaching out to customers with better services, greater convenience or lower price), for creating a new business or offering. ICT can be embedded in the product, sold as a service, or provide a platform for customer interaction. In all cases, ICT is seldom the end product itself.

For this analysis, we will focus on two main groups of companies<sup>6</sup>: *Technology providers*, who sell hardware or software, and *service providers*, who in principle are consulting companies, helping customers conceive, develop, maintain and run information systems. The companies differ mainly in what they sell: Technology providers sell a specific instantiation of (or access to) intellectual property (IP), whereas the IT service



#### **Visma: Integrating vertical software**

Visma is the largest general software company in Norway, a collection of vertical solution software (ERP and CRM specialized for specific industries) providers which has grown by acquisition and technical integration.

Visma is a story ups and downs, turnarounds and countercyclical investing. The company was formed in 1996 as a financially driven merger of various accounting and maritime control systems companies. In 1997 Visma was in reality bankrupt, and Øystein Moan was hired as CEO to turn things around. He fired 40% of the employees, got rid of a few suppliers, and had the company in the black in 3 months. The biggest decision was to divest Visma Marine and Logistics, a company that made and sold control software for ships. IT was acquired by the Netherlands company KPN – and, was paid for with NOK 900m in cash, rather than the far more common payment in stock, which was expected to increase tremendously during the dot-com boom. By the end of 2000 Visma had 140 people, NOK 1b in the bank, and a market value less than cash reserves.

Then the IT industry collapsed, and Visma acquired more than 40 companies, including one hostile takeover of the Swedish accounting software company SPCS. In 2006, the private equity company Sage made an offer for Visma, it was rejected by the board, who invited Hg Capital to step in and take the company private. The plan was to take the company public in 2011, but in 2010 several private equity companies, in the end Kohlberg Kravis Roberts, the world's foremost private equity company, offered NOK 11b.

Visma differs from the other large IT service and technology companies in Norway in that they are relatively highly priced – their market value is relatively high and their goodwill assets (essentially, payments for companies over book value) are relatively low. This can be attributed to their skill at integration of acquired companies. Not only does the company have a technology strategy (focused on architecture and development discipline) for doing the technical integration of products they acquire, but they also pay attention to the integration of acquired companies before the acquisition agreement is signed. The company has a very focused strategy: Continue to acquire, sell software and services of interest to the CFO in middle-to-large companies, and stay within the geographical area (The Nordics, Netherlands, and Rumania where some work is outsourced.) Their plan is to grow the business to NOK 10b in revenues from the current 6, maintaining the current 20% profit margin, by 2015. At that point, the company should have grown to a size making it attractive to large, international investors, and it will be taken public again.

<sup>6</sup> Other significant groups are mainly wholesale and retail sellers of standardized technology, such as the consumer electronics chains Lefdal, Elkjøp and Siba (or, specialized on Apple computers, Eplehuset and Humac.) While selling many computers and mobile phones, these companies are not really IT companies – they provide the technology, but their expertise is in the logistics and vending of goods, rather in the development of the technologies themselves. In other words, their role in IT knowledge development is limited.

providers primarily sell the services of their people, either as problems solvers (consultants, working on development projects) or as providers of continuous services, such as infrastructure (basic computer hardware and software) management or application (business-specific software, such as a CRM system or an eBusiness suite) provision and maintenance.

The two types of companies face rather different business environments: The technology companies are primarily driven by the evolution of technology, constantly having to enhance the functionality and performance of its offering compared to other technology companies around the world. Their business is (with a few exceptions, primarily for software companies creating systems that have to conform to Norwegian regulation, such as accounting systems) global and, with the rapid distribution enabled by the Internet, increasingly so. The IT services companies are offering services to a larger extent specified by individual customers, and so are driven more by evolution of customer needs rather than technology itself. Of course, what customers need is shaped by what the technology can offer – but for a service company, a new technology needs to be translated into an individual customer need before money can be made off it.

*It takes character to sell rubber bands by the meter.*  
 Oddvar Nordli, former Norwegian Prime Minister

## Size

Measuring the size of the ICT industry is difficult, both in terms of measuring the overall size of the industry and measuring the relative size of the various subcategories inside it. Statistics Norway refers to the “Information sector”, a categorization that includes the ICT sector, but also publishing and media<sup>7</sup>. The ICT sector includes telecommunication, but excludes ICT use that is directed towards a specific industry.

The size itself represent a problem because IT is now used everywhere – most companies of any kind either has IT embedded in their systems or provide a service along with their product that is heavily computerized. A modern car has dozens of computing devices and usually a network connecting them. The functionality and quality of the embedded software and hardware frequently represents a large part of the differentiation of the product. Most service companies today interact with their customers using some form of information technology. DNV, a global maritime classification and certification company, would fall in this category, without being counted as an IT company. Finn.no, for instance, is the classified

**1 Informasjonssektoren. Sysselsatte personer. 2007-2008**

	2007	2008
Informasjonssektoren	96 446	100 442
IKT-sektoren	68 398	72 474
IKT-Industri	4 556	4 357
Engroshandel med IKT-utstyr	9 642	10 033
IKT-Tjenester	54 200	58 084
Innholds- og mediesektoren	28 048	27 968
Utgivelse av bøker, tidsskrifter og annen forlagsvirksomhet <sup>1</sup>	17 355	17 180
Virksomhet innenfor film, video og fjernsynsprogrammer	3 394	3 626
Produksjon og utgivelse av musikk- og lydopptak <sup>1</sup>	440	469
Radio- og fjernsynsringkasting	5 905	5 926
Andre informasjonstjenester	954	767

<sup>1</sup> Sysselsettingen for Utgivelse av bøker, tidsskrifter og annen forlagsvirksomhet, og Produksjon og utgivelse av musikk- og lydopptak, og aggregerte tall der disse inngår, er for 2007 ikke direkte sammenlignbar med senere årganger.

**Figure 2: Statistics Norway: The information sector, employment 2007-08**

<sup>7</sup> Figure from <http://www.ssb.no/iktoms/tab-2010-07-20-01.html>, retrieved April 2011.

ads subsidiary of the Schibsted group, a large Norwegian media group that has survived and prospered through its ability to rapidly adopt and evolve information technology. Yet Finn.no is not an information technology company – it is a market, replacing what previously was printed on paper.

Estimating the size of the IT industry in Norway is not uncontroversial. IKT-Norge, an industry organization, maintains that Norwegian ICT industry has about 80000 employees and 2008 revenues of NOK240b, making it the second largest industry in Norway (after petroleum). Their figures include telecommunications, wholesale technology sales, and selected areas of the media sector. This figure is often used by the organization to claim that the IT industry is Norway's second largest industry, and thus worthy of more public attention and financing.

We chose, in this report, not to take a stand on the size of the industry, since we primarily want to focus on the knowledge aspects of the industry as well as its strategic evolution. A first search of companies from Norway's central repository of accounts, based on pertinent industry codes from Statistics Norway, yielded 7,100 companies with combined 2008 revenues of NOK 142b, which could be a reasonable starting point.

Not only is the size of the overall industry difficult to estimate – meaningful subdivisions are also tricky. The technology itself is in flux: Software is, in a sense, the replacement of business or technical processes by computer algorithms. Hardware is, very often the physical instantiation of software. Drawing the line between products and services is difficult (Sagelvmo 2009), because most companies offer a combination of hardware or software and services, not distinguishing between the two in their accounts. SAS Institute, for instance, is a software producer that takes much of its income in helping their clients in their own business through their expertise in data acquisition, operations research and business intelligence – yet is listed as a software provider. Companies that are not even in Norway (Google<sup>8</sup>, Amazon) offer hardware as a service available over the web, free or paid with a credit card.

For the purposes of this analysis, a narrower definition of "IT industry" is needed. The Knowledge-based Norway project analyses telecommunications as well as knowledge-based industries as separate from the IT industry. Drawing a precise line between these industries can be exceedingly difficult – companies such as Hands, Opera and Tandberg provide software and hardware primarily for the telecommunications industry or telecommunications uses, for instance, but should still be considered IT companies. Consulting companies such as Accenture do management consulting as well as information technology consulting, without reporting the relative proportions<sup>9</sup>. Large technology companies such as Siemens make everything from locomotives via computers to dishwashers, as well as, of course, the software necessary to run it all. Computers and other consumer-oriented information technology makes up a large and valuable portion of sales for the large consumer electronic retail chains, but breakdowns on relative size of sales here are not available. Many companies that in effect are software and hardware technology companies, such as the Kongsberg Group, an advanced technology company with more than 700 software developers,

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<sup>8</sup> Though Google is registered in Norway, its activities here are largely promotion-oriented and run on a cost basis, and its very sizeable revenue stream is invoiced through Ireland.

<sup>9</sup> Accenture is included in this sample.



making control systems for ships, offshore oil rigs and weapons systems, are traditionally not defined as belonging to the IT industry even though up to 70%<sup>10</sup> of what they sell is software.

In order to arrive at a usable set of companies, we selected companies with SSB industry codes relevant to the IT industry. Then we went through them manually, classifying them as belonging to the IT industry or not based on their home pages, annual report and our own knowledge. The initial selection was in the thousands of companies, but they were quickly pruned down to about 400 companies – the largest in terms of revenue – since the long tail (Anderson 2004) of IT companies is exceedingly long, and many of the smaller companies, particularly in consulting, are not really active. The combined revenues from these companies were around NOK 56b in 2008, with about about 43000 employees.

A few, quick observations can be made from this sample. First, the industry is growing: The sample has roughly doubled in size from 2000 to 2008, with a slight decrease in 2002 (following the “dot-com” bust in 2001). This observation, hardly surprising, should be interpreted with caution, since they are subject to “surviving firm” bias and may reflect consolidation as well as growth. Increase in the number of employees in the IT industry comes both from organic growth, but also from the industry’s acquisitions of internal IT departments (formerly classified under different industries, such as petroleum, telecommunications, metals or services) into companies that are classified under IT.

### ***Outside looking in: The software market***

If we limit our analysis to software companies, the variation in technology definitions and industry categorizations becomes even more apparent. To say that there is variation and measurement problems in estimating the market for software and ICT in Norway barely hints at the problem:

- An international market research report from 2011 (Datamonitor 2011) pegs the software market in Norway in 2009 at \$1.373b (NOK 8,647b) – a slight decrease from 2008 – and expects the market to grow at a compound annual growth rate of 5.1% until 2014. The definition of “software” is rather strict, focusing on these generic software categories: General business productivity software (22.9%), network and database management software (22.1%), cross-industry and vertical applications (20.5%), operating system software (19%), other systems software (10.6%), and other application software (4.8%).
- A report from the industry association IKT Norge (IKT-Norge 2008) estimates the software market in Norway to 25B NOK, provided by 1172 companies. Their definition of a software company is one where 5% or more of the revenues come from “software related activities”, which include software sales and leases, configuration and development of software, software-based web services, and maintenance revenues.
- A report from Statistics Norway (Sagelvmo 2009) calculates the annual value of investments in software in Norway in 2006 at NOK 6.245b with an additional NOK 1.502b spent on internal IT development. This number seems rather small – it is not hard to think of individual projects that together come close to this number.

We will, for this project, not attempt to measure the software market in Norway – only note that most of the companies selling software also sell consulting and maintenance services for it, with the

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<sup>10</sup> A number frequently quoted both by managers and technologists in the company. Kongsberg is not included in the list of 400 largest IT companies here.

income from those services in most cases counting for much of the value created<sup>11</sup>. In the case of open source software, where the customer does not necessarily pay for the software itself, but rather for its configuration and use, software sales would necessarily be very close to zero – and this model is increasingly used, without anything showing up in statistics.

### ***The role of exports***

The 2011 World Economic Forum's report on competitiveness<sup>12</sup> set high technology's share of Norwegian exports is 4.1%, a 56<sup>th</sup> position of the countries surveyed, and very likely a function of Norway's high degree of oil, gas, fish and timber exports, which are classified as commodities despite the very high technology (including information technology) that lies behind its production. Even of high tech, information technology is a very low portion. Very little of that is IT per se, but IT has a supplementary role in exports, such as marine engineering products, marine and telecommunications services, and medical equipment.

- Direct software and service exports from Norway are small – though some companies, like Opera, has a user base in the hundreds of millions, the actual revenue from direct software exports is very small. Telecommunications services is an exception, but falls outside the scope of this report.
- Contribution of the technology to exports are great – for instance, Kongsberg-gruppen, a high technology company developing and largely exporting control systems for ships, oil platforms, automobiles and weapon systems estimates that about 70% of its exports are software, the rest hardware and services.
- Some Norwegian-based IT service companies (mostly, EDB Ergo Group and ATEA) have expanded to prominent market shares in the Nordic market.
- Norwegian information technology providers tend to be exported in the sense that they grow to a certain size, and then are acquired by foreign, larger companies.
- Some software companies are global from the outset, such as Opera, Trolltech, FAST and some of the oil/energy software/maritime operations, as well as the gaming industry.
- Some hardware companies operate globally, primarily out of the Trondheim area. Examples include Atmel and Nordic Semiconductor (customized chips to the telecommunications equipment and control industries), as well as Q-Free, which makes road monitoring and toll charging technology.

Overall, though, information technology exports is a relatively small part of Norwegian export.

### ***Location, location, location***

Location is exceedingly important in all policy discussions in Norway, and an analysis of any industry will need to spend quite a bit of time on understanding where and why companies and employees are located. For the IT industry, this is especially interesting since many policymakers – not to mention many of the IT companies themselves – have held up the IT industry and the technology

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<sup>11</sup> This situation – that the products have thin margins and after-purchase service and consulting is where the profits are taken, is not limited to the software industry. Auto manufacturers and most of the industrial subsidiaries of General Electric, for instance, make most of their income on services (and, in addition, financing the customers acquisitions of those assets.)

<sup>12</sup> See excerpt at end of this report.

itself as a solution to the problem of centralization and urbanization, on a global as well as national scale. After all, a technology developer or salesperson can be located anywhere in the world, and still do work locally. So, where are the IT workers in Norway<sup>13</sup>?

The following table shows the number of IT employees in each of Norway's counties<sup>14</sup>:

	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Nr employees per county (IT, bostedskommune)</b>									
Østfold	699	828	861	920	1 102	1 299	1 518	1 724	1 834
Akershus	4 675	5 362	5 401	5 504	6 151	6 732	7 214	8 121	8 652
Oslo	5 399	6 522	6 386	6 605	7 371	8 432	9 454	11 270	12 503
Hedmark	581	627	578	559	631	659	776	842	931
Oppland	382	478	479	499	630	712	759	915	990
Buskerud	1 137	1 400	1 361	1 331	1 456	1 678	1 772	2 018	2 095
Vestfold	1 283	1 437	1 489	1 555	1 670	1 782	1 922	2 144	2 438
Telemark	396	429	403	425	499	580	648	714	734
Aust Agder	696	722	518	426	386	412	405	526	575
Vest Agder	276	322	299	299	351	405	410	466	522
Rogaland	1 207	1 490	1 522	1 547	1 710	1 942	2 447	2 951	3 255
Hordaland	1 714	2 317	2 486	2 577	2 780	3 012	3 191	3 312	3 490
Sogn and Fjordane	104	103	100	125	152	177	214	226	250
Møre and Romsdal	355	391	423	450	559	645	667	816	866
Sør-Trøndelag	1 320	1 237	1 214	1 259	1 525	1 842	1 958	2 181	2 413
Nord-Trøndelag	133	159	147	136	173	172	188	218	230
Nordland	226	331	325	314	353	447	488	512	604
Troms	181	288	274	280	338	368	407	424	438
Finmark	69	80	68	77	75	76	93	93	91
Svalbard									
Offshore									
Total	20 833	24 523	24 334	24 888	27 912	31 372	34 531	39 473	42 911

<sup>13</sup> In the location analysis, we have chosen to use the employees' place of residence, rather than the location of the companies themselves. Companies tend to be registered and have their headquarters in central locations, so using the company's official address as an indicator of location would show the industry as more centralized than it really is. People also pay taxes to their residential municipalities, meaning that for discussions about regional economy, residence is more important than company address.

<sup>14</sup> Adjustments: Cells with less than 20 observations are not displayed, for confidentiality reasons, which primarily has the effect of excluding Svalbard and "offshore" (mainly oil installations in the North Sea) from the analysis.

Displayed as proportions, we get the following picture:

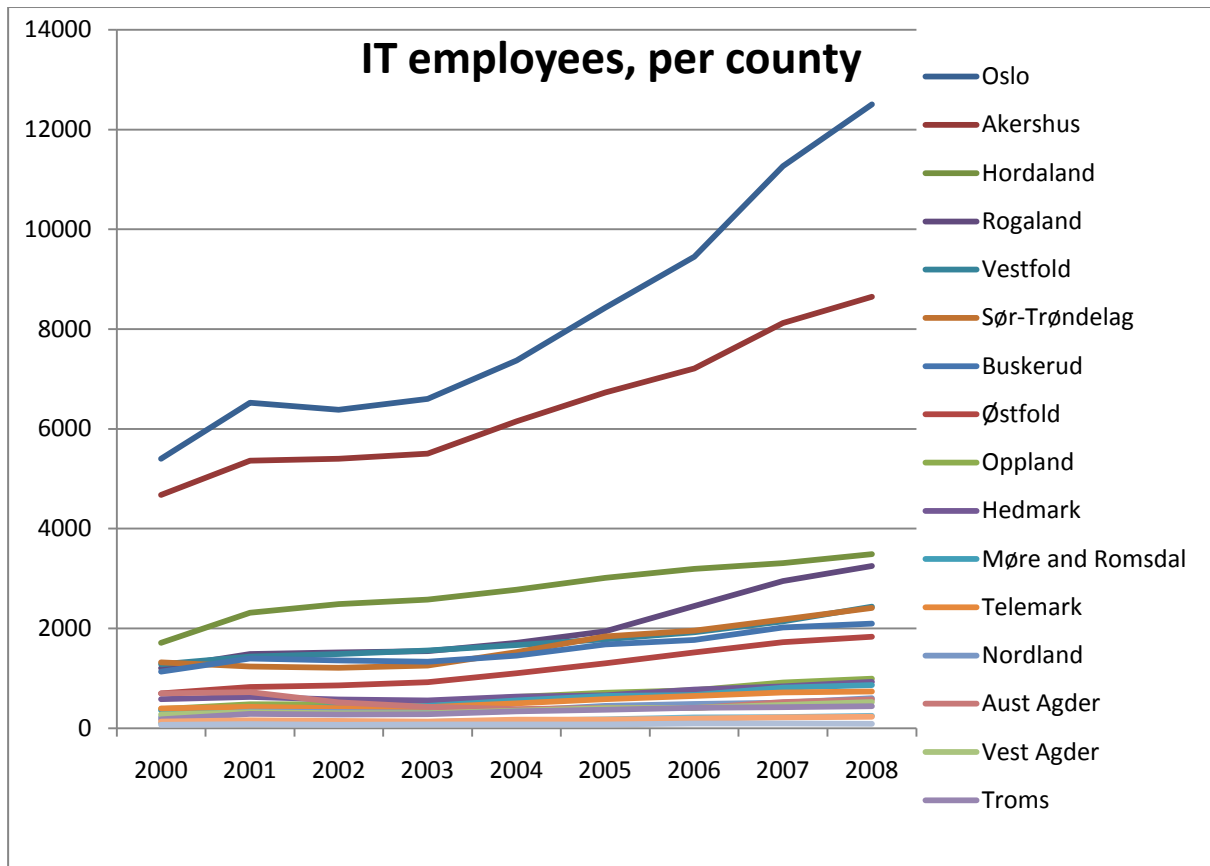
<i>Relative</i>	2000	2001	2002	2003	2004	2005	2006	2007	2008
Østfold	3,36 %	3,38 %	3,54 %	3,70 %	3,95 %	4,14 %	4,40 %	4,37 %	4,27 %
Akershus	22,44 %	21,87 %	22,20 %	22,12 %	22,04 %	21,46 %	20,89 %	20,57 %	20,16 %
Oslo	25,92 %	26,60 %	26,24 %	26,54 %	26,41 %	26,88 %	27,38 %	28,55 %	29,14 %
Hedmark	2,79 %	2,56 %	2,38 %	2,25 %	2,26 %	2,10 %	2,25 %	2,13 %	2,17 %
Oppland	1,83 %	1,95 %	1,97 %	2,00 %	2,26 %	2,27 %	2,20 %	2,32 %	2,31 %
Buskerud	5,46 %	5,71 %	5,59 %	5,35 %	5,22 %	5,35 %	5,13 %	5,11 %	4,88 %
Vestfold	6,16 %	5,86 %	6,12 %	6,25 %	5,98 %	5,68 %	5,57 %	5,43 %	5,68 %
Telemark	1,90 %	1,75 %	1,66 %	1,71 %	1,79 %	1,85 %	1,88 %	1,81 %	1,71 %
Aust Agder	3,34 %	2,94 %	2,13 %	1,71 %	1,38 %	1,31 %	1,17 %	1,33 %	1,34 %
Vest Agder	1,32 %	1,31 %	1,23 %	1,20 %	1,26 %	1,29 %	1,19 %	1,18 %	1,22 %
Rogaland	5,79 %	6,08 %	6,25 %	6,22 %	6,13 %	6,19 %	7,09 %	7,48 %	7,59 %
Hordaland	8,23 %	9,45 %	10,22 %	10,35 %	9,96 %	9,60 %	9,24 %	8,39 %	8,13 %
Sogn and Fjordane	0,50 %	0,42 %	0,41 %	0,50 %	0,54 %	0,56 %	0,62 %	0,57 %	0,58 %
Møre and Romsdal	1,70 %	1,59 %	1,74 %	1,81 %	2,00 %	2,06 %	1,93 %	2,07 %	2,02 %
Sør-Trøndelag	6,34 %	5,04 %	4,99 %	5,06 %	5,46 %	5,87 %	5,67 %	5,53 %	5,62 %
Nord-Trøndelag	0,64 %	0,65 %	0,60 %	0,55 %	0,62 %	0,55 %	0,54 %	0,55 %	0,54 %
Nordland	1,08 %	1,35 %	1,34 %	1,26 %	1,26 %	1,42 %	1,41 %	1,30 %	1,41 %
Troms	0,87 %	1,17 %	1,13 %	1,13 %	1,21 %	1,17 %	1,18 %	1,07 %	1,02 %
Finmark	0,33 %	0,33 %	0,28 %	0,31 %	0,27 %	0,24 %	0,27 %	0,24 %	0,21 %

As can be seen, fully half of the industry is located in Oslo and Akershus, i.e., the capital and its surrounding area. The proportions are relatively stable, with Aust-Agder<sup>15</sup> as the main exception.

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<sup>15</sup> Agder is a relatively small county, and was disproportionately hit by a technological change (the transition from hardware- to software-based telecommunications infrastructure equipment, specifically telephone switches, which caused the telecommunications hardware producer Ericsson to shut down its Grimstad campus in 2001-2002).

In terms of growth, the main story is about Oslo and Akershus:



Oslo and Akershus, as mentioned, account for roughly half (49.3%) of all IT employees. Six counties (Hordaland, Rogaland, Vestfold, Sør-Trøndelag, Buskerud and Østfold) together have about one third (36.2%). These counties are all relatively urban and have urban areas with technology companies and technology higher education – Hordaland has Bergen, Rogaland Stavanger, Vestfold a cluster of IT industries around Horten, Sør-Trøndelag Trondheim (with NTNU, the MIT of Norway), and Buskerud has Drammen<sup>16</sup> and Kongsberg.

### ***Growth and relative distribution***

A quick glance at total growth over from 2000-2008 shows that the IT industry is growing faster than the rest of the economy in every county except Aust-Agder:

<sup>16</sup> An increasingly attractive location due to the removal of car traffic through the center and the focused development of infrastructure to attract knowledge-based companies.

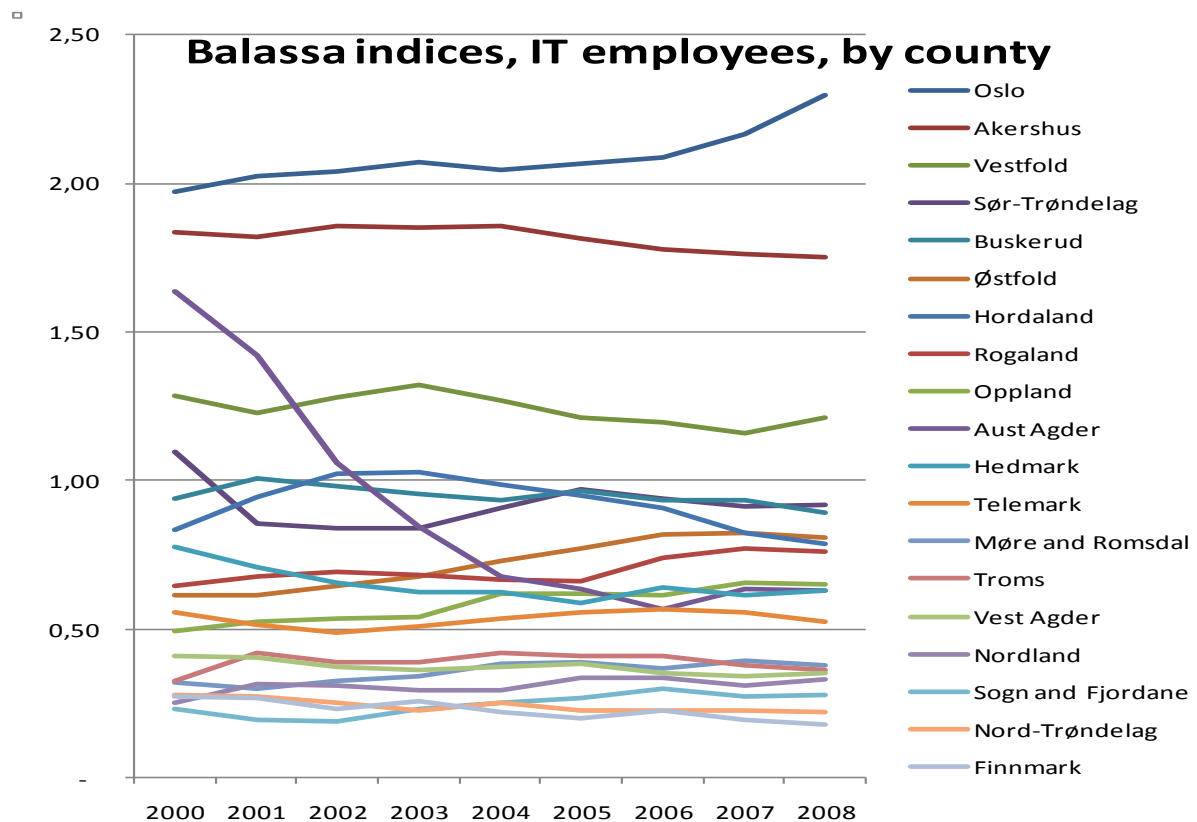
County	All employees		IT employees	
	2000-2008	CAGR	2000-2008	CAGR
Oslo	21,10 %	2,15 %	131,58 %	9,78 %
Akershus	18,35 %	1,89 %	85,07 %	7,08 %
Hordaland	21,40 %	2,18 %	103,62 %	8,22 %
Rogaland	20,94 %	2,14 %	169,68 %	11,65 %
Vestfold	19,91 %	2,04 %	90,02 %	7,39 %
Sør-Trøndelag	18,59 %	1,91 %	82,80 %	6,93 %
Buskerud	23,08 %	2,33 %	84,26 %	7,03 %
Østfold	19,42 %	1,99 %	162,37 %	11,31 %
Oppland	30,36 %	2,99 %	159,16 %	11,16 %
Hedmark	35,48 %	3,43 %	60,24 %	5,38 %
Møre and Romsdal	38,97 %	3,72 %	143,94 %	10,42 %
Telemark	31,88 %	3,12 %	85,35 %	7,10 %
Nordland	20,83 %	2,12 %	167,26 %	11,54 %
Aust Agder	25,27 %	2,53 %	-17,39 %	-2,10 %
Vest Agder	32,83 %	3,20 %	89,13 %	7,34 %
Troms	32,99 %	3,22 %	141,99 %	10,32 %
Sogn and Fjordane	24,62 %	2,48 %	140,38 %	10,24 %
Nord-Trøndelag	32,40 %	3,17 %	72,93 %	6,27 %
Finmark	25,77 %	2,58 %	31,88 %	3,12 %

A Balassa index<sup>17</sup> table of the counties underscores the uneven distribution of IT employees. Only Oslo, Akershus and Vestfold have a Balassa index of more than 1, with the lowest of the “intermediate” counties has an index of 0.76 for 2008 – in other words, 24% less IT workers than predicted by its non-IT workforce:

Balassa index	2000	2001	2002	2003	2004	2005	2006	2007	2008
Oslo	1,97	2,03	2,04	2,07	2,04	2,07	2,09	2,17	2,30
Akershus	1,84	1,82	1,85	1,85	1,86	1,81	1,78	1,76	1,75
Vestfold	1,29	1,23	1,28	1,32	1,27	1,21	1,20	1,16	1,21
Sør-Trøndelag	1,09	0,86	0,84	0,84	0,91	0,97	0,94	0,92	0,92
Buskerud	0,94	1,01	0,98	0,95	0,93	0,96	0,94	0,93	0,89
Østfold	0,61	0,62	0,65	0,68	0,73	0,77	0,82	0,83	0,81
Hordaland	0,83	0,95	1,02	1,03	0,99	0,95	0,91	0,82	0,78
Rogaland	0,64	0,68	0,69	0,68	0,66	0,66	0,74	0,77	0,76
Oppland	0,50	0,53	0,53	0,54	0,62	0,62	0,61	0,65	0,65
Aust Agder	1,64	1,42	1,06	0,84	0,67	0,64	0,57	0,64	0,63
Hedmark	0,78	0,71	0,66	0,62	0,62	0,59	0,64	0,61	0,63
Telemark	0,55	0,51	0,49	0,51	0,54	0,56	0,57	0,56	0,53
Møre and Romsdal	0,32	0,30	0,33	0,34	0,38	0,39	0,37	0,39	0,38
Troms	0,32	0,42	0,39	0,39	0,42	0,41	0,41	0,38	0,36
Vest Agder	0,41	0,40	0,37	0,36	0,38	0,38	0,35	0,34	0,35
Nordland	0,26	0,32	0,31	0,29	0,30	0,34	0,34	0,31	0,33
Sogn and Fjordane	0,23	0,19	0,19	0,23	0,25	0,27	0,30	0,28	0,28
Nord-Trøndelag	0,28	0,27	0,25	0,22	0,26	0,23	0,22	0,23	0,22
Finmark	0,28	0,27	0,23	0,26	0,22	0,20	0,22	0,20	0,18

<sup>17</sup> In this context, the ratio of actual IT workers to expected number of IT workers if the distribution was proportional to workers in all other industries. If a county has a Balassa index of 1, it has as many IT workers as the national average.

Furthermore, a plot of the Balassa indices shows Oslo as the primary IT location, and gaining on all others:



### Implications

One observation is that the counties seem to fall into three categories:

- High IT counties: Oslo and Akershus. This is the most urban area of Norway, the Oslo region is by far the most populous, with 24.2% of private sector employment in 2008, 23.2% of the population, and 49.3% of the IT employees. The Balassa index for IT employees versus population is 2.12, for all employees vs. population 1.04.
- Middle IT counties: Hordaland, Rogaland, Vestfold, Sør-Trøndelag, Buskerud and Østfold. Together, these six counties collectively hold 40% of the population but 36% of the IT employees. These counties all have relatively large cities in their centers (Bergen, Stavanger, Horten, Trondheim, Drammen/Kongsberg and Fredrikstad/Sarpsborg, respectively.) Vestfold is the outlier here, with a disproportionate number of IT employees, largely due to a group of IT-related companies around Horten. All these counties are growing in population more than the national average. The Balassa index for IT employees versus population is 0.90, for all employees vs. population 1.04.
- Low-IT counties: The rest, collectively holding 36.4% of the population but only 14.5% of the IT employees. Most of these counties are growing less than the national average. The Balassa index for IT employees versus population is 0.40, for all employees vs. population 0.93.

In other words, IT is highly centralized, even though business as a whole is not.

### ***Importance of location***

In her book *The Death of Distance*, Francis Cairncross (1997) argued that the IT and communications revolution would free companies from thinking location: “Companies will be free to locate many screen-based activities wherever they can find the best bargain of skills and productivity.” However, the fact that IT companies, in theory, *can* be located anywhere does not mean that they *will* be. As noted by Cairncross and later Florida (2006), when location no longer is important, it might become very important, but for different reasons – “as individuals spend less time in the office and more time working from home or on the road, cities will change from concentrations of office employment to centers of entertainment and culture.” (Cairncross, 1997)

The location of the IT industry in Norway shows that highly mobile knowledge industries tend to co-locate – if not cluster in Porter’s (1999) sense – in urban areas. People working in knowledge industries are highly sought after and free to move – so they move not to where the work is, but take the work with them to a place which to them is enjoyable and, given the nearness of customers and possible life and business partners, profitable. It should also be noted that Oslo is gaining relative to Akershus – and it is tempting to attribute this to a development where the typical IT worker to a larger extent is an urban coffee-bar-frequenting hipster, working with web development, social networks and market-facing applications rather than a suburban, station wagon-owning family person working with ERP configuration, server maintenance and scientific programming. Tempting, but, perhaps, premature.

The numbers reported here do not include IT workers in the public sector, nor people doing IT within non-IT companies. There are reasons to believe – though we do not have numbers – that including public sector IT workers would somewhat mitigate the centralization. In some cases, a decline in private sector IT employment is to a certain extent compensated by public sector IT workers: For instance, in the case of Aust-Agder, the loss of many IT jobs when Ericsson shut down in 2001-2003 was to a certain extent mitigated by the Norwegian Tax Authority gradually (the process had started before Ericsson left) moving much of its data processing to the same area, even into the available Ericsson facilities.

The IT industry in Norway receives relatively little public research funding and relatively little public startup support – in fact, despite being one of the largest and most knowledge-intensive industries in Norway, Innovation Norway recently shut down its IT-specific program activities<sup>18</sup>. The explanation given for this apparent oversight is the industry’s lack of specialization – its lack of identifiable clusters and high-profile, easily conceptualized applications. IT companies and IT workers do not complain when times are hard – they are used to technologies going obsolete and understand the need for upgrading knowledge and products and moving on to something else. IT employees are also highly educated – meaning they can find work in non-IT companies if necessary. And there are few, if any, IT companies in Norway that have anchor positions in small towns with few prospects of other

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<sup>18</sup> “Innovasjon Norge vraker IT-sektoren”, Computerworld Norge, 28. januar 2011, <http://www.idg.no/computerworld/article194351.ece>, accessed February 1, 2011



employment<sup>19</sup>. Furthermore, in a country where public funding frequently is based on the desire to mitigate centralization and maintain population levels in remote areas, the geographical distribution of the IT industry might be a contributing factor to its relative invisibility in public budgets.

### ***The global IT industry***

The broad picture of the global IT industry is that it is truly global, but with the center of gravity still being on the west coast of the USA, first and still foremost in Silicon Valley south of San Francisco. Specialized knowledge clusters are springing up around the world, but retain a very close connection to the US side of the industry, which originate much of the technology and the ever-important standards. Most of the large companies are US-based in their origin, and the discussion of the evolution of the industry is influenced by that. The broad categories of hardware, software and service have evolved in a similar fashion, but with some differences:

- *Hardware* started out dominated by the US, then with Japan and to some extent Western Europe entering. Over time, production of hardware components has moved to lower-cost countries, particularly to Taiwan and then China. This started first as a cost play, later because the Asian producers proved more adept at miniaturization and industrialization of components where the basic design changed little, such as memory chips. Certain US companies (Apple, Intel, Cisco, IBM to a certain extent) have maintained a dominant position, initially with design primarily done in the USA. As the technology has become more powerful, some of the technology subcontractors (Acer, Asus, Flextronics, Lenovo with their acquisition of IBM's PC division in 2004) have emerged as leading technology designers and end-producers in their own right.
- *Software* is an industry to a large extent dominated by five giants (Microsoft in operating systems and general productivity software, Oracle and SAP in enterprise applications, IBM in various specialized categories, Google in search and web-provided applications) who to a large extent command evolution of their layer of the functionality stack. Apple, passing Microsoft in revenues in 2010, is traditionally seen as a hardware company. It is now probably most appropriately listed among the four software giants, since its integrated approach and proprietary "ecosystem" around apps and digital contents enables the same dominance around standards. All these companies face a two-sided market (Parker and Van Alstyne 2005) where they need to attract both developers (often in the form of companies selling specific implementations of their software, or doing consulting) and users. The main evolution here has been one of a transition from product sales towards a service model, where software is provided on a pay-as-you-go basis. Open source software (Raymond 1999) has emerged as a platform for giants such as Google, but also as a readily available platform for innovation, both in academic and start-up settings.
- *Services* has followed a pattern of formalization, specialization and globalization, coming from three areas: Former technology companies migrating into service provisioning (IBM and HP); Specialized outsourcers moving into full-blown service companies by acquiring consulting companies (CSC, EDS (recently acquired by HP), Perot Systems); and management consultancies moving into outsourcing (Accenture). India has taken the same role in services

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<sup>19</sup> Horten may be an exception, but the town has several IT and high tech companies and the small "Electronic Coast" (Fjeldstad, Andersen et al, 2000) cluster seems robust, if somewhat consolidated.

as China has in hardware production: Initially competing primarily on cost and capacity, some of India's IT service companies (TCS, Infosys, Wipro the largest and most well known) have emerged as very capable and profitable enterprises, but the market power remains with those companies that take their revenues closest to the customers.

 <p><b>Questback: Feedback as a very simple service</b>  <i>Questback shows the ease and simplicity of the Saas (software as a service) model, but also the difficulty of expanding a simple, useful service without acquiring cost due to increased complexity and higher need for customer adaption and support</i></p> <p>Questback, started in 2000, provides a conceptually very simple service: It allows customers to conduct surveys online. Enjoying double-digit growth and profitability from the very beginning, Questback currently has 170 employees, more than 4,000 customers in 50 countries and 20 locations in Europe, North America and Africa. The company bills itself as the European leader in Enterprise Feedback Management, and is owned by management, the employees, and one venture capital company.</p> <p>Questback has a very simple pricing model: 79,000 NOK gives the customer the ability to conduct an unlimited number of surveys over the web. The simplicity is both a boon and a challenge: It allows for very simple technology provisioning (all customers are served from the same technology base, a single platform built on Microsoft's .net technology and Oracle databases), but it can cause a misalignment between value seen by customers and what Questback receives. The company struggles with finding ways to extract more money from its heavy users – including ways to develop higher-end services.</p> <p>With revenues in 209 at 136m NOK (up 36% from 2008) and profits of 28m NOK the company is doing very well financially, but the market is beginning to saturate – it is running out of countries with high Internet penetration, as it has found when trying to enter Germany and France.</p>	 <p><b>Iterate – a classic IT consulting startup story</b>  <i>Iterate, a software development consultancy with 25 employees, is a typical example of a mid-size IT consulting company: Founded based on a desire to use certain tools, dependent on relatively few customers, little interest in building sales muscle – and use of their lack of commercialism as a motivating factor for their employees.</i></p> <p>Iterate was founded in early 2007 by Anders Haugeto, Simen Fure Jørgensen and Kim Ophus Leskovsky, all system developers unsatisfied with what they saw as sloppy project management and fascinated by the concept of <i>lean software development</i>, a technique focused on developing software as fast as possible with as little waste, in terms of delays, unnecessary coding, or blind alleys – as possible. The method borrows many ideas from the concept of <i>extreme programming</i> (Beck 2000) as well as from Toyota's lean production methods.</p> <p>The company now has 28 employees, mostly recruited through each developer's contact network. They make 95% of their money from consulting (i.e., systems development for customers) and has been profitable from the start. Its goal is to grow to 70 employees within 3 years, ideally with no single customer accounting for more than 10% of the total business.</p> <p>The company is currently building a sales organization and thinking about international expansion, both in terms of customers and capacity. The lean methodology requires trust from the customer in the consulting company, and also, given the high focus on time, comes at odds with the traditional consulting company's practice of billing for hours consumed rather than a fixed price for a final product. As with many consulting companies, clarity around the business model and the marketing comes up as the company reaches a size where more formalization is necessary.</p>
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Hewlett-Packard, the largest IT company in the world, operate both in hardware and services, but do not really dominate in any sense, aside from having a very large market share in printers and peripherals. Southeast Asia is increasingly the world's hardware producer – first in Japan, then Taiwan, then Chian and now production is gradually moving to Malaysia, Indonesia and the Philippines. In IT services, India is sailing up much like China has done in overall manufacturing, through a transition from contract manufacturing to forward integration and development of own

products. India's transition has happened in four phases<sup>20</sup>: First, Western companies offshored software maintenance to access available capacity (much of the demand was based on the need to upgrade old enterprise systems to deal with the Y2K problem), then to take advantage of labor arbitrage (driven by cost considerations following the dot-com bust), then to access capability (as many of the Indian domestic service providers have achieved CMM<sup>21</sup> 5 certification levels and have taken leadership positions in a quest to industrialize software development), then, finally, as customers of a fledgling collection of Indian companies designing their own systems and products and selling them to the world<sup>22</sup>.

## Trends

More than any other industry in Norway, the IT industry is shaped by continuous changes in technology. Some of the more important trends are

- **Globalization:** The IT industry is global in nature, and becoming more so. The large international companies, most of which started out in the United States, are becoming increasingly global not only in the scope of their activities, but also in their organization. For instance, HP, IBM and Accenture, the largest and most prominent technology and



### Mamut: ERP starting small and going cloud

*Mamut, along with Visma, Software Innovation and SuperOffice, exemplifies Norwegian software companies that follow a strategy of first capturing the Norwegian market, then gradually expanding abroad.*

Mamut ASA was founded in 1994 as Guru Software by Eilert Hanoa. His simple idea was to offer Windows-based, simple software for accounting, tax calculation and other standard business processes, at a very low price point, to small (even single-person) and medium-sized businesses.

At the end of the nineties, the company had expanded to 100 employees and the software included the offering of a web page with e-business functionality for small companies. It changed its name to Mamut, expanded internationally (into Sweden, then the Netherlands), then into the UK, Denmark, Ireland and, in 2008, Germany.

In 2006 the company was listed on the Oslo Stock Exchange, and started expanding by acquiring a web services company in Norway as well as accounting and CRM software companies abroad. It has entered into strategic agreements with Microsoft UK and a large software provider in Germany. In 2010, it had revenues 500m NOK, 460 employees and more than 400,000 customers in 16 countries. The organization remains centralized despite its geographical, with Eilert Hanoa as the CEO and most development taking place in Oslo.

A feature of Mamut has been the longevity of its customer relationships – customers typically come in as a company is started and everything is done by the founder him- or herself. Then they tend to stay, growing with the software. Customers leaving tend to be for two reasons: The startup fails, or it is acquired by another company which uses different software.

A second customer group is independent accountants and bookkeepers who use the software on behalf of customers. There is a strong focus on partnership – both with customers (who can earn commissions by recommending Mamut) and with Microsoft, the main provider of technology.

From 2010 Mamut is consciously trying to move their customers from distributed software model – where the software runs on individual PCs – to a model where the customer accesses the software on the web (SaaS). This will allow shorter development cycles, easier access to the software for the users (you can access it from any PC) but represents the biggest change for the users yet – and as such can be a risky move if the company's technological evolution outstrips that of the customers.

In June 2011, Visma made a formal offer for Mamut, approved by Eilert Hanoa..

<sup>20</sup> Part of this story is well told, with many examples, in Friedman (2005).

<sup>21</sup> Capability Maturity Model, a certification framework used for systems development.

<sup>22</sup> Public policy makers, take note: This last evolution is driven by a return of Indian expatriates from Silicon Valley firms – they have capital and knowledge of the international technology markets. For a smart technology person leaving Norway, returning is often for retirement than a second career.

service companies, now the largest parts of their organizations (in terms of employment) in India. Furthermore, Indian IT service companies have grown at annual rates of around 30% since the 1990s, and the largest of them (Tata Consultancy Services, Infosys and Wipro Technologies) are global companies offering their services directly to (mainly, large) customers all around the world, without bothering to go through agents or other third parties.

- *Continued rapid technology evolution:* Despite many predictions to the contrary, information technology continues to evolve and increase capability in processing, storage and communication. Processors get faster, hard disks and memory chips ever more capacious, and communication lines faster. There is little reason to believe that this trend will abate in for at least another 10 years – faster technologies are in the labs already, and available capacity is quickly consumed by new uses.
- *Open source software/free software:* Traditionally, software vendors have sold the machine-readable version of their software to customers, keeping the human-readable part (the code) to themselves. Alternative models (exemplified by Trolltech/Qt Technology<sup>23</sup> and Redpill/Linpro) have sprung up, where the customer can have access to the source code (including copying it and making modifications) and/or have the programs for free – with the seller taking their revenues through consulting. After initial, considerable confusion around what this market approach meant<sup>24</sup>, including the rights allocated to authors and users, this model is becoming



## basefarm

### Basefarm – the lean infrastructure provider

Basefarm is a provider of platform services – it runs the computers that provide the services behind many well-known web sites in Norway, such as altinn.no (portal for companies' reporting of tax and other government interactions), minsida.no (individual government portal), norwegian.no (low-cost airline, tv4.se (Swedish TV channel) and others.

Started in 2000 and located in Nydalen in Oslo, Basefarm specializes in providing infrastructure – standard technology, much of it based on the LAMP architecture – in a very reliable and cost-effective manner. Their target customers are companies for whom the Internet is business critical. They provide highly dependable service, with redundant equipment, security procedures, backups and application maintenance. Their competitors are on the one hand traditional service providers such as EDB Ergogroup, a much larger company with more complex service offerings, but also with more legacy responsibilities and more bespoke relationship with their customers. On the other hand, they compete with the cloud computing services of Google and Amazon.com.

Basefarm's strategy is to offer much of the simplicity of Google and Amazon's offerings, but in a Norwegian context – contrary to the automated interfaces of these companies, Basefarm is just a phone call away. The fact that many customers (particularly in the public sector) demand that their data is physically stored in Norway has helped them win many customers.

Basefarm has grown to 250m NOK in revenues with just 150 employees in 2009, which shows that there is money in providing basic, highly reliable IT services. Their challenge lies in achieving much of the same economy of scale (through automated software maintenance and installation) while maintaining the closeness to the customer and relative simplicity of technology that shaped the company from the beginning.

<sup>23</sup> See previous case.

<sup>24</sup> Most common is the misconception that open source (the customer can see and modify the source code) and free software (i.e., that the customer can use it without paying). Many of the larger software vendors will allow their largest customers to inspect their source code, especially for certification issues. Similarly, many versions of close-source software is available for free – one example is the widely used Adobe Acrobat Reader.

increasingly common, especially for companies in the innovation phase and for public sector initiatives<sup>25</sup> where there is a desire to avoid *de facto* monopolies.

- A continued *transition from products to service*: Given that software sold as a product can be easily copied and distributed, more and more software (and, through cloud computing, hardware) is being made available as a service. Microsoft Windows, for instance, can be bought and installed as a product, but it can also be pirated. A pirate user, however, will not have access to updates, extensions and error fixes continually distributed to *bona fide* customers over the Internet. An exchange of technology and business models has taken place (Fjeldstad, Andersen et al. 2000), where the telecommunications industry gradually has adopted the technology of the IT industry, while the IT industry has adopted business models from telecommunications. These services are provided as layers of functionality (Andersen and Fjeldstad 2003) priced according to relative market share and layer functionality. For instance, Basefarm, a server hosting company, provides services to Norman Data Defense, which themselves provide infrastructure services (virus scanning, email cleaning) for customers.

Though these trends are very visible and highly publicized, it would be a mistake to think that the whole industry is constantly changing. While hardware and software changes rapidly, there are layers of functionality that stay relatively constant – server operating systems and interfaces, databases, user interfaces, and standard productivity software. Transition to new technologies happens by consumers adopting new technologies, which then are adopted by companies for business use<sup>26</sup>; by service providers migrating their background technologies through automation to raise productivity, and companies gradually (and very slowly) changing their systems, mostly in response to technical innovations propagated by service and technology providers.

### **Current market structure**

The Norwegian IT industry is a very varied collection of companies. Some important groups are:

- Large service companies, who primarily do consulting and maintenance work for customers large and small. In general, the larger and less Norwegian-owned the company, the more they work with large customers. This part of the industry is consolidating. Examples include IBM's service activities, Accenture, EDB Ergogroup with its many subsidiaries, Bouvet, Devoteam DaVinci, Logica, to a certain extent Atea, etc.
- Technology integrators who provide technology to customers and make most of their money by simplifying its use. Examples include IBM's software and hardware activities, Microsoft, Apple, Hewlett Packard, Oracle, and Cisco
- Norwegian technology companies selling technology and services mainly towards a global market. Examples include Opera, FAST (now Microsoft Development Center Norway), Tandberg (now part of Cisco), Trolltech, etc.

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<sup>25</sup> One example is NDLA (Nasjonal Digital LæringsArena, see ndla.no), an organization funded by Norwegian counties with a mandate to develop free and open source learning software for use in schools. NDLA was started as an initiative to create alternatives both to commercially available learning software and also to lessen the school system's dependence on commercial publisher's text books.

<sup>26</sup> The transition to consumer-led innovation, particularly in hardware, started with the PC in the 80s and has become more and more prevalent – in fact, many large companies now let their employees choose their own equipment, particularly for mobile phones and laptops. Personal technology is getting, well, personal.

- Norwegian technology companies selling technology and services primarily toward the Norwegian (and in some cases Nordic) market. These are characterized by starting in Norway and then expanding into the Nordics and, in some cases, Northern Europe. Examples include Visma, Mamut<sup>27</sup>, Questback, SuperOffice, etc.
- Smaller technology and consulting companies with an exclusively Norwegian focus, either providing a specific technical service (Syscom, providing security services) or business service (Akelius<sup>28</sup>, Ibistic<sup>29</sup>) or regionally oriented consulting services (e.g., First Consulting, started in Bergen and now expanding to Oslo).

The IT industry is a lively source of new companies and employment – startup costs are very low, especially capital investments, and a relatively easy expansion path can be found (especially for consulting-oriented companies) up to 25-50 employees. Many consulting companies seem to want to stop at this stage, preferring a stable, comfortable income and family-friendly work demands to the more risky (and definitely less technically oriented) challenges of expansion<sup>30</sup>. The truly ambitious (on a world scale) entrepreneur remains an outlier in Norway – and one that frequently moves abroad to get some air under his or her wings.

The market structure in itself is complicated, but can be described as a set of layers (in computer parlance, a “stack”) of functionality, with some layers (processors, operating systems, consumer search, social networks) being dominated by a few large players, and the intervening layers (computer hardware, particularly those having reached a modular stage, services and distribution, administrative software) being fragmented. Shifts in these layers occur with technological changes – either with new technology creating new, large, dominant players in new markets (IBM with mainframes, Microsoft and Apple with microcomputers, Yahoo, Akamai and Amazon with the Internet, Google with search technology, Facebook with social media) or by disrupted players migrating into other parts of the stack in search of superior profits (Christensen, Raynor et al. 2001). The (near-)monopolized layers stabilize the stack, drive down the total cost of ownership so that new uses for the technology can be found, and effectively free up the adjacent layers for innovation – and eventually creating their new competition. IBM created a PC, legitimized and standardized the market, and was subsequently nearly killed by its own invention. As Neal Stephenson (1999) put it in the case of the emergence of the open source industry:

Credit for Linux<sup>31</sup> generally goes to its human namesake, one Linus Torvalds, a Finn who got the whole thing rolling in 1991 when he used some of the GNU tools to write the beginnings of a Unix kernel that could run on PC-compatible hardware. [...] To write code at all, Torvalds had to have cheap but powerful development tools, and these he got from Stallman's GNU project. And he had to have cheap hardware on which to write that code. [...] Really the only way to make hardware cheap is to punch out an incredible number of copies of it, so that the unit cost eventually drops. [...] The only reason Torvalds had cheap hardware was Microsoft. Microsoft refused to go into the hardware

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<sup>27</sup> During the wrapping up of this report, Visma made an offer for Mamut. At the time of writing, the deal is not formally consummated, as some of the shareholders want a higher price.

<sup>28</sup> A company providing tax return and basic accounting software.

<sup>29</sup> A company providing software-based invoice handling services for large companies.

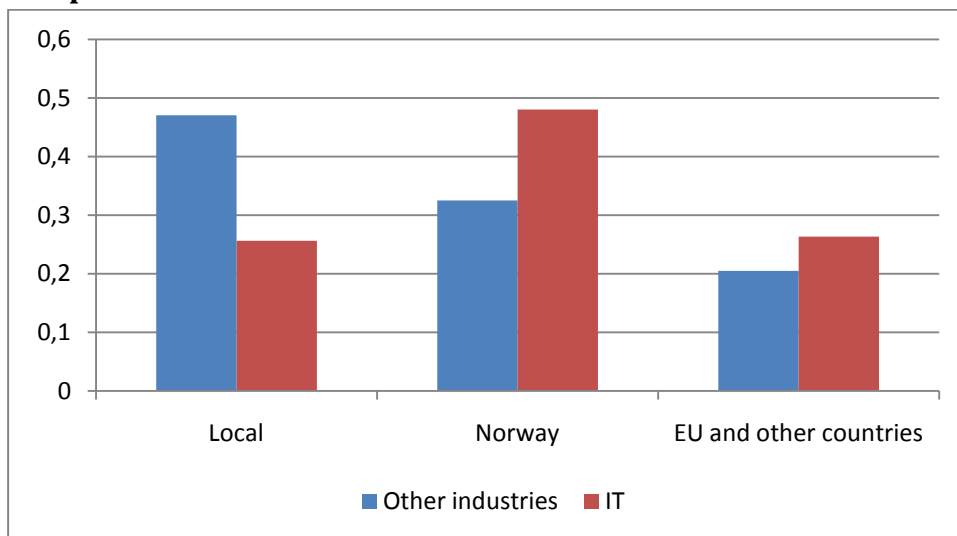
<sup>30</sup> Several leaders in IT companies we interviewed expressed irritation over Norwegian consultants' apparent lack of ambition for growth – a tendency, both part of managers and employees, of satisficing rather than maximizing growth and profits.

<sup>31</sup> A widely used open source operating system – see [en.wikipedia.org/wiki/Linux](http://en.wikipedia.org/wiki/Linux).

business, insisted on making its software run on hardware that anyone could build, and thereby created the market conditions that allowed hardware prices to plummet. In trying to understand the Linux phenomenon, then, we have to look not to a single innovator but to a sort of bizarre Trinity: Linus Torvalds, Richard Stallman, and Bill Gates. Take away any of these three and Linux would not exist.

The cheap tools made by Torvalds and others were happily taken up by software entrepreneurs all over the world. Two of them were Larry Page and Sergey Brin, who in 1998 described a search algorithm (Brin and Page 1998) based on academic citation indices and went on to create Google, using Linux and other open source software, and today is, along with Apple, Microsoft's chief competitor in the consumer and gradually the business market.

## Competition



**Figure 3 Competitive focus of IT companies (percentages reporting activity)**

Norwegian IT companies are primarily focused on the Norwegian market (as opposed to the local of international one) and compare themselves to their close competitors within Norway. The international competition is less of a factor, except for a few companies that are global from the start. Norwegians want things in Norwegian – i.e., the customers want Norwegian software for administrative applications (for instance, it will need to integrate into Altinn and in other ways conform to Norwegian laws and regulations<sup>32</sup>). Mostly, they also want Norwegian-speaking consultants to deal with, except for the very largest, international customers.

Consequently, a large part of the Norwegian IT industry is kept busy either providing technology customized for the Norwegian market, or taking foreign technology and adapting it to Norwegian conditions. The more generic the task performed by the software, the less likely it is created by a Norwegian company – with exceptions, of course. One exception to this is open source software, where no international vendor – largely because there are no vendors in the sense of selling software, only companies providing services utilizing or configuring the open source tools.

<sup>32</sup> The continuing changes in Norwegian rules and regulations remain a constant source of irritation for administrative software providers in Norway – who do not seem to realize that should the government cease to change the rules and create a stable situation, it would to a much larger extent make the market viable for large, international actors.

## Revenues and value creation

The following figure shows the evolution in revenues of the four main groupings of companies in the IT industry the last decade. After an industry-wide hit after the dot-com bust, the growth has been substantial, particularly in Norwegian consulting and services. Much of this has come from consolidation, however, in particular the major acquisitions of EDB Business Partner from 2003 on (partially buying internal IT departments, but also acquiring a NOK1b business from IBM in 2003, transferring that business from “international” to “Norwegian” service provisioning) and Ergo Group’s splitting out from the Post Office in 2005.

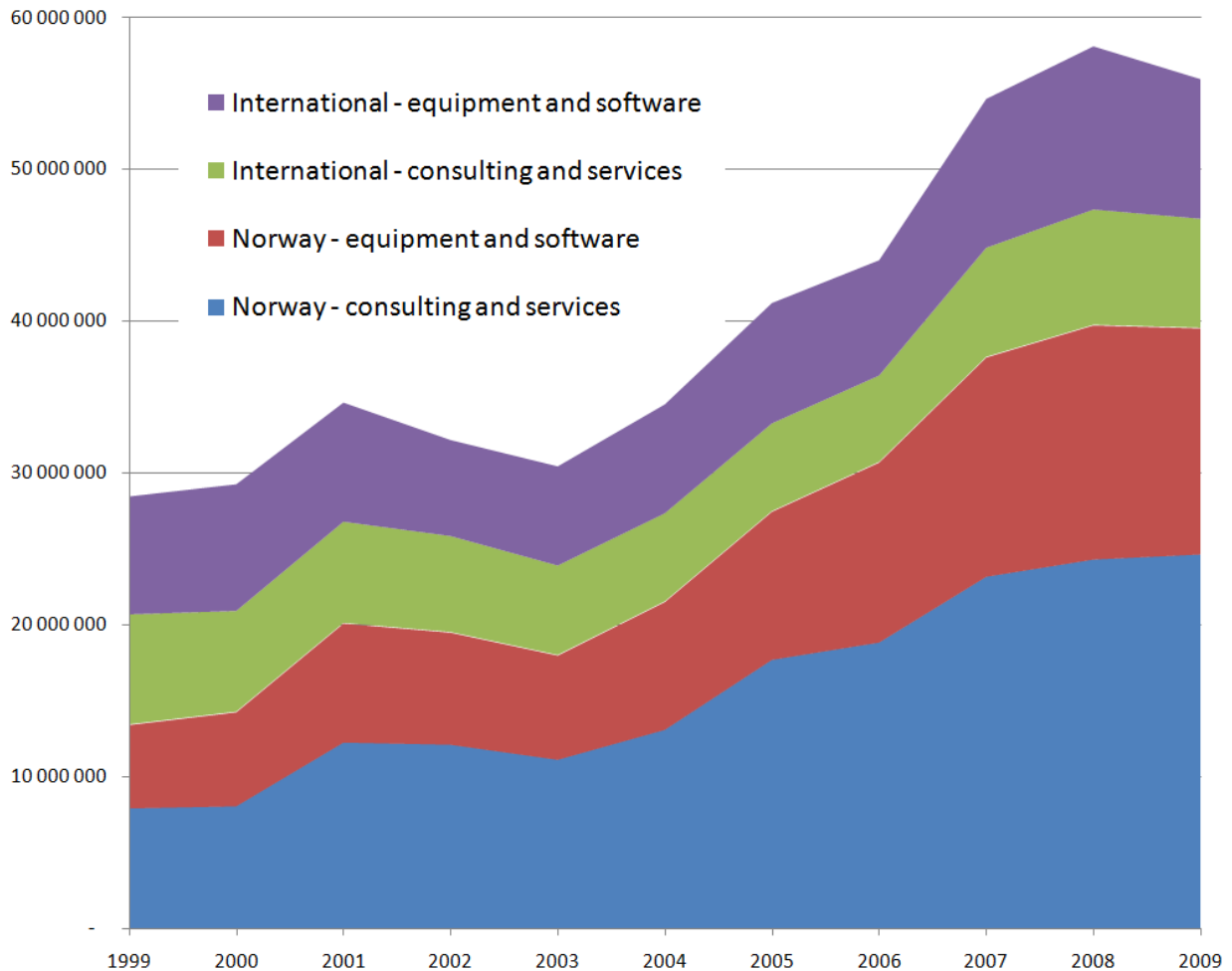
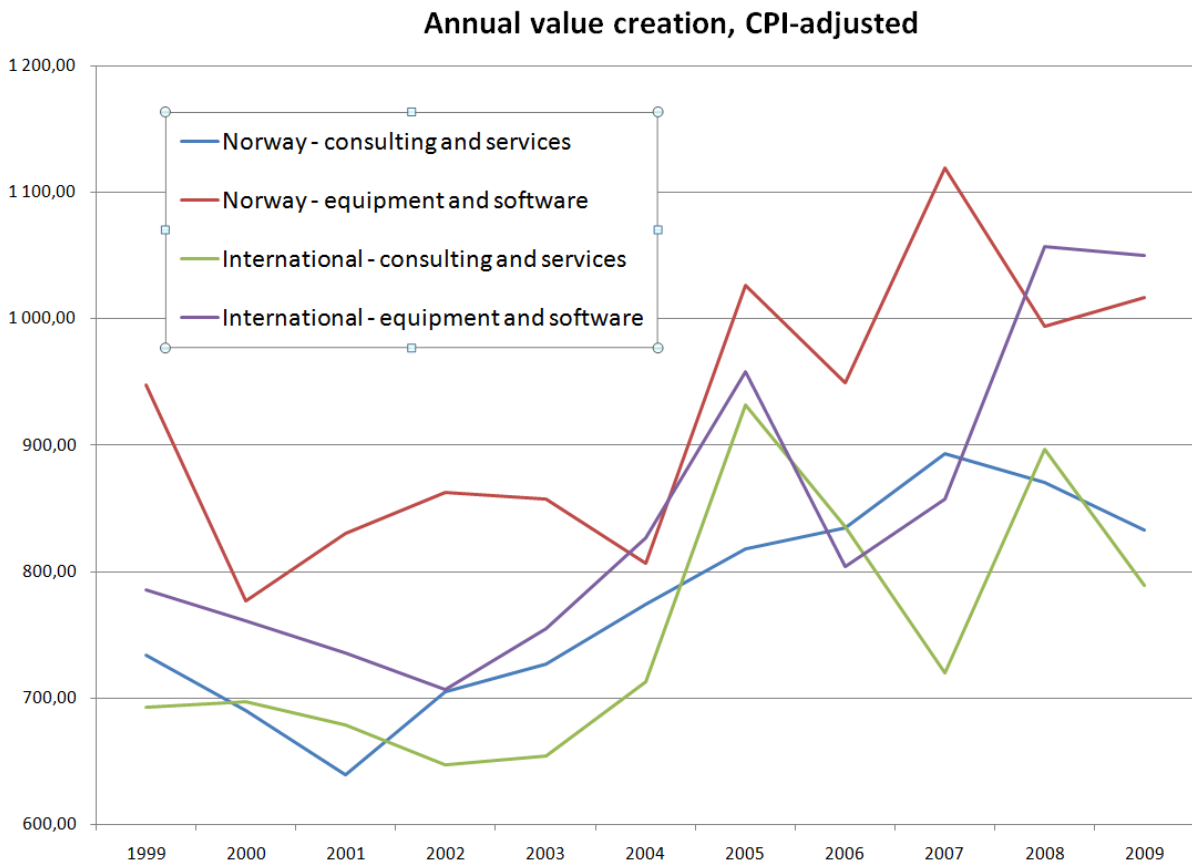


Figure 4: Revenues, technology and services, Norwegian market

From a knowledge-based viewpoint, revenues are less interesting than value creation – i.e., salaries and operating revenues per employee. In a country with a very high living standard, high wage equality and constant demands for more productivity, valuable companies will employ knowledgeable (hence, well paid) employees) and make money above “normal” profits.

As can be seen from the next figure, value creation within these four categories shows more variation, with equipment and software companies showing substantially higher valuation per employee as the decade draws to an end.





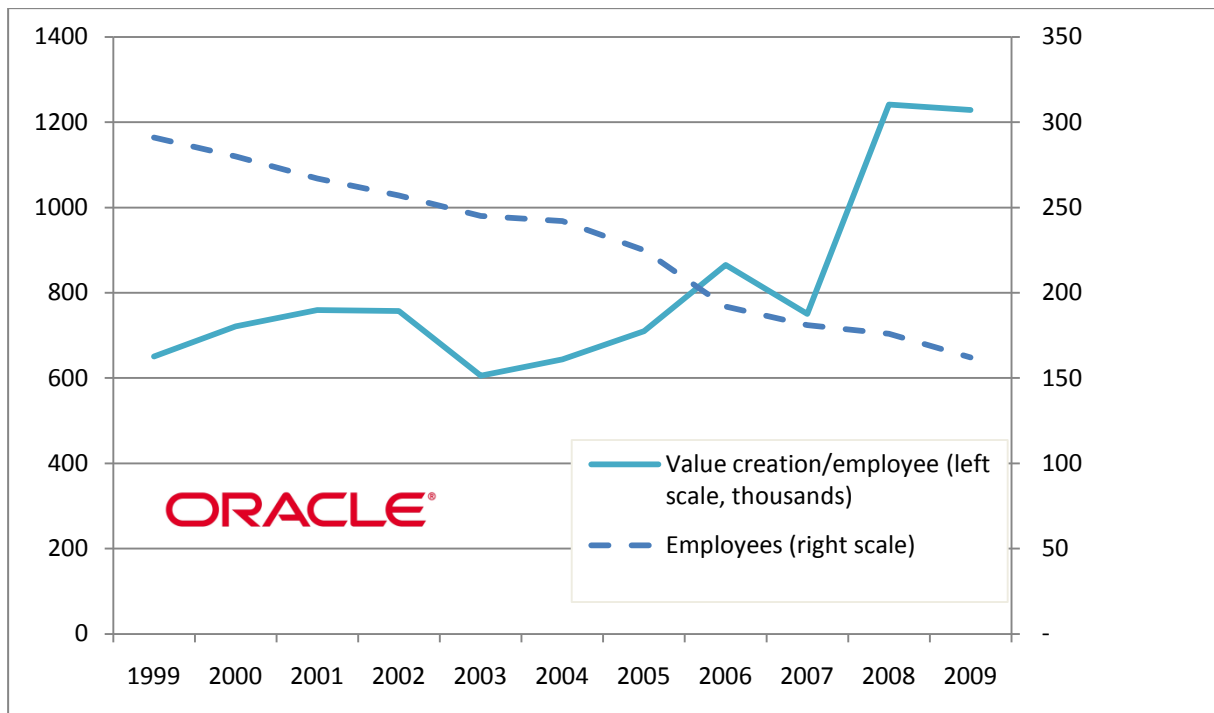
**Figure 5: Average value creation, technology and services, Norwegian market**

It is at the individual company level, however, that value creation becomes interesting, because it shows the effect (and value) of individual strategies. Companies can be found to increase value per employee both while growing the employee base, and by shrinking it.

One example of a company that is growing value creation per employee is Oracle – which is very decidedly employing a strategy of moving lower-level skills jobs from high-cost countries to low-cost. Oracle is a very large international software company for whom the business in Norway is relatively small, with revenues of close to NOK300m, mostly from licensing fees. Oracle Norway, in the face of a slowly declining market<sup>33</sup>, has gradually has moved half the workforce (mostly technical support and maintenance) in Norway to lower-cost countries, mostly to Eastern Europe and India, leaving the higher-value work in Norway<sup>34</sup>:

<sup>33</sup> Oracle Norway's revenues were NOK 343m in 2001, dipped to NOK 234m in 2006, before climbing to NOK 284m in 2009.

<sup>34</sup> A number of other specialized technology companies, such as EMC<sup>2</sup>, an advanced storage company, have gone even further, and now does everything in the Norwegian market from Sweden.



**Figure 6: Oracle evolution of workforce**

For Oracle, as for many other companies, the world is essentially becoming one – since the *lingua franca* is English and database software and ERP software (Oracle’s main products) are used pretty much the same way all over the world, it makes little sense to maintain local presence, except for sale to high-end clients and relatively advanced tailoring for special businesses.

It is interesting to compare Oracle to another large software company, that of SAS Institute. SAS provides software for analysis of data, and has roughly doubled its business in Norway (from about 100m NOK in 2000) the last decade. The workforce has increased with about 50% - and the value creation per employee has almost increased 80%:

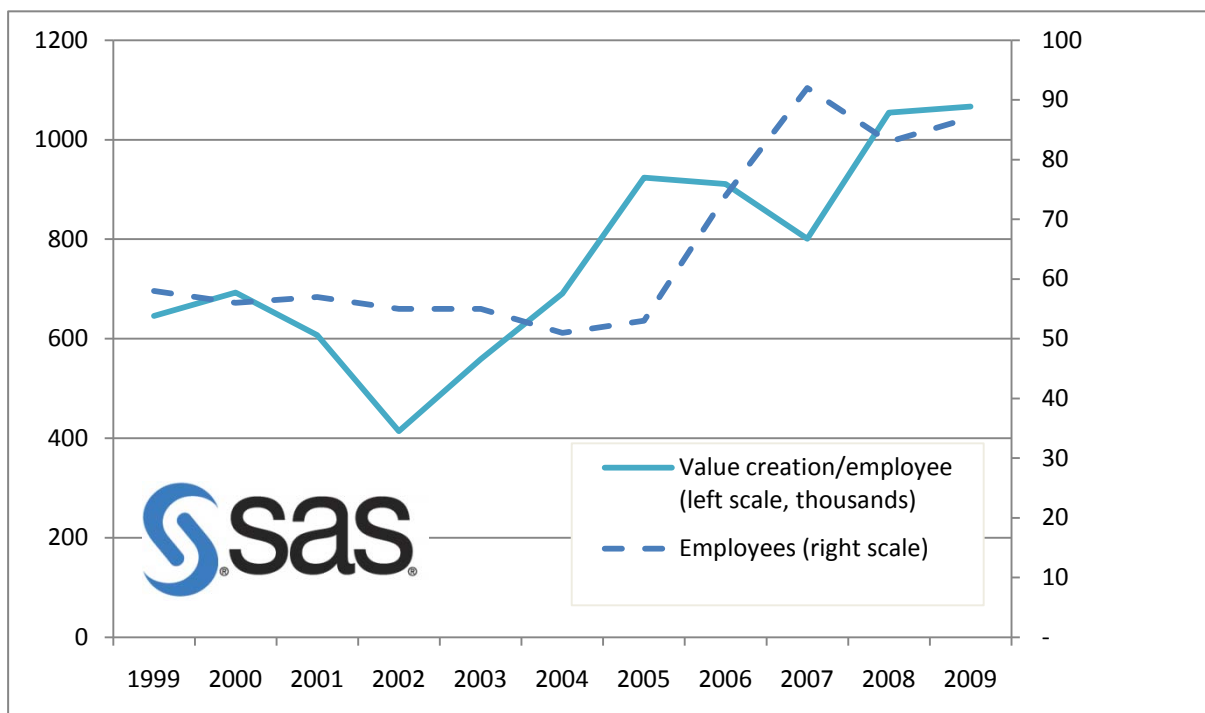


Figure 7: SAS Institute evolution of workforce

SAS differs from Oracle in that almost every customer of some size buys not just the software, but also access to an SAS consultant (a business intelligence specialist, say, or an engineer for analysis of oil rig maintenance data). In many ways, SAS as a software company is selling expertise at analytics, supported by their own, very advanced software. The highly domain-specific knowledge is very hard to move abroad or automate – partly because the customers want to talk to a local expert, partly because it changes with the domain rather than the software.

Value creation per employee is not used much as a reported measure. It has a number of problems (especially when evaluating international companies, who to a certain extent can move costs and revenues around) but can be quite revealing as an operational measure and as an indicator of the value of a company.

### ***Technology as identity and competitive framework***

One peculiar feature of the IT industry is that for many developers (and, indeed, companies) the competition is not between companies, but between technologies and methods. Quite often, companies are formed not with a view to solving problems for customers, but because a group of developers want to use a certain kind of business model, such as open source or agile systems development methods, sometimes referred to as extreme programming(Beck 2000). Linpro (now Linpro/Redpill, after a merger with a similar Swedish company), the leading consulting and software development company, vows to exclusively work with free software and for a long time had developers and, indeed, management seemingly unconcerned with economics, as long as they were allowed to work with the technology they loved. Iterate (see case) was formed by a group of people wanting to develop using agile methods and seem less concerned about growing the company than maintaining the purity of their methods.

While found in other industries (the car industry comes to mind), this level of technological self-identification is relatively unknown in other places – and it does sometimes become a factor both in business and policy discussions, sometimes excessively so. One reason might be that for certain purchases, the end customer may not have sufficient technological expertise, leading management to delegate the decision and interaction down to a too low technological level (Keen 1991), leading to a situation characterized by one technology CEO as “nerd-to-nerd marketing.”

A recurring theme with software companies is that while customers can buy and install software, sophisticated high-value use of IT requires hiring experts to either do the analysis or help with configuring the software for use. A typical example here is SAS Institute, which sells software for statistical analysis, primarily to large, technology-intensive companies, making much of its money from providing expertise within the areas their customers want to use the software to analyze, such as risk management, customer analysis and logistics. This mode of delivery ties the customers to the company and improves profitability, but the reliance on human experts limits growth for the company and can make it vulnerable for disruptive innovations (Christensen and Raynor 2003) as seen in the Norwegian media monitoring industry (Andersen 2008), where increasingly automated cruder and cheaper search and analysis tools have replaced human analysts.

### ***Internationalization and globalization***

Though most Norwegian IT companies are focused on the Norwegian market, the business is becoming increasingly international, driven by the capacity increases in the technology and the hunt for lower costs or experts. This goes both ways for the Norwegian industry – it moves work abroad, but also provides a world-wide market for advanced labor-saving technology. The large, international IT companies are truly multinational, buying and selling technology and services all over the world. They also form alliances, do mergers and consolidations at an unprecedented level.

International changes, however, seem to change the relationships and economics of the Norwegian IT-industry itself relatively little. One reason is that a number of the large international technology service providers just aren't present in the Norwegian market – the low number of large customer companies and high cost of local labor see to that. This means that many large mergers are not relevant for Norway: For instance, the merger of HP and EDS in 2008 had little significance for the Norwegian market, since EDS had few operations there. When asked about to what extent international relationships led to collaboration inside Norway, almost all interviewees thought that they were not particularly important – in competing for Norwegian contracts, companies would enter into collaborations with almost anyone<sup>35</sup>.

There is one exception to this, however, and that is what happens when a Norwegian technology provider, such as Tandberg or Trolltech, is acquired by a large international player, normally because that player wants the company to add a specific technology capacity to its portfolio. In that case, prior collaborations with other international players in Norway – and sometime customer relationships – can be impacted. Similarly, a number of industry initiatives, particularly in lobbying towards politicians and other decision-makers, can be hampered by individual player's need to tout their technology as the solution to whatever the problem might be. Collaborations that would make

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<sup>35</sup> One exception might be Avanade, an joint venture of Microsoft and Accenture, which has 200 employees in Norway.

sense in a small market are sometimes forbidden by the international organizations, often for very schematic reasons<sup>36</sup>.

The most important aspect of IT internationalization in the last decade has been offshoring. Norway occupies a middle position here – the small language base means that the number of places you can offshore services such as user support is limited, since Norwegian users, for all their supposed English-speaking capability, want Norwegian-speaking help. The informality of Norwegian business also means that most Norwegian companies are not used to formal specification of tasks, instead relying on a shared understanding of problems and a shared culture of egalitarian communication.

Nevertheless, offshoring has become quite a factor, led by the international technology and service companies, such as Accenture, HP, and Oracle. Norwegian service companies have made investments abroad – 25% of EDB Ergogroup's provisioning happens outside Norway, for instance – but offshoring still remains something of a mum subject. Near-shoring to the Baltics and Eastern Europe is seen as a compromise, but classical offshoring to India is slowly picking up. Norwegian customers are insisting on the cost savings of offshoring, but (with a few exceptions, such as Veritas' work with Infosys) prefer to deal with the issue by outsourcing their IT to international companies, such as Accenture, who then turn around and move the work to "fulfillment centers" around the world while maintaining a Norwegian customer interface.

Indian outsourcing companies have started to move into the mainland European market and also to Sweden, acquiring smaller consulting companies to act like market fronts, but this has not progressed beyond the experimental level at the Norwegian market at present. The main reason seems to be size – as one EVP of European operations in an Indian outsourcer told us: "When we decide to go into a [country], we will like to see revenues of around \$180m in about 2 years." Contracts of that size are few and far between in Norway – and many of them are in the public sector, where direct offshoring or even outsourcing<sup>37</sup> to a non-Norwegian company still is thought not acceptable.

### **Factor conditions**

Most of the factors necessary to start and run an IT company in Norway – capital (at least up to a certain company stage), technology (especially fast communications), and locations – are relatively easily had. There is a paucity of "knowledgeable" venture capital when companies grow to a size where an expansion outside Norway – one informant lamented the fact that the Norwegian Stock Exchange seems to value companies with intellectual property no more than pure consultancies – but the declining cost of hardware and the availability of open source software or traditional software supported by its providers (such as Microsoft's many offers to budding software companies) means that the need for capital, in most cases, is relatively modest compared to industrial companies.

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<sup>36</sup> The telecommunications industry seems to have a better understanding of this – for instance, the two Norwegian telecom companies Telenor and Netcom, despite being bitter competitors, have had a number of technological collaborations together, both in infrastructure construction and servicing, and in creating joint industry frameworks for, for instance, content provisioning over their mobile networks.

<sup>37</sup> The terms *offshoring* and *outsourcing* are frequently used interchangeably, but are quite different concepts: Outsourcing is a legal term, referring to having a task performed by a different company (legal entity). Offshoring is a geographical term, referring to having a task performed in a different (and often cheaper) country. It is quite possible to offshore without outsourcing, as General Electric, for instance, have done, and Aker Solutions is doing for production and certain engineering, and vice versa.

*Electric power*, especially the “clean” kind created by renewable sources of energy, is a factor for very large, centralized computing centers. Much time and intellectual effort is spent on achieving energy efficiency in centralized data centers, effectively turning them into large computers in their own right (Barroso and Hölzle 2009). Norway has hydroelectric energy in abundance, as well as many disused caves, mines and industrial facilities, especially along the west and northern coast. This, along with Norway’s excellent fiber-optic networks and stable politics, has led to a certain rush from many communities<sup>38</sup> and some companies seeking to entice large data center providers or users – such as the CERN research center – to locate their server farms in Norway. This is done in the hope of generating employment, but since these data centers are highly automated and rarely employ more than 30 people, any substantial gains in employment are likely to be limited to the building period. The chief economic benefit of locating data centers in Norway seems to be that transporting electric energy (in the form of bits) through a fiber-optic cable may be a more energy-efficient way of selling power to Europe than transporting it through traditional power lines, where energy is lost along the way.

The overwhelmingly important factor in the IT industry, in Norway as everywhere else in the world, is *talent*, i.e., knowledgeable and motivated people. Candidates from technical education institutions currently face a very attractive job market, especially if they are good and come from IFI or NTNU, the two main IT universities. The demand is especially strong for people with a combination of technical and organizational expertise, creativity and communicative skills. The demand is highly stratified, however – certain “middle” positions, such as basic maintenance, user support and well-specified development, can be more cheaply done abroad, either by clever out-tasking or by directly recruiting employees in lower cost countries. Up till 2001, many young people wanted to go into information technology, less for the technology itself than for the investments and growth in the area fueled by the dot-com boom. When this bust in 2001, enrollment at IT-related studies fell dramatically (see later chapter on research and educational institutions) and has not recovered.

### **Customers**

The customers of the IT industry are, basically, all individuals and organizations in the world. A useful categorization can be set up based on size and organization form, as in the figure:

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<sup>38</sup> See, for instance, the article “Alle vil ha Google til bygda” in *Aftenposten*, May 22, 2011 ([www.aftenposten.no/okonomi/innland/article4127689.ece](http://www.aftenposten.no/okonomi/innland/article4127689.ece))

	Small	Large
Individual	Consumer	Prosumer
Business	SMB	Corporate
Public	Municipality	National
International	International consumer	International business

Figure 8: Customer categories

Most companies serve at most two or three of these markets, and the go-to-market strategy varies significantly. New market spaces are frequently found in the borderlines between these markets – for instance in the space between prosumers and large companies, where cloud computing and other web-based services now can be purchased by individuals but used in large company settings.

### ***Individual – consumer and prosumer***

Individual customers in Norway consume technology like few other nations on earth – at or near the top in households with PCs, Internet connections, mobile phone use, and social network use. Contrary to the US, adoption of new technologies is not driven by well known users, but more by vendors, word of mouth, and newspaper articles. The government has been relatively early in promoting digital interfaces between the government and the individual citizen, with the Norwegian Tax Authorities leading the way. Norwegian consumers submit their tax returns by SMS and businesses theirs via the government portal Altinn.no<sup>39</sup>, launched in 2003, which as received more than 50 million forms submitted from 2004 to 2009.<sup>40</sup>

<sup>39</sup> It should be noted that while the interface between the government and the individual is highly digitized, the administrative and service processes between and within government organizations are not automated and digitized to the same degree.

<sup>40</sup> [www.brreg.no/kurs/altinndag09/0\\_Innledning%20-%20Fossum.pdf](http://www.brreg.no/kurs/altinndag09/0_Innledning%20-%20Fossum.pdf)

As a consequence, Norwegian consumers are digitally enabled, communicate by email and social networks, have the highest use of Internet banks in the world, and are relatively comfortable with buying things online (in particular tickets, travel and other services, books and electronics). To the extent that electronic commerce is less prevalent than in the USA, this probably has more to do with the relatively small size of the Norwegian market and the difficulty in importing things from abroad.) In particular, the classified ad site Finn.no organizes the Norwegian market for real estate, cars, jobs and sundry items – Schibsted being a celebrated case (Anand and Hood 2007) one of very few media houses that have managed to make a profitable transition from paper to web.

*Prosumers* – individuals with high expertise in IT and IT use – are less visible in Norway than in, for instance, Sweden or the USA. This may have to do with the relatively small size of Norway, but also that a Norwegian IT prosumer, given his or her proficiency in English, may as well participate directly in discussing, evolving and consuming technology directly from technology

sources, be they foreign or domestic. The consumer gets his or her IT news – what to buy next, from iPods to iPads – from newspapers and vendors, the prosumer from the Internet. A special case of prosumer is the independent software/web developer, which is wooed by technology vendors with software development kits and free promotional versions of technology. Companies such as



### **Schibsted – a transformed media house**

Schibsted, a very traditional media company with Norway's two largest newspapers, the tabloid VG and the broadsheet Aftenposten, has over the last 20 years transformed itself into a global media house, especially in the classified ad business.

When the Internet became public in 1994, Schibsted had already made a decision to diversify its activities from traditional newspapers to other media channels. Under its young and dynamic CEO, and with support from the main owner, Tinius Nagell-Erichsen, who with a blocking ownership post of 26.1% (changes in company structure demanded a 75% majority) embarked on a long-term investment and development strategy. The company invested in TV channels, in the Internet connection provider Oslonett and later the ISP Scandinavia Online (both were eventually sold, at substantial profits, to Telenor), and in both free and traditional newspapers abroad.

The most important change happened on the classified ad side. Aftenposten, the largest subscription newspaper in Norway, had long held a dominant position in classified ads, to the extent that someone looking for a new job was referred to as "reading Aftenposten from the back", where the job ads were. The company created an online classified ad market, finn.no, and initially launched it with ads for real estate (with some of the biggest real estate agents having ownership interests in this section,) cars, boats and various used items. As Internet connections became common (especially after the introduction of ISDN lines in the late 1990s and broadband in the early 2000s) traffic picked up, and Schibsted's management overrode the protestations of Aftenposten and let Finn.no conquer the new ad market. Aamot was conscious that significant network externalities work in this market – buyers go where the sellers are, and vice versa – and was loath to see this market taken over by non-media companies, as has been the case in most other countries.

During the creation of Finn.no and with a failed attempt at creating Sesam.no, a Norwegian search engine to compete with Google, Schibsted played an important technology driver role, serving as the leading customer for FAST Search and Transfer, spearheading the development of the Norwegian search technology business, and as an important collaborator with Telenor and a number of other Norwegian information technology companies. After a consolidation and cost reduction drive in 2008-9, the company has lost its technology leader role.

In 2011, Schibsted has successfully spread its Finn.no business (with varying technology platforms) to Sweden, Spain, France, Indonesia, Singapore, Malaysia and the Philippines, the latter by going in early, establishing a dominant position and growing as the number of Internet connections grow. It is experiencing growth both in revenues and profit margins as their markets and market shares grow. The editorial side of the business, however, remains something of a puzzle – the online side is growing, the paper side is not, but the paper side is where the customers are still willing to pay for news. Stay tuned.



Microsoft aim their prosumer marketing efforts towards technology students, gamers<sup>41</sup>, and to a very small extent bloggers. To a certain extent (and little realized except in the open source community) the prosumer market is important because it can consist of people with influence over business market decisions.

### ***Business – small and large***

The purchasing pattern and usage of technology in SMBs and corporations differs more in size and formality than in principle – both large and small companies want standardized administrative systems, outsource much of what they do (the small to small providers, sometimes affiliates of ATEA, the large to larger consulting companies). Most companies want basic IT that works, and providers are paid for making sure the systems work and can exchange information with other systems.

For bespoke, more advanced solutions, certain industries stand out: Oil and gas (where the change in oil production from platform-based to land-based is one of the most important uses of IT in Norway), telecommunications (particularly payment and content interface systems developed by Netcom and Telenor individually and together), banking (individually, dominated by DnB Nor, the only large Norwegian bank left, and collectively, working off the shared payment clearing house Bankenes Betalingssentral (merged with the Danish PBS to form Nets in 2010,) electric power generation and distribution (developing applications for shared power markets and trading, one of the few industries where internal IT organizations have not yet been massively outsourced) and various specialized companies associated with the maritime industry (Aker Solutions, The Kongsberg Group, DNV) remain the big customers for bespoke systems, primarily competed for by the big service companies, often in collaboration with each other.

The business market for IT is changing in two main ways: It is getting more professionalized, with many, especially large companies managing IT investments as a portfolio (McFarlan 1981; Aral and Weill 2004), investing in specific capabilities for vendor management (Venkatraman and Loh 1994) and even beginning to use sophisticated techniques such as real options (Campbell 2002; Fichman, Keil et al. 2005) – in practice, if not in theory – to evaluate development projects and provisioning contracts. This can lead to a tougher competitive situation for the IT service providers – for instance, when the Norwegian Post Office got a new CIO with experience from the oil industry in 2009, the IS provisioning contract was renegotiated at a substantially lower price, a situation that may have played a role in Ergogroup merging with EDB Business Partner in 2010. Some of the larger, international customer companies are also, increasingly, seeking IT partners that can provide services and technology all over the world. With international concerns coming to the forefront, smaller Norwegian providers will have to expand, seek alliances, or retreat from the biggest contracts.

### ***Public sector – local and national***

The public sector can be divided into three areas: Municipalities, national government organizations (various departments, police and military, tax authorities and the welfare administrators (NAV)), and publicly owned service companies (such as the Mail, the health services, and some transportation

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<sup>41</sup> Norway hosts one of the world's largest computer party (meeting of games- and computer interested young people) in the world, every Easter vacation in the Vikingskipet Olympic Arena in Hamar. Since 2004, the five day party has regularly sold out at 5,200 participants. ([www.gathering.org/tg11/en/info/random-facts/](http://www.gathering.org/tg11/en/info/random-facts/), accessed May 23, 2011)

companies, particularly railways.) Together, the public sector is the most important identifiable customer group for IT in Norway<sup>42</sup>.

At the municipal level, smaller actors in the public sector buy their relatively standard systems with varying degrees of central coordination from a plethora of vendors, service companies and consultancies, often locally. Any purchase over a certain amount<sup>43</sup> (in many cases as low as \$15,000) has to be subjected to competitive bidding through Doffin, an online project database. For these purchases, negotiation is not allowed. This has led to a number of different strategies to reduce transaction cost, from collective buying to collecting IT services and purchases in under ongoing contracts from larger vendors. A constant complaint, however, from technology vendors, industry observers and to a certain extent from politicians, is lack of ordering capability – “bestiller-kompetanse” – in the many small municipalities in Norway, frequently described as “completely missing”.

In the national government organization, such as the various departments, the tax authorities, the police and the military, a significant portion of IT management and consumption is done in-house, sometimes with quite advanced results. The Norwegian Tax Authority, for instance, has been a leader in using information technology to make interaction with the public easier, an initiative started in 1995 under the leadership of its inspirational managing director Bjarne Hope. The Tax Authorities started by creating pre-filled tax returns, initially for about 40% of the tax payers, by collecting data from banks, employers and various other sources, under the principle that rather than trying to automate everything, one would start with the simplest tax forms and work from there. Gradually, this system has been expanded, an individual (Minside.no) and business portal (Altinn.no) has been added, and for most people, doing the tax return is now a matter of casting a quick glance at the proffered figures, if that. The portal Altinn<sup>44</sup> has also, by locating the initiative with the relatively inconspicuous government (and thus, less a target for power plays) registrar Brønnøysunds-registrene<sup>45</sup>, has managed to gradually become a platform not just for interaction between various government agencies, but also a serious contender for the position as primary communications platform between the various agencies as well. The Norwegian State Educational Loan Fund (Lånekassen) has seen a very positive increase in its public standing after overhauling and making web-ready its customer interface.

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<sup>42</sup> Foreign observers frequently misunderstand the difference between public and publicly owned organizations. Telenor, the world's 7<sup>th</sup> largest mobile phone company, Aker Solutions (engineering), Statoil (oil and gas exploration and production,) DnB Nor (Norway's largest bank) and the Kongsberg Group (weapons, aerospace and maritime electronics) have or have had significant government ownership, but are run as private companies reporting to stockholders via the stock market. The main reason for public ownership seems to be to keep the companies on Norwegian hands, and politicians very seldom intervene directly in the running of the companies. In their IT purchasing patterns and technology strategy, these companies belong in the private sector.

<sup>43</sup> The amounts and where the project has to be announced varies, see [no.wikipedia.org/wiki/Offentlige\\_anskaffelser](http://no.wikipedia.org/wiki/Offentlige_anskaffelser) (accessed May 23, 2011) for a succinct summary.

<sup>44</sup> Recognized with the CIO of the Year prize, from IDC/Computerworld, in 2010, see [blogs.sas.com/no/innsikt/index.php?archives/15-rets-IT-direktr-Strategi-og-verdi-er-veien-frem.html](http://blogs.sas.com/no/innsikt/index.php?archives/15-rets-IT-direktr-Strategi-og-verdi-er-veien-frem.html), accessed May 23, 2011

<sup>45</sup> An organization keeping track of various registries (house deeds, car registrations, company papers and annual accounts) located in the small town Brønnøysund in Northern Norway.

These organizations are often held up as examples of effective public management and technology use in Norway – but key to their success is their conceptually simple information models. After all, all they have to do is to make sure the right amount of tax is paid, loans provided and forms delivered, and that the process is as simple and convenient as possible. The other end of the government agencies is exemplified by NAV, a merger of the social services, health benefits administrations, and public unemployment office in Norway, which has been operationally creaking at the seams since its inception in 2006 and is currently subject to a huge IT systems overhaul under the leadership of Accenture, an international consulting company. Regularly and well-deservedly pilloried in the press for syrupy performance and lack of informed and coherent decisions, NAV, as well as large parts of the public health service companies and administration has become something of a burden on the public image of Norway as an IT-savvy (Weill and Aral 2005) country. The issue is partially that the organization faces an exceedingly complicated environment, lack of knowledgeable employees (a situation not helped by the bad press image), endless demand for fast and complete services, coupled with relatively low budgets for investments in training and IT systems. The underlying information is, as with most value shops (Stabell and Fjeldstad 1998) voluminous, equivocal, and changes with the addition of more information.

In the publicly owned service company area, the situation varies. With the exception of health, most of the large public services companies have outsourced much of their IT management (Norway's largest IT services company, EDB Ergogroup, was partially formed by the Post Office IT department, for instance). In the health services, there has been considerable centralization, first to five and then four health regions. One of these, again, have formed their own centralized shared services, Sykehuspartner, which does IT and HR services for more than 69,000 employees in Helse Sørøst (Southeast), the largest regional health company. As with NAV, the information integration between and within the various health authorities and providers will be one of the large public IT challenges for the next decade – an area fraught with informational complexities, long established organizational cultures and power dynamics, and complicated issues of privacy and data integrity.

The market interface with the public sector is somewhat different than business, international or domestic. Some of the main differences are

- The prevalence of RFPs (i.e., public bids for contracts) which, according to many industry sources, creates a complicated and possibly self-defeating competitive situation, where quality gets pushed aside by politicians and bureaucrats consistently choosing the cheapest solution in order not to have to justify their choice. In situations where there is less competition, prices can become high. In any case, transaction costs can be high, especially for smaller municipalities facing few real choices.
- The lack of a clear goal function – most private businesses can create a relatively clear business case for their systems, and use cost reduction or increased revenue as a measurement of the system's success. In the public sector, cost is important, but creating clear-cut business cases as a decision criterion for whether to purchase a system or not is difficult.
- Lack of knowledge and authority on the purchasing side. In many cases, the public officials lack expertise in specifying systems and evaluating proposed solutions, leading to a situation where this is outsourced to vendors and consultants. This is especially prevalent in smaller organizations, such as municipalities. This can lead to situations where vendors, in effect,

write their own tickets. As IT organization, management and systems become more standardized, this is changing, especially since a number of the larger public organizations have taken to recruiting senior technology management from with hard negotiation experience from the private sector.

A persistent problem in the public sector, referred to by several interviewed executives in consulting companies and technology providers, is that the public sector to a too large degree considers itself as special (and certainly not comparable to the private sector), and overinvests in bespoke, complex systems when more could be achieved by technological standardization and organizational simplification. As a result – also, possibly, because fiascos are harder to keep secret in a public setting – most of the so called IT scandals (IT systems that run over budget or never get delivered) tend to be in the public sector. Famous cases in Norway is Golf/LOS, an SAP implementation for the military (complete with corruption charges against Siemens Business Services, one of the developers); Flexus, a ticketing system for public transportation in Greater Oslo; and Au2sys<sup>46</sup>, a vehicle- and driver's license registry for the public roads department. In all cases, the major culprit seems to be unclear objectives, complicated business requirements (in Flexus' case, four different algorithms for calculating ticket prices) and an unwillingness to change the organization to fit the system.

The movement to cloud computing, with simple software delivered from centralized systems over the world wide web, is seen as a promising avenue for simplification and rationalization of the public sector's IT use – indeed, it forms the basis of the current effort to reform IT management in the US Federal Administration (Kundra 2010), with millions of public workers transferring from distributed to



### **Opera Software: Compressing the mobile Web**

Opera Software was established in 1995 as an offshoot from Telenor R&D. The company's one product was the Opera browser, an early competitor to Netscape and Microsoft's Internet Explorer. Though technically very sophisticated and a favorite of advanced users, the browser never capture a market share above a few percent, though the company's influence in technical circles belied its tiny size – Sun offered to buy the company for NOK 100m when they had four employees, and Microsoft was worried enough about them as a competitor to downgrade to implement anti-Opera features in its server technology – a practice allegedly leading to an out-of-court settlement and much animosity between Microsoft and Jon S. von Tetzchner, Opera CEO (until 2009) and co-founder (with Geir Ivarsøy).

An efficient code base – the browser code itself was the same for all versions – and disciplined development allowed Opera in the early 2000s to migrate its browser from the web over to PDAs, set-top boxes and eventually to mobile phones. The company was well positioned when mobile phones started to take off, particularly in Asia – the fact that the company was *not* Microsoft was an important selling point when talking to network operators, who would buy Opera's technology to facilitate their users' surfing as well as talking. Opera Mini, a mobile phone browser launched in 2008, could speed up mobile browsing by rendering images on centralized servers and reduce the data traffic between handset and the web by as much as 90% by compression.

Opera Mini has quickly garnered more than 150 million users and caused Opera's revenues to double from 2007 to 2010, with healthy profits. The company had stepped out from its relative obscurity. As mobile phone use in Asia continues to rise, the company faces good growth prospects, but also the threat of becoming a commoditized service: They value offering to customers and operators alike is that of reducing load (and, as long as customers pay per Mb downloaded, price). As mobile data networks increase in capacity, their service will be less useful.

In the meantime, the company aims for the next billion users – those that, as CEO Boilesen phrases it, equate the Internet with Opera Mini. In June 2011 Jon von Tetzchner announced that he would be leaving the company, which opens up the possibility that the company can be put in play.

<sup>46</sup> See [e24.no/it/it-fiasko-i-vegvesenet/2080649](http://e24.no/it/it-fiasko-i-vegvesenet/2080649), and [www.tu.no/it/article141862.ece](http://www.tu.no/it/article141862.ece), accessed May 23, 2011.

cloud-based services. In Norway, the main area where this has been tried is in Learning Management Systems, where two Norwegian companies, Class Fronter (founded in Norway in 1998 and acquired by Pearson Education in 2009, 1 million users) and It's Learning (a Bergen-based company, started 1999, with more than 2 million users in 2010), competes and delivers systems via centralized servers.

### ***International – consumers and companies***

The international consumer and business market for information technology is not different from the Norwegian one in anything but size – and consequently. Companies going to market tend to follow one of three strategies:

- If they sell technology as a product – i.e., hardware or software – they go global from the start, especially if the product is very specialized in terms of what it does. An example here is Opera Software, which does various kinds of browsers and currently has almost two hundred users of its Opera Mini, most of the in Asia. If they are successful, they are acquired by a large international player that wants to add their functionality to their repertoire – FAST and Trolltech being the most visible examples in software, as well as the gaming companies (see own text box). In hardware and software combined, the main company so far has been Tandberg, a video conferencing company that was acquired by Cisco in 2010. (In both the FAST and Tandberg case, the international acquirers have increased the number of developers located in Norway, though the long-term effect of this commitment remains to be seen.) Other companies remain relatively small – examples include the specialty chipmakers around Trondheim and in the Horten area, as well as Q-Free, a traffic monitoring technology company.

- If they do more generic services or software, they build a market in Norway and then expand geographically. Examples here abound – SuperOffice, a sales support system; Mamut, an accounting system for small businesses; VISMA, a financial/accounting software provider with various vertical solutions.
- If they do software tailored to a certain industry, they tend to establish their market position with the Norwegian industry and then follow that industry out in the world – frequently as part of another company. Kongsberg Maritime is one example, as is Powel, a company specializing in software for electric power distributors. Sometimes a software-based solution grows from an internal solution, as with Wilhelmsen's global logistics solution which is being made available to vendors of ship supplies. IBM has a petroleum exploration and extraction competence center in Stavanger, which provides development services for the Norwegian oil industry and expertise for the rest of IBM.

# TANDBERG

## Tandberg –focus on market-driven videoconferencing

Tandberg, a Norwegian producer and marketer of dedicated video conferencing systems, was founded on the remains of Tandberg Radiofabrikk, a radio producer which went bankrupt in 1978. Tandberg Telecom, as the activity was called, entered into collaboration with Telenor's R&D facility at Kjeller. In 1988 Jan Opsahl was hired as CEO, and \$6m was invested in developing a commercial version of the videophone. This was launched in 1991, sold to 11 countries and gave Tandberg a 45% market share in Europe.

Jan Opsahl, chairman of the board from 1998, is a visionary who understood the importance of building a distribution network and set goals of 30-50% growth per year. In 1997 Tandberg sold its television business and focused on video telephony, especially in the rapidly growing US market. Jan Opsahl's view – and the strategy of the company – was that if you were going to develop technology in Norway, you had to go international almost immediately if there was to be any hope of a substantial business.

The September 11, 2001 attack on the World Trade Center meant a drastic reduction in travel – and boom times for videoconferencing. Tandberg grew 50%, developed systems that could be shared of company-internal LANs, and entered into a strategic alliance with world-wide Internet technology company Cisco. All this was done on a very lean organization – less than half of that of Polycom, Tandberg's biggest competitor.

From 2001 to 2005, under CEO Andrew Miller, revenues grew from \$80m to \$400m, a second headquarter was established in the US, and worldwide market share grew to 45%. When Miller resigned in 2005, the share price dropped 1/3 on the news that the next CEO was former CFO Fredrik Halvorsen, a relatively unknown Norwegian, only 31 years old. Halvorsen, who recruited more young managers from McKinsey, proved the analysts wrong, and sales increased to \$900m in 2009, helped by the acquisition of the British conference bridging company Codian in 2007.

In 2009, Cisco made an offer for Tandberg, and eventually acquired the company for \$3.4b, the largest IT-related acquisition in Norway. The Tandberg name was officially changed to Cisco in February 2011 – and Tandberg as an independent entity ceased to exist.

Interviewees attribute the success of Tandberg to its focus on only one function. i.e., video conferencing; a very strong market focus, including its ability to collaborate with Cisco; heavy investments in technology development with a view of being first to market; external production of the hardware; and a focus on developing systems that could be used with non-Tandberg equipment and could relatively easily be integrated into unified communications technologies, since it used no Tandberg-only standards. This strategy also sat very well with Cisco, which has followed a similar strategy for its technology development.

Tandberg is a Norwegian success story, but illustrates the often expressed point that Norwegian technology companies, after reaching a certain size, are then sold out of Norway. As with FAST, however, the technical development continues in Norway: Cisco has increased the workforce in Norway by 65 to 550 employees – and the former Tandberg offices are now the global development center for all Cisco's videoconferencing activities. Whether that means continued world-class product leadership or a gradual folding in towards providing a component rather than a finished product remains to be seen.

Compared to the rest of the IT industry, the numbers are rather small, though. Opera, the most visible independent Norwegian software company<sup>47</sup> with the most customers in the consumer market<sup>48</sup>, had sales of roughly NOK700m in 2010, with 700 employees – good for one company, but hardly the basis of an internationally industry. On the other hand, Norway is a very small country – as one discussant said: “The fact that we, with a population the size of a suburb of a large city, can compete internationally is quite something in itself<sup>49</sup>.”

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<sup>47</sup> And incidentally, a company that has not been sold largely because the founders control a large share of the stock and refuse to sell.

<sup>48</sup> Sales happen to a large extent through mobile phone operators, but adoption as an individual, consumer basis.

<sup>49</sup> <http://xwave.no/innovasjon/svar-pa-forestillinger-om-norsk-it-bransje/> (accessed April 2011)

## IT providers and IT services

Traditionally, the Norwegian IT industry has been concerned with importing and configuring foreign technology for Norwegian customers, in Norway. There have been many examples of companies exporting Norwegian IT abroad, but they have tended to be single companies, not part of a cluster – with the exception of a small cluster of microchip design companies in Horten and Trondheim, Norwegian export of any size by many companies have been in the telecommunications industry, rather than in IT itself (Fjeldstad, Andersen et al. 2000).

To understand the evolution patterns, go-to-market and strategic challenges of IT companies, it is important to distinguish between *technology providers* and *service providers*<sup>50</sup>:

- *Technology providers* are primarily driven by changes in technology – both the inevitable evolution as a technology matures, and the impact of new technologies being developed and affecting all IT companies. They tend to develop very specialized technology, often as a component or add-on to existing technologies or technology platforms. They tend to be global in their outlook – though they may start out with a local market or knowledge hub, they quickly have to go abroad – globally, not in a specific geographical sequence – to find customers. Their employees and management tend to be driven by the technological challenge of doing something difficult and advanced. They can do acquisitions, but do them rarely and mostly in a friendly manner in order to acquire specific technological capabilities.
- *Service providers* are primarily driven by changes in customer demand. Charged more with making the technology available, convenient, reliable and to varying degrees tailored to the customers' needs, these companies' competitive advantage lies more in their long-term customer relationships and deep knowledge of the customers' preferences than in deep knowledge in developing complex technology. They tend to be local in their outlook, seeking customers in geographical proximity, expanding geographically as they grow larger (though they can follow large customers needing global support abroad), acquiring companies more for market expansion and strategic positioning (trying to acquire economies of scale and scope) than for technological capabilities.

Both these types of companies have evolved over time. The following is a description of how and why they have developed in Norway

### ***Evolution of technology providers***

The evolution of technologies – and technology-driven companies – is relatively well documented and happens in all technologies, not just IT. When a technology is new, it tends to have an integrated architecture (i.e., all components are provided by the same company and cannot easily be separated out from the end product itself), the competitive focus is on functionality, and there are many providers of the technology. A typical example is Apple, which creates new technological concepts – the Mac, the iPod, the iPhone, the iPad – and provides a complete user experience, provided the

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<sup>50</sup> A more traditional categorization is hardware, software and services. However, the technical evolution of the industry has meant that almost all hardware platforms are connected to the Internet and a large part of their functionality is delivered as software. Given the increasing similarity in business models, the dichotomy between technology and services providers make more sense.



user sticks with the company as the sole provider. FAST Search and Transfer is a Norwegian example – the company started out building tailored search and storage solutions for demanding uses.

Eventually the technology becomes *modularized* – partly because of diversity of customer demand, partly because the component technologies develop at different rates, so that some components will need changing, which again demands a modular architecture. Advanced technologies become features tied to standard technologies. Microsoft and Dell are companies that sell component technologies – Microsoft provides software that runs on many types of computers and allows customers to leverage training and software development over a variety of platforms, Dell configures computers when customers orders them, assuring that not computer they ever sell is obsolete. Microsoft's acquisition of FAST fits into this pattern: FAST provided very advanced technology, unfortunately at a price

point where the number of customers willing to pay the price of customization to exploit the technology was not sufficient for the company to keep expanding. Microsoft needed search technology, less for its advanced uses than for the simple user interface it can provide as an access point to unstructured information. For this to work, FAST's technology has to be packaged into a



### **FAST – from product leadership to collaborative building block**

FAST Search & Transfer was founded in 1997, out of the computer science faculty at the Norwegian University of Science and Technology. The company developed technology to search, store and transfer large quantities of data. Eventually the company focused on search technology, developed the consumer search web site Alltheweb.com, which for a time was the largest search engine on the Internet. It was listed on the Oslo stock exchange in 2001.

Google eventually won the lion's market share of the consumer search market (i.e., search in open information on the Internet), and FAST concentrated on developing sophisticated search technology and sell it for companies to use in their own web sites. Customers were some of the largest and most used web sites on the Internet: New York Times, Best Buy, IBM, Reuters, and specialist web sites such as CareerBuilder.com and Scirus.com. In Norway, the company enjoyed a long and very fruitful collaboration with Schibsted, who used FAST's technology for building it's very successful Finn.no advertizing web site.

As Google and other search engines' use expanded, it gradually became apparent that search technology was not just an application, but in fact was an alternative way for web users to navigate the web. FAST understood this transition and spent much time and energy transforming its technology from "just a search box" to a "conversational interface" – i.e. a staged system for letting users navigate large collections of information. In doing so, FAST built up a strong development team.

FAST's technology was expensive, however, and consequently their market was largely limited to large companies needing very advanced technology for web sites with lots of data and many visitors. These customers also needed much configuration – in practice, many FAST installations were managed by the company themselves. Growth became expensive, and the company by 2007 was facing financial shortages, exacerbated by being forced to restate their accounts following errors in revenue recognition.

Before that issue came to the fore, however, Microsoft (in 2008) acquired FAST for \$1.2b, with a view of taking the technology and making it the centerpiece and underlying technology of its SharePoint collaborative software platform. Microsoft moved its other search activities (including parts of its consumer search engine Bing) to Oslo, and FAST gradually was integrated into Microsoft, first under the moniker "FAST, a Microsoft subsidiary" and in the Spring of 2011 as Microsoft Development Center Norway. The technology was also integrated, a move that required rewriting the whole search engine from Java to Microsoft .net.

The challenge FAST – or, rather, MDCN – is to hold on to their key concept and technology developers. Already a number have left – salespeople frustrated with the shift towards integration and reduction in development speed, developers preferring certain technologies, and managers seeking more individual influence than what can be found in a very large company. On the other hand, Microsoft has added staff from abroad – and made Oslo the center of all its search activities.

standardized format and provided as part of a larger package (in Microsoft's case, the enterprise collaboration system called Sharepoint).

As technology moves from a proprietary to modular phase, flexibility and responsiveness takes precedence over technical and functional performance – the user wants a multi-purpose car rather than one that is as fast as possible.

Towards the end of the 1990s, this looked like it was about to change. A number of promising technology companies were coming into prominence, with FAST, Opera, and Trolltech gaining most of the recognition. These companies were technology leaders in their field and competed globally, their presence and customers in Norway incidental. From the viewpoint of 2011, however, this promising development seems to have stalled somewhat. With one notable exception (Opera), the rising stars of the turn of the century have been acquired by large, international players:

- FAST Search and Transfer, a software company producing advanced search software, was acquired by Microsoft in 2008 for \$1.2b. The company is now referred to as

Microsoft Development Center Norway, and continues to develop advanced search technology, now to be used inside Sharepoint, Microsoft's enterprise collaboration software.

- Trolltech, a software development company specializing in open sources tools for technical development, particularly for mobile platforms, was acquired by Nokia in 2008. The future of this development environment remains uncertain – Trolltech's two main offerings; Qi, a technical software development environment and Qtopia, a development and delivery platform for smartphones, are still being maintained. However, Trolltech was acquired mainly for its development expertise, and recent changes in Nokia's overall strategy suggests that Trolltech's technology, while strong, stands in danger of being a technologically blind alley due to influences outside the company's control.



#### **Integrasco – the cloud-enabled startup**

Integrasco was founded as a spin-off from Intermedium, a media analysis company, in 2004. Located in Grimstad, at a technology park formerly used by Ericsson (and the location of the fledgling Grimstad technology cluster), the company provides analysis (called sentiment analysis) of on-line discussion forums. Initially funded by management, employees and Coventure, an incubator, the company received funding from the Norwegian venture company Alliance Venture in 2009. Currently the company has about 20 employees and revenues of about 12m NOK.

Integrasco's customers are mainly international consumer electronics companies, specifically mobile phone companies that quickly want to know what customers think of their new models, both in terms of style, usability and unknown technical problems. Much of the market reception of a new model is determined by superusers – people who usually are the first to buy new phones and discuss them on the web. This calls for sophisticated linguistic analysis, since most discussions tend to be fairly detailed and multidimensional – just rating a blog post or a comment as “positive” or “negative” is not good enough.

The company is an interesting of a new kind of startup: The global-from-the-start, cloud-enabled startup. Integrasco's customers are in Sweden, Russia and Great Britain. Its employees are located in Grimstad, UK (one salesperson) and Chengdu, China (currently, four technicians.) Its computers are in the United States – all the heavy processing required for the linguistic analysis is done on the Amazon EC2 (processing) and S3 (storage) platform, using open source tools such as the LAMP architecture and Solr, an open source enterprise search platform built on the Apache Lucene platform.

The long-term survival prospects of the company remains to be seen – the competition, both from startups and from established players within media analysis is very keen. The company is developing its technology further in collaboration with its key customers, drawing of funding from public sources and from its venture capital owners – and remains optimistic.

- Tandberg, a company selling high-end videoconferencing platforms and software, was acquired by Cisco in April 2010 for NOK 19b or \$3.4b. Top management had, uncharacteristically for Norwegian technology companies, pursued an aggressive and highly successful international sales strategy, acquiring other video conferencing companies along the way, enabling it to negotiate a high valuation based on its solid financial performance as well as its very advanced video codec<sup>51</sup> technology. Cisco has made acquiring small technology companies in order to market their technologies around the world something of a specialty, indeed a practice, and had had a long-term relationship and co-branding agreement with Tandberg before the acquisition.
- Visma, a vertically oriented ERP provider, was acquired by the private equity company KKR in 2010 for NOK11.2b. Visma has followed a strategy of growth by acquisition of vertically oriented software companies, with an aim to integrate their offerings into their own technology portfolio. As of 2011, the front end of their applications appear well integrated, but to what degree the company can integrate deeper down in the software stack and by doing so exploit economies of scale remains to be seen.

The “selling out” of Norwegian technology companies to foreign competition has produced mixed reactions: On one hand, selling out is seen as necessary to achieve growth beyond a certain point, secures financing for funding global growth, provides an exit for financially oriented investors. On the other hand, concerns are growing that this development might mean the dissolution of important technology knowledge environments – that capability, not just technology, might be leaving the country. Microsoft/FAST and Cisco/Tandberg may be counterexamples of this, since both companies have relocated their global search and videoconferencing activities, respectively, to FAST/Tandberg, but the long-term effect of this remains to be seen – less for organizational than for technology evolution reasons<sup>52</sup>.

Technology environments tend to change over time, with pioneering developers moving on as the technology matures and the focus changes from functionality to performance, from developing new algorithms to making things faster, better, cheaper and, above all, more compatible with existing technology. Superprofits accrued to small companies tend to come in the early phases, where product, rather than process innovation dominates, and when customers are willing to pay for relatively small increases in functionality. Cisco/Tandberg and Microsoft/FAST may in fact be the result of videoconferencing and search moving from a proprietary to a modular/ubiquitous phase – and a key challenge to Norwegian technology companies seems to come during this transition.

### ***The issue of externalities***

It is common for technology companies to face challenges once competition shifts away from the product and its features and towards other factors, such as to what extent the company’s products or services are aligned with other technologies (i.e., your product may be great but you may have picked the wrong platform to base it on), whether you have a viable business model or not (i.e.,

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<sup>51</sup> Short for “coder-decoder”, a system that converts audio/video signals into data streams that can be sent over computer networks and then converts them back again. The performance of the codec is a bottleneck in video conferencing, especially for higher end, “telepresence” systems.

<sup>52</sup> GE Healthcare’s acquisition of Vingmed seems to have been a success in this regard – GE Vingmed has taken a leading innovator position in portable ultrasound with its VSCAN product.

should the software be sold as a product, as a component in a development or innovation project, or as a web-delivered service), and whether you can achieve a solid enough market share for network effects to kick in. There are several examples of Norwegian technology companies experiences these issues: Trolltech (or, at this point, Qt software) was acquired by Nokia, less for its main product and the soul of the company, the Qt development environment, than for Qtopia, initially a side product. When Nokia in 2011 signed an agreement with Microsoft to use their software platform on their next generation of cell phones, it no longer needed Qt nor Qtopia, and the company was cut loose. FAST at one point (in 2003) had the largest search engine on the web, but Google at a critical point – without a clear business model – could muster investment and self-confidence – enough to manually reconfigure their search engine for the most common search results, improving user quality perception, gaining market share just as Internet users were switching from category lookup (Yahoo) to search as the dominant personal information access strategy (Andersen 2006). Schibsted and Telenor are two Norwegian technology-enabled companies that have understood the critical importance of gaining dominant market share early, and have had success in a number of markets by going in early and heavy and become the dominant provider.

*Our idea has been to have few, but smart people.*  
Sr Executive, Tandberg

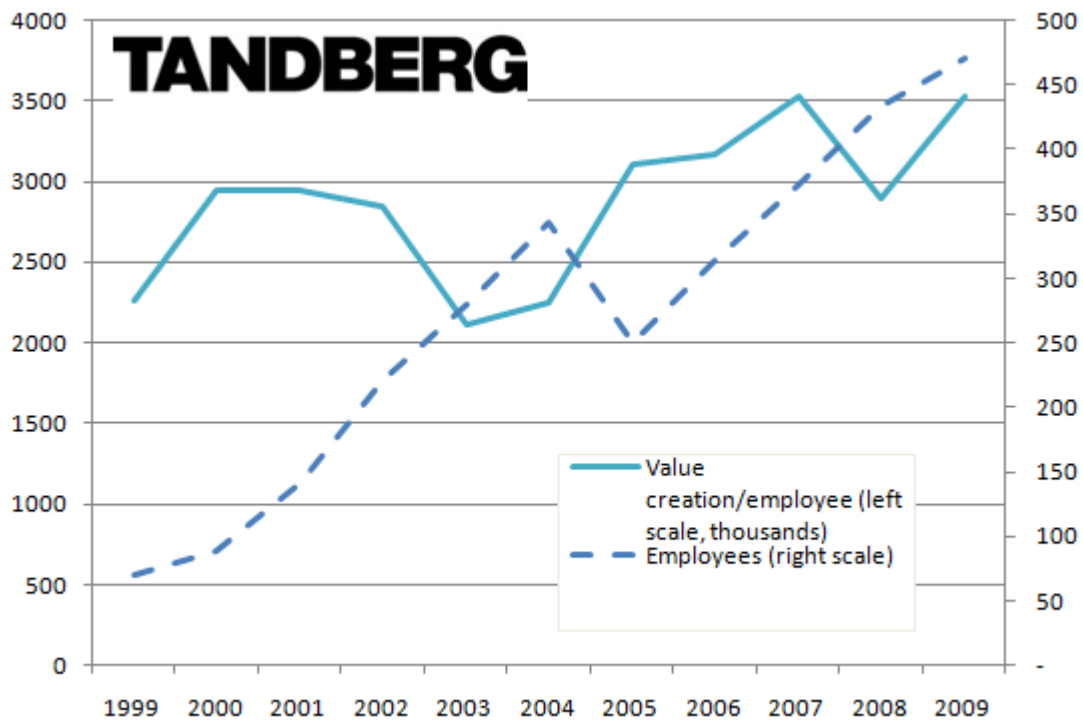
### ***The changing face of IT startups***

A concern by several interviewees was the question of where the next generation of new star companies is going to come from. New software companies today have fewer employees than before, partly because much of the technology can be had as services or very cheaply, partly because the transition to service means that many companies will grow large as a result of network effects rather than size of sales or services. For instance, four of the hot new international information technology companies currently achieving high valuations – Skype, Facebook, Twitter and LinkedIn – are all companies that connect their users through a relatively simple interface, taking advantage of cheap and relatively standardized infrastructure to provide worldwide services<sup>53</sup>. As recently detailed by the economist Tyler Cowen in his book *The Great Stagnation* (2011), Facebook has 2000 employees, Twitter has 450. Innovation for small companies becomes a question of developing software that adds small value for very many customers through a standardized platform, be it Facebook for games (as is done by Playfish, see case) or by lots of small companies for Apple iPhones or iPads.

Tandberg is an example of the value of productivity of innovation: By employing a very focused strategy of technology excellence, farming out production and having strong marketing and sales teams in its key international markets, the company has consistently maintained (indeed, increased) a very high value created per employee while quintupling its number of employees over 10 years. The company shows what can happen when a technology provider focuses on the customer rather than the technology, and consistently focuses on high-value work:

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<sup>53</sup> A number of other technology companies, such as Apple and Tandberg, create great value per employee by outsourcing many of the labor-intensive activities, such as manufacturing and distribution. This does, however, create jobs in the producing industries, since the activities are moved to low-income countries rather than completely automated.



As the world gets smaller, so will many of the companies serving it.

## Funcom and Playfish: The old and the new in gaming development

Funcom and Playfish, formed 15 years apart, illustrates the old and the new in terms of how computer games are developed, marketed and paid for. With more and more infrastructure readily available, moving fast rather than creating deep technology becomes an option.



Funcom, the first computer gaming company to be listed on the Oslo Stock Exchange, was started in 1993 in Oslo. Initially developing games for specialized game hardware platforms, the company is most well known for *Age of*

*Conan*, an MMORPG (Massively Multiplayer Online Roleplaying Game) which initially sold 700,000 copies before its launch in 2008. The company was also known for its all-consuming development environment – many of the game developers lived their whole life inside the company, sleeping on makeshift beds, obsessively programming fueled by free Coca-cola and junk food.

*Age of Conan* is a computationally intensive game, where the player interacts with others in a life-like environment, a fantasy world of striking graphics and complex rules of interaction. Sold as downloads, these games address a market of experienced and interested gamers, who spend more than 3 hours online daily, invests in powerful computers to improve the experience of the game and the competitiveness of the gamer's characters (avatars).

This model, favored by developers deep in advanced programming, complex storylines and exquisite graphics, has its problems both in technology and business model. Funcom's 2002 game *Anarchy Online*, highly praised, proved a disappointment when its servers were unable to cope with the massive demand for downloads and computing time when the game was launched. *Dreamfall*, a 2006 follow-up to the company's first success *The longest journey* (1999), was cracked and more than 200,000 copies illegally downloaded.

As the company has grown (currently at 317 employees), the developer base and much of the administration has moved outside Norway – mainly to Montreal, for tax reasons and in search of development talent. The main concept work, however, is still done in Norway, and much of the technical programming and rendering in China. In 2007, Funcom started to switch to a different development and business model, seeking to stabilize its high-risk, feast-or-famine revenue stream. It started to develop "smaller" MMO games, for standard computers and handheld devices, addressing a market of children, youngsters or non-gamers. Rather than using Dreamworld, its own advanced gaming engine, it uses a simple Java-based game engine, smaller development teams, and tries to push out games, initially with beta status, every three months.



Formed in 2007, Playfish is not really a Norwegian company, though much of its development is done in Tromsø. The company was formed by 8 founders, one of whom was Kim Daniel Arthur, a Norwegian game developer who had met Kristian Segerstål, the later Playfish CEO, in an online chat room, and moved with him to London to develop mobile phone games. The company, Glu Mobile, was acquired in 2004. Playfish was formed to create games over social networks, and managed to time its launch and development almost perfectly with the ascendancy of Facebook.

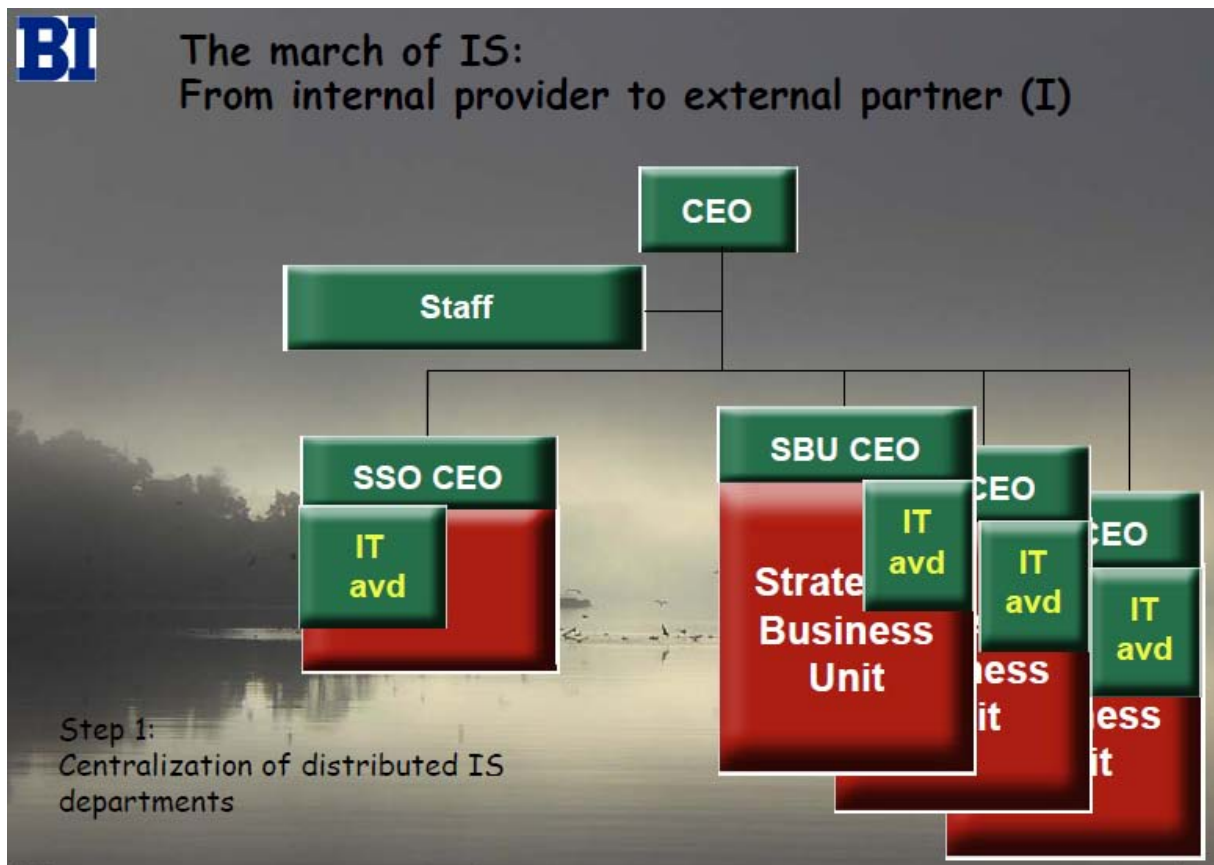
Playfish is almost entirely cloud computing-based: The company uses Amazon.com's EC2 service both to run and develop its software. Its games are simple things, mostly running over Facebook, spreading electronic recommendations. The games are free, but players can spend money to acquire assets which will allow them to compete better, accumulate collections of desirable virtual items, or give gifts to online friends. This model, termed "play-to-pay" (as opposed to the traditional "play-to-pay") allows a low-risk adoption curve for each individual player, obviating the need for specialized computers or large investments of time in learning how to play.

Using the Amazon platform offers advantages both in reduced capital expenditure and technical scalability: When *Restaurant City* was released in April 2009, rather than the 100,000-250,000 players the company initially had expected, more than 4 million players signed up within the first 8 weeks. Amazon's massive computing platform had no difficulty seamlessly scaling up to this demand.

As of January 2011 Playfish had almost 40 million monthly users on Facebook (making it the third largest games provider on that platform), and more than 340 million other installations on various platforms. In November 2009, two years after its founding, Playfish was acquired by Electronic Arts, a dominant games developer, in a deal worth \$400m, 10 times the company's annual revenues.

## Evolution of the IT service sector

Until the 1990s, most large Norwegian companies – the transaction processing part of financial services being a conspicuous example – had their own, internal IT departments. These provided administrative IT services and to a certain extent specific IT services for functions, such as production or sales; or for strategic business unit. During the 1990s, many of these departments were increasingly centralized (first by centralizing data centers and network services, then by centralizing user support and systems development) into *shared services organizations*<sup>54</sup> within the larger corporations. Some IT would remain in each strategic business unit<sup>55</sup> – its relative size determined by the commonality (or lack thereof) of the systems and business processes within the unit.



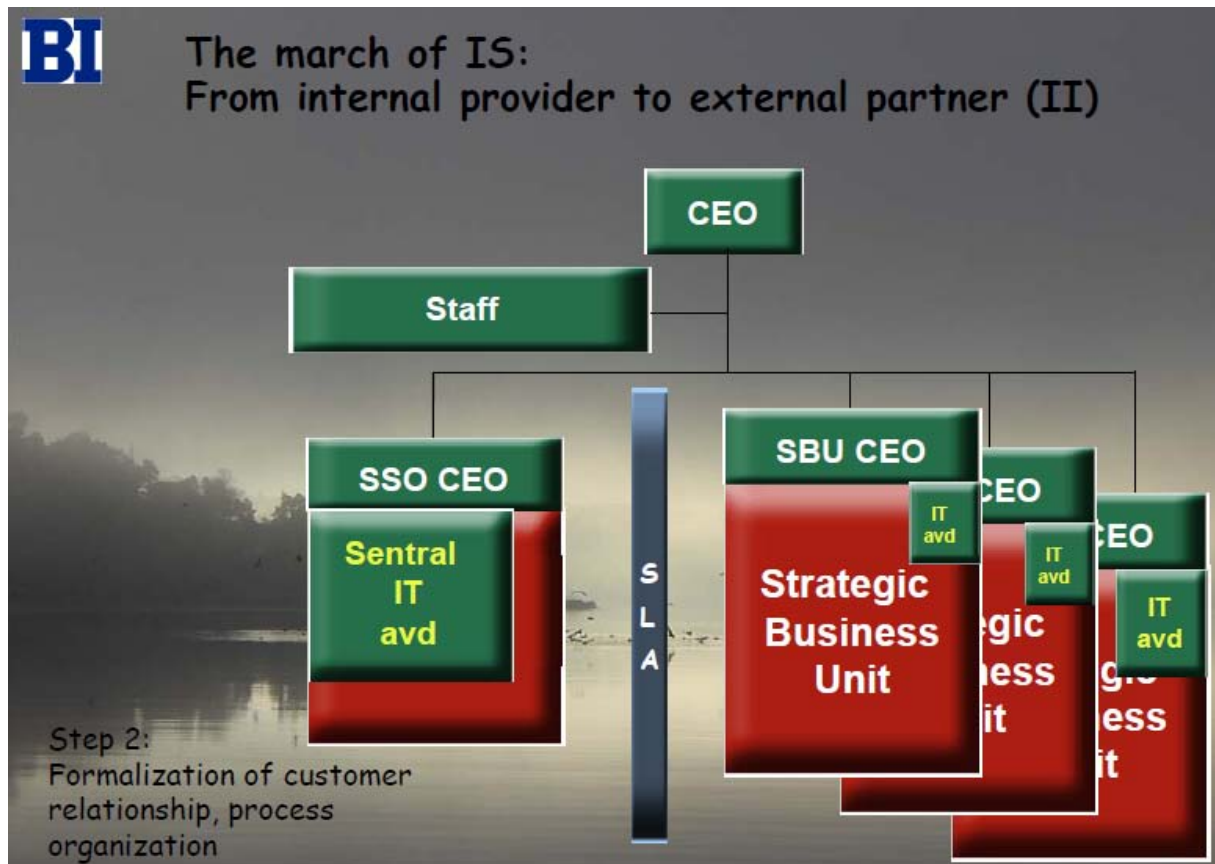
Headed by a CIO, these businesses-within-the-business (Norsk Hydro, Statoil, and Telenor all had large internal IT service providers, for instance) developed formal contracts – *service level agreements, or SLAs* – with their internal customers, modeled on the contracts consulting companies and other vendors would offer as well as on semi-academic organizational frameworks<sup>56</sup>. With this formalization came other service management practices, such as formalized system development methodologies, centralized call centers for user support, project portfolio management, and formal

<sup>54</sup> This centralization was not limited to IT: HR, accounting and the operational part of customer service, such as call centers, were also common targets for centralization.

<sup>55</sup> Business units typically are defined based on geography, markets (typically, business customers and consumers) or products/services. One of the long-term influences of information technology is to increase the use product or market organization at the expense of geographical. Large multinational organizations now typically organize with geographically distributed global product or service centers.

<sup>56</sup> A typical example is ITIL (Information Technology Infrastructure Library), promoted through the Norwegian Computer Association.

IT governance structures (Weill and Ross 2004) for project prioritization, infrastructure investments and technology architecture decisions.



Aside from creating and maintaining the “serious” IT systems, much of the work of these IT departments lay in standardizing and making available PCs, email and networked servers and printers for the knowledge workers of the organization – in effect, gradually changing organizations from working with paper and telephones to more and more working with digital documents, emails, and spreadsheets and presentations<sup>57</sup>. The Y2K problem<sup>58</sup> caused many companies to move from internally written, bespoke systems to standardized “packages” – accounting and process automation software from emerging giants such as SAP and Oracle. The eventual dominance of Microsoft’s Office package<sup>59</sup> as well as the availability of the Internet meant that companies started to resemble each other in terms of their technology: The standard was Microsoft Office, SAP or Oracle Financials for the enterprise systems, and, eventually, a TCP/IP based network infrastructure. As the technology became more standardized, more and more companies started to outsource much of their running services to IT service organizations – both to vendors or PCs and software, and to dedicated IT outsourcers.

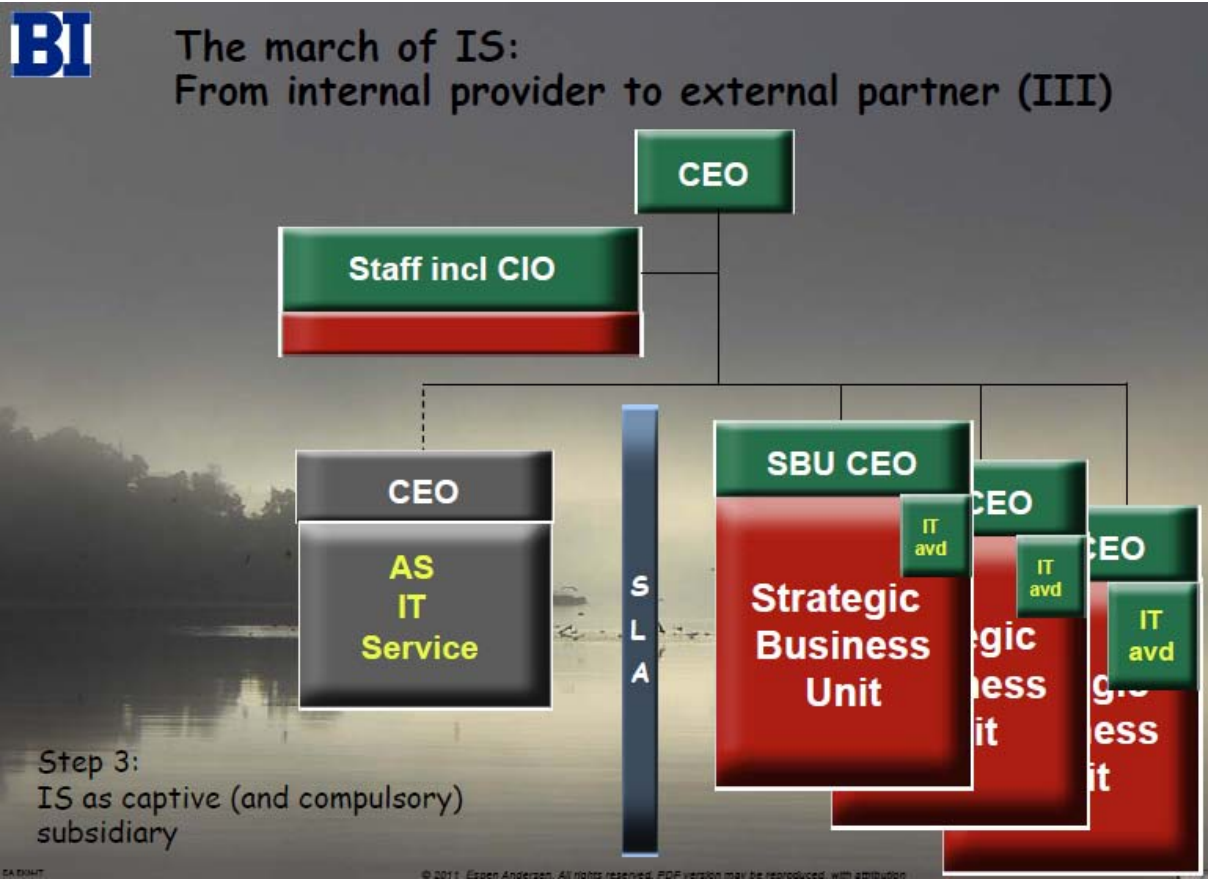
<sup>57</sup> See Ross, J. W. (2003). Creating a Strategic IT Architecture Competency: Learning in Stages. Cambridge Massachusetts, MIT. for an excellent description of the evolution of information systems architecture as the technology has evolved.

<sup>58</sup> Many systems had to be rewritten or at least audited to make sure they would not malfunction as a result of storing the year part of dates with only two digits, causing a rollover from 99 to 00.

<sup>59</sup> Statoil was the last major organization to implement this, in 1998, moving from an internally assembled set of tools to Microsoft Office. The impetus was less the quality of the tools themselves than the fact that not using the industry standard made it increasingly difficult to communicate electronically outside the corporation.

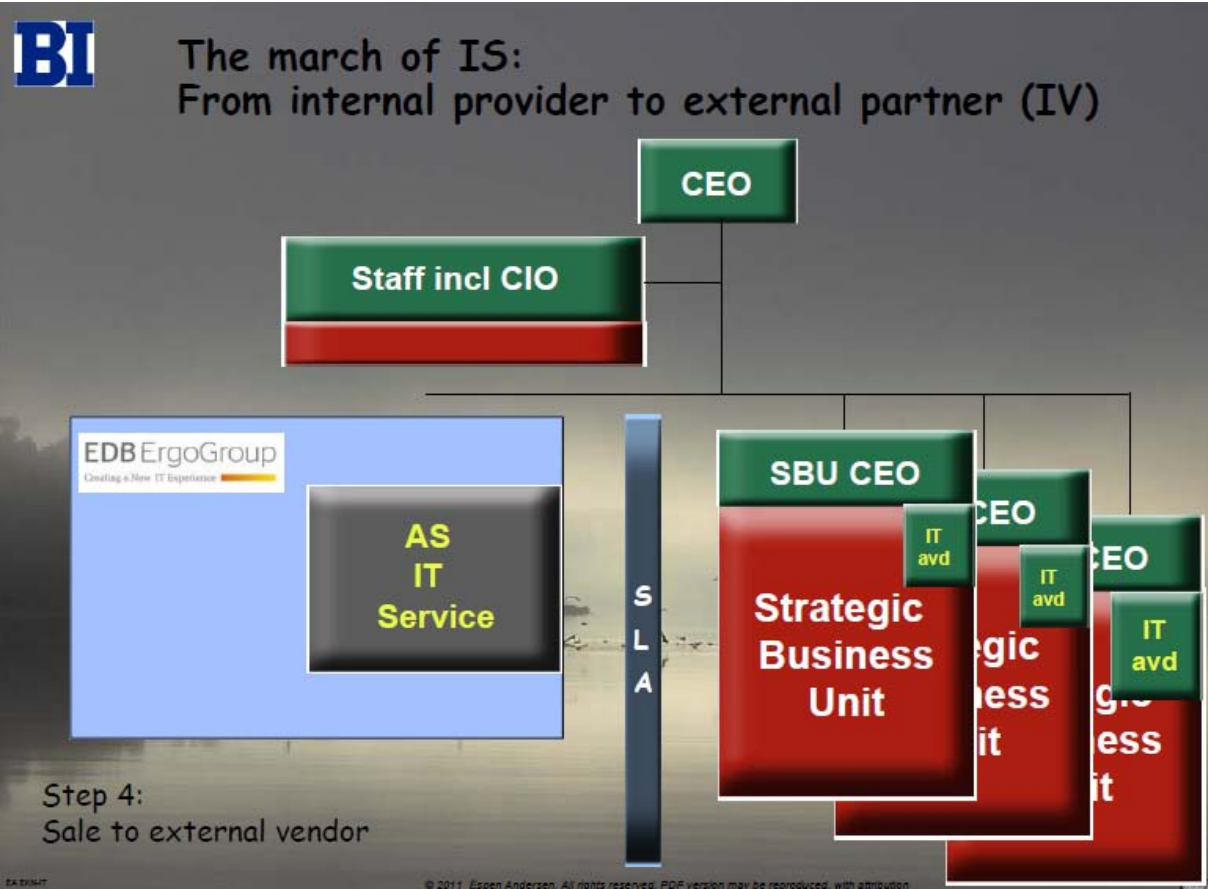


By the turn of the century, the shared service organizations increasingly started to look like IT companies in their own right. Some of them, like Hydro Business Services, even emerged as something very much like a fully developed consulting company, with a matrix structure, dedicated account management positions and explicit capabilities (and responsibilities) for organizational change management by the end of the 90s. These organizations played an important part in transforming their mother organizations: Statoil's IT organization, for instance, implemented a home PC ownership program called the IT Step in 1997. This program played a significant role not just in training employees in the use of a PC as a natural source of information and interaction, but also provided an impetus for Telenor to build out their ISDN and eventually broadband network and formed the basis for an official policy of giving tax breaks for companies sponsoring home PCs for employees.



As the technology gradually became embedded in people's daily work and life, the IT organizations found their influence diminishing again – they no longer represented something new and innovative. Cost-consciousness following the dot-com bust in 2001, an emerging outsourcing industry, and the fact that many of the shared services organizations looked like independent, if captive, business in their own right led to the next development: Shared service organizations being spun out as their own IT company (as Hydro did with ISPartner in 2003). The reasoning behind this varied, as did the degree to which the IT subsidiaries really behaved like independent companies – many of them remained captive (i.e., they could not provide IT to clients outside the mother corporation) and some, at least for practical purposes, compulsory (i.e., the clients could not go outside the internal IT provider). For some, the impetus was to expose the IT organizations to competition by making them bid for the business of providing IT services to the mother corporation, thereby reducing some of the

power the IT organization held over technology use. In some cases, particularly where the owners were state-owned organizations such as the Norwegian Post Office, one reason may have been to allow the IT subsidiary more freedom in terms of recruiting (particularly for management positions, as getting management talent became increasingly hard in the go-go atmosphere of the dot-com bubble) and free up individual employees from stringent union-based rules about pay and working hours. The introduction of the Sarbanes-Oxley act in 2002, following the Enron scandal, did much to force companies listed on US stock exchanges to make their information processes explicit and verifiable – and caused Telenor to spend more than 500 MNOK on documenting and restructuring both their IT systems and their IT organization, in the end outsourcing much of it, primarily to Accenture (which co-located with Telenor in their new headquarter at Fornebu outside Oslo) and EDB Business Partner.

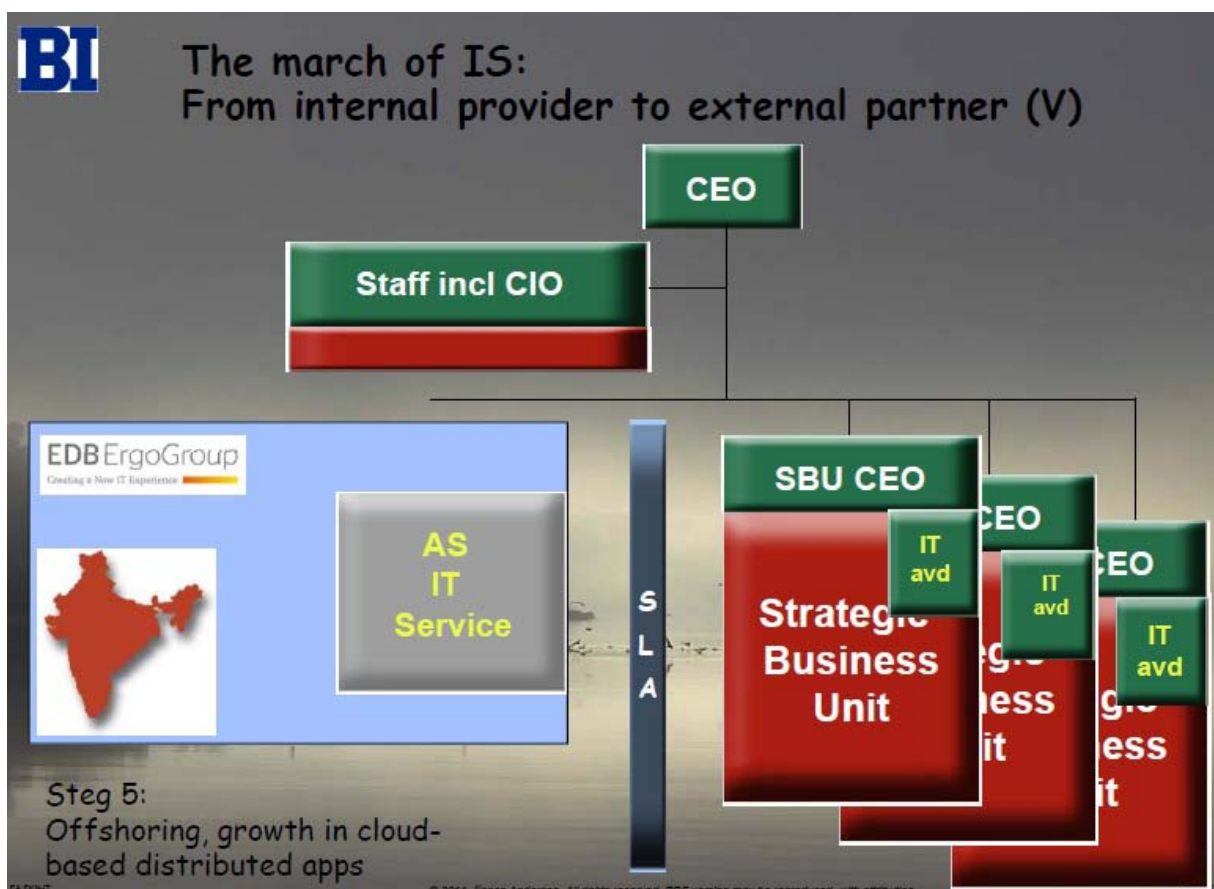


These IT subsidiaries, in most cases, did not last long – particularly when the dot-com bubble burst in 2001 and even large corporations (including the privatized Telenor and StatoilHydro) were looking to reduce their asset base. It helped that the two main independent IT services companies in Norway, EDB Business Partner (a large IT service provider, built on the banking data centre Fellesdata and majority owned by Telenor) and to a lesser extent Ergo Group (built on the state-owned public data processing center Statens Datasentral and 100% owned by the Norwegian Post Office) were eagerly looking to expand. EDB Business Partner, under its very aggressive CEO Endre Rangnes did more than 20 acquisitions from 2004 to 2008, acquiring much of the (outsourced) IT activities of Telenor, Statoil, Hydro and the Norwegian banking industry as well as attempting to compete with the large, foreign-owned consulting companies (Accenture, Tieto, Steria, Cap Gemini) by acquiring boutique (specialized) consulting companies such as Avenir (general IT) and Spring (SAP development) in 2007.

Ergo Group was less active, but did acquire a couple of SMB IT service providers and in 2007 the “high-end” IT consultancy BEKK.

Towards the end of the 2000s, both companies were facing a tougher business environment – in particular, many of their long-term clients started to demand better terms, in part driven by the reduced prices offered by international technology providers such as Accenture, IBM, Oracle and HP, who gradually were moving more and more of their IT service provisioning *offshore*, primarily to India. While both EDB and Ergo had acquired controlling interests in small Indian service companies (EDB in Span technologies in 2007, Ergo in ION NOR in 2008), they could not match the relative share of offshoring which Accenture (with more than 60,000 of its 200,000 employees in India by 2010) and other international players could do. A new CIO in Posten Norge renegotiated the Ergo Group’s contract with its mother company, reducing it by more than 800MNOK in 2009. At the same time, EDB Business Partner struggled with lack of integration between its various business units – many of retained their independent profile and remained as departments inside EDB rather than as a merged, shared organization.


The name of the game in IT service provisioning has traditionally been thought to be economies of scale. Ergo Group in 2010 had 3,700 employees and revenues of NOK 5.5b. EDB Business Partner had 6,000 employees and revenues of NOK 7.5b. In June 2010, the two companies announced that they would merge, creating Norway’s largest IT services company, EDB Ergogroup.



**The situation as of early 2011**

As of early 2011, the Norwegian IT service market is very consolidated – partly as an effect of consolidation of the customers. A large part of the market is dominated by large service providers such as EDB ErgoGroup (10,000 employees), ATEA (a collection of many small, acquired companies, more geared towards infrastructure provision, computer sales and support, and the SMB market), Accenture (an international management and IT consulting company which holds a larger than normal market share in Norway – the Norway office is also the Nordic office), IBM, Steria (a French-owned consulting company with a strong position in systems development), Tieto (a Finnish company which competes with EDB Ergogroup for the position of largest IT service company in the Nordic market), Gap Gemini and others. Almost all large organizations have most of their IT outsourced to service companies, the main exceptions being the larger health organizations (who have their own subsidiaries providing IT services as well as more specialized hospital services), the armed forces (who maintains a significant internal IT organization because they have the people and extreme security needs), and, chiefly because their owner structure have resisted outsourcing, the main power distributors. With the exception of the armed forces, further divesture of internal IT is expected within the next couple of years.

The main IT service vendors and their key figures are<sup>60</sup>:

 <b>The main IT service companies in Norway</b> <small>Numbers from 2008 unless otherwise noted. Listed in terms of service size</small>					
	Revenues	Mrk cap	Employees	Business	Ownership
EDB Business Partner	\$1.3*	\$700m (merged 2011)	6,000*	55% operations, 19% solutions, 26% applications. Little synergy between divisions. Strong in banks and industry	51% owned by Telenor, rest on OSEX. Growth by acquisition of contracts and boutique consulting companies.
Ergo Group	\$1b*		3,700*	Based on post office and other public services + Netcom	100% Post Office
Atea	\$2b	\$1b	4,800	Infrastructure sales/service/support.	Listed on OSEX.
Accenture	\$300m*	n/a	1,000	Telenor partner, large companies, 40% public sector	Norwegian office also Nordic HQ. Avanade has about 200 empl.
IBM	\$210m***	n/a	1000 (total)	60% services, rest HW/SW. Oil industry and health focus.	100% IBM. Business probably higher (HW sold through Ireland.)
Tieto	\$200m	\$1.3b	670**	Norway is 5% of their business), application management, development. 25% offshore	Finnish/Swedish, listed NASDAQ.
Cap Gemini	\$195m	n/a	700	Focus on application management (ops by EDB)	100% Cap Gemini
Logica	\$166m	n/a	571	Retailers, utility, oil and gas. Strong Indian connections.	CMG, listed, came from WMDData, acquired SBS.
Steria	\$127m*	n/a	391*, **	Mostly applications and systems development. Offshoring to Eastern Europe	French owned, listed, comes from Bull (which came from Norway).
HP/EDS	\$100m	n/a	400*	Some services, primarily in oil and gas.	100% HP
CSC	\$90m***	n/a	350*	Focus on finance and insurance	100% CSC

\*2009 \*\*FTEs \*\*\*estimate

<sup>60</sup> Most of these companies do not break out their services vs. other activities, which mainly has implications for IBM, ATEA and HP. Accenture does systems development and outsourcing, but general management consulting, which is not broken out in detail in their accounts.

At the same time, the buyer's side of the market is also extremely consolidated – there are few large private companies in Norway – Statoil, Telenor, Aker Solutions, DnB, DNV, REC, the shipping industry pretty well sums it up – and they are in their organization and administrative demands nothing out of the ordinary. Consequently, to the extent that the Norwegian IT service industry has competence different from other countries, it is partly in public sector systems (the public sector organizations and companies demanding more bespoke systems than the private sector, who look for standardization), partly in the provision of systems and services for the companies and industries which Norway specialize in, in particular petroleum and marine technology and services, and telecommunications (in particular, mobile telephony). The relatively small size of the market and the relatively few contracts being offered

## EDB ErgoGroup

Creating a New IT Experience 

### EDB Ergogroup: The Norwegian IT services behemoth

EDB Ergogroup, formed in January 2011 by the merger of EDB Business Partner and Ergo Group, is by far the largest Norwegian IT services company with approximately 10000 employees and NOK 13b in revenues in 2010. Its main customers are the large companies of Norway: Statoil, DnB NOR, Telenor, Hydro, and various government organizations.

The companies are quite alike: Both have experienced rapid growth, primarily through acquisition, through the 2000s. Both have acquired “higher-end” consulting companies (Avenir/Spring for EDB, BEKK for Ergogroup), and both have invested in offshoring capabilities in Eastern Europe and India in order to take advantage of the growing acceptance of offshoring. Both companies also had one large company (with, in turn, the Norwegian government) as majority shareholder (Telenor for EDB, The Post Office for Ergo.)

EDB Ergogroup's main challenge is that, while growth has been spectacular, the financial results have been steady, but not exciting. Currently the market value of the combined company now is less than the goodwill, largely acquisition premiums, on the books. The international IT services industry – and EDB Ergo now rivals the Finnish Tieto for size in the Nordics – has become a global delivery engine, but EDB Ergogroup may have more difficulty taking advantage of the labor arbitrage and technical capabilities of Eastern Europe and India than the competition: Many of its customers are in the government sector, where offshoring of Norwegian workers is considered politically difficult or, in cases of information security, not possible. Secondly, many of the acquired companies are the former IT departments of their customers – meaning that many of the systems EDB Ergogroup maintain for their customers are bespoke “legacy” systems, where knowledge may be less transferrable between customers than then underlying application and technology labels may indicate.

EDB Ergo is a large player in Norway, but its business remains somewhat fragmented and unexciting. The company clearly cannot expand more by acquisition, at least not in the short run. Its management faces a challenge of increasing value creation by organizational and technological integration – the company needs to be able to serve many customers from the same “machine”, but also to make sure that its high-end consulting capability transfers into long-term maintenance and delivery contracts. The case is still open on whether it will.

every year has meant that competition from foreign companies (European, American or Indian) have been relatively non-existent – Norway is under the radar for most large IT services companies, at least for those not already established here<sup>61</sup>.

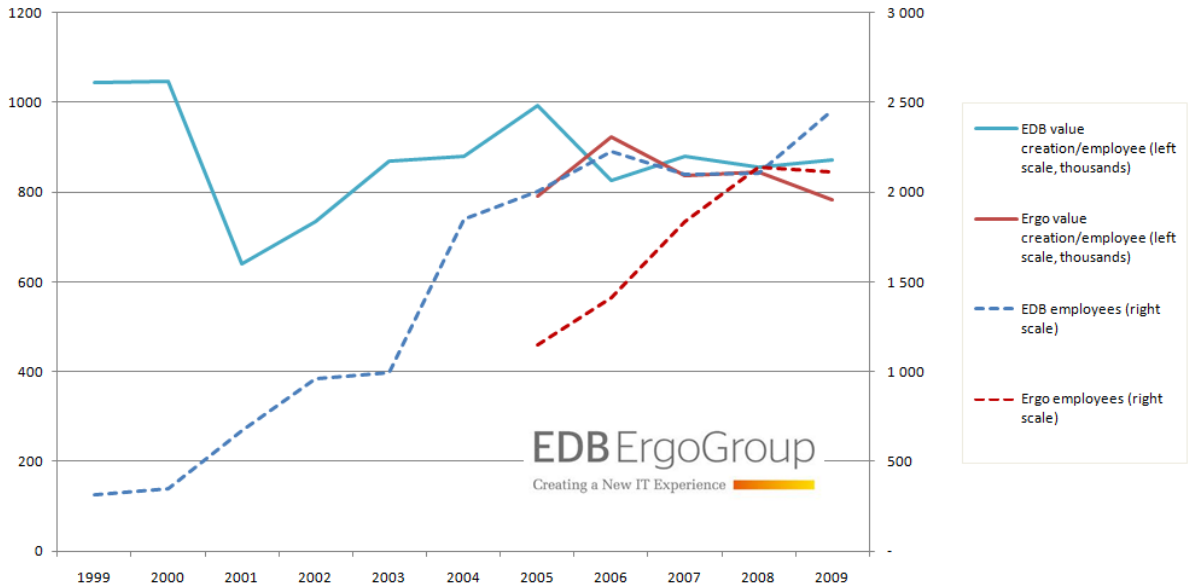
The relative stability of the actors in the marketplace also owes something to the procurement procedures – almost all systems development contracts are offered on a more or less open RFQ process. Most of the IT service providers in Norway would need to partner with one or more of the others in order to fulfill a contract, either because they lack some competence or capability in their own organization, and partially because some customers insist on it, to avoid being wholly

<sup>61</sup> One Indian outsourcing company we spoke with said their expectation of a new market – i.e., enough to set up a local delivery organization – would be around \$180m after two years.

dependent on one vendor. These partnerships seems to happen on an ad hoc basis, in response to each contract, though some long-term partnerships (Accenture’s collaboration with EDB Business Partner, initially a shotgun marriage because both wanted to Telenor’s business, for instance) can be detected. With a few exceptions (the Accenture-Microsoft joint venture Avanade being one) international collaborations and acquisitions have relatively little effect on the Norwegian IT service market – for instance, HP acquired the US outsourcing company EDS in 2008, but this has had relatively little effect in Norway since EDS was not represented here before the acquisition. It does, however, influence the collaborative environment within the industry, and to a certain extent hampers collective initiatives to make the industry united and visible.

**The challenge of integration**

A particular challenge for the two main Norwegian IT service providers (Atea and EDB Ergo Group) is integration. Both companies grown by acquisition, but have not been able to substantially increase their value creation per employee:



**Figure 9: Value creation per employee, EDB Business Partner and Ergogroup**

The stock market has understood this – the market value of EDB Ergo Group is now (May 2011) less than their goodwill assets, indicating that they have overpaid for all their acquisitions and not been able to benefit from the acquisition in anything other than market share. These numbers point to a managerial challenge of integration, which will be very difficult given the rigidities in the Norwegian labor market and the close connection between various large customers and the people within EDB Ergo Group servicing them. Though EDB Ergogroup has made acquisitions in low-cost countries (Ukraine and India) to the extent that every fourth employee in the corporation is abroad, it does not seem to have been able to turn this into substantial productivity increases – as compared to, for instance, Oracle.

Atea shows a similar story, but with more variation – value creation per employee has increased, but more as a result of fluctuations in the market than managerial action:

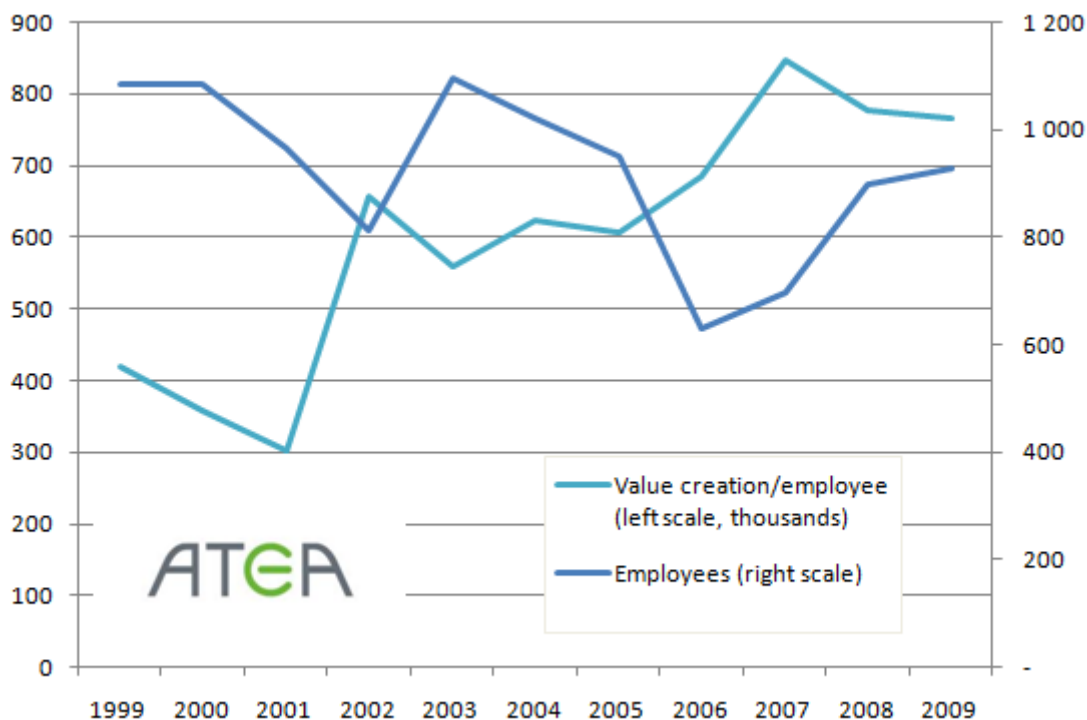


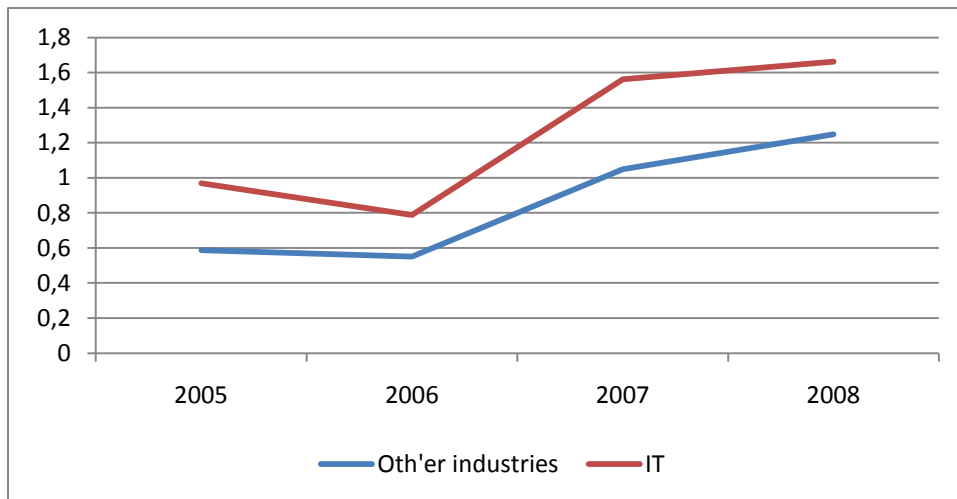
Figure 10: Value creation vs. Employee numbers, Atea (Norwegian activities)

Atea delivers, to a large degree, relatively basic IT services, and is financially driven – something that may account for a lower goodwill asset/market value ratio.

### ***The role of foreign R&D***

The IT industry has a slightly larger proportion of foreign R&D workers than non-IT industries. Again, this should not be a surprise – given a shortage of skilled IT personnel, that much of the technology is foreign (and most of the industry works in adapting foreign technology to Norwegian customers and circumstances) and the working language in many companies being English, the IT industry is a relatively natural place for a foreign worker to seek employment.

A common complaint in IT, as well as other R&D-intensive industries in Norway, has been that it can be hard to attract good foreigners to Norway. There are many reasons of this: They have a hard time becoming integrated (unless they learn Norwegian, often by acquiring a Norwegian spouse); the technical environment can be narrow; and given that there are relatively few technical companies, a heavy investment in settling in (Norway is a country where relatively few people rent their houses and moving house because of a job shift is not as common as in, say, the US) can be risky.



**Figure 11: Average number of foreign R&D personnel**

This may be shifting, however – as seen both in the numbers and from direct observations. Firstly, the Norwegian economy is somewhat countercyclical to the rest of Europe, and the Norwegian currency has appreciated significantly against Euros and US dollars since 2008. Given the financial crisis in the Euro-zone and the USA, the egalitarian salary structures in Norway suddenly don't look so bad. Secondly, research funding for elite initiatives (the SFF and SFI<sup>62</sup> projects from the Norwegian Science Foundation, for instance) have been able to recruit excellent researchers from abroad.

The main example here is the Simula Research Center, which has taken an elite, international position from the start. A few, very international companies in non-IT industries (DNV, for instance) have recruited many foreigners. The development environment connected to some of the Norwegian technology providers that have been sold to foreign companies (Trolltech and FAST) have managed to retain a significant portion of their development staff – furthermore, many of the managers and head developers that have left, have stayed in Norway and are busy working on new initiatives, as yet under the radar screen.

Lastly, and perhaps most significantly, the supply of foreign candidates is increasing – though many of the Indian and Chinese engineers and computer science majors see the USA as their preferred destination, a reduced number of H-1 visas and tougher immigration requirements in the USA has led many to shift their attention to other countries. As a result, the number of foreign workers in the IT industry is increasing, as is the number of foreign faculty and researchers.

The fact remains, though, that Norway is a relative outpost in the IT world, though the industry seems gradually to become less focused on Norway and less prone to chauvinism in its hiring and promotion practices. The shortage of talent means that immigrants (both work immigrants and naturalized children of immigrants) are considered. Norway has had significant non-European immigration since the 1970s, and the children of immigrants seek higher education as a way to achieve career success, often being more motivated than ethnic Norwegian students. Lastly, the success of the Indian and Chinese technical industries have led to a larger acceptance – indeed, expectation – that Indians and Chinese are IT-competent. As Dalip Devan, Chief Technical Officer for

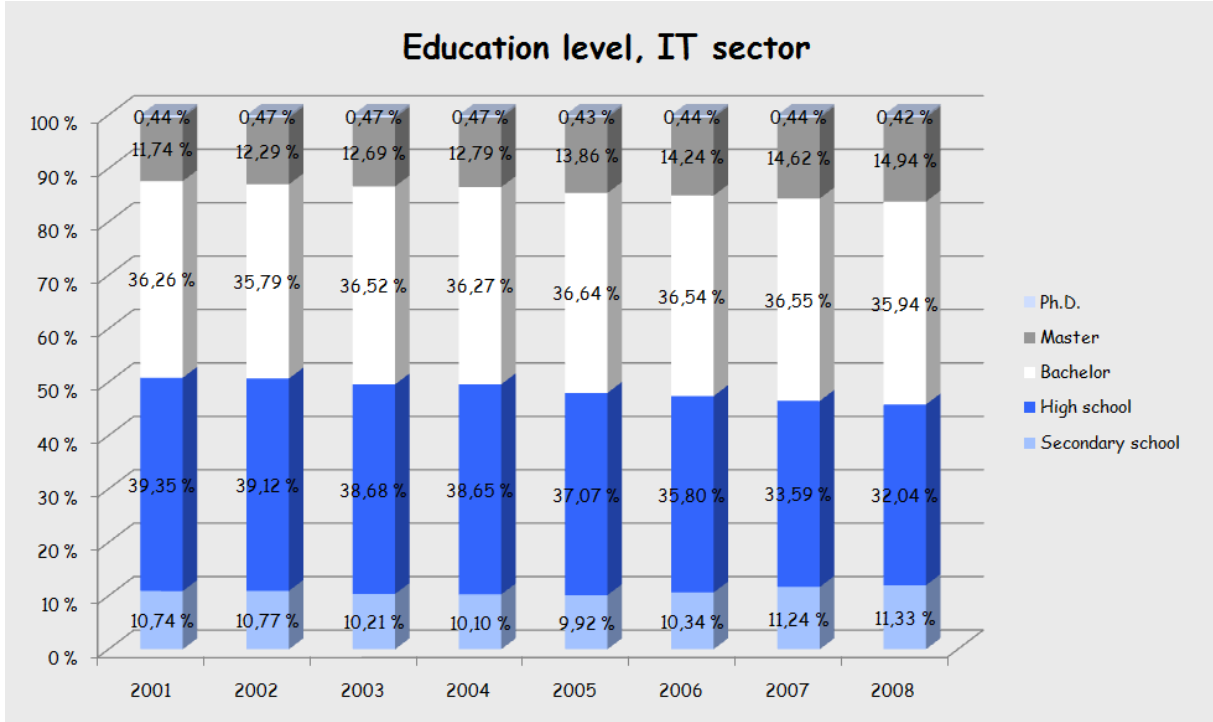
<sup>62</sup> Center for Excellent Research (theoretical) and Center for Research-Driven Innovation (more practical), respectively.



VISMA, an Indian who has lived in Norway and influenced the Norwegian IT industry for 25 years, once told this author:

Previously, people saw I was Indian, and assumed that I didn't know anything about computers. With the success of the Indian offshoring industry, they now see I am Indian – and assume I know everything about computers....

**The hunt for talent**



**Figure 12: Education levels, IT sector**

The education levels in the IT industry are generally higher than in other industries in Norway, approaching 60% with post-secondary education levels.

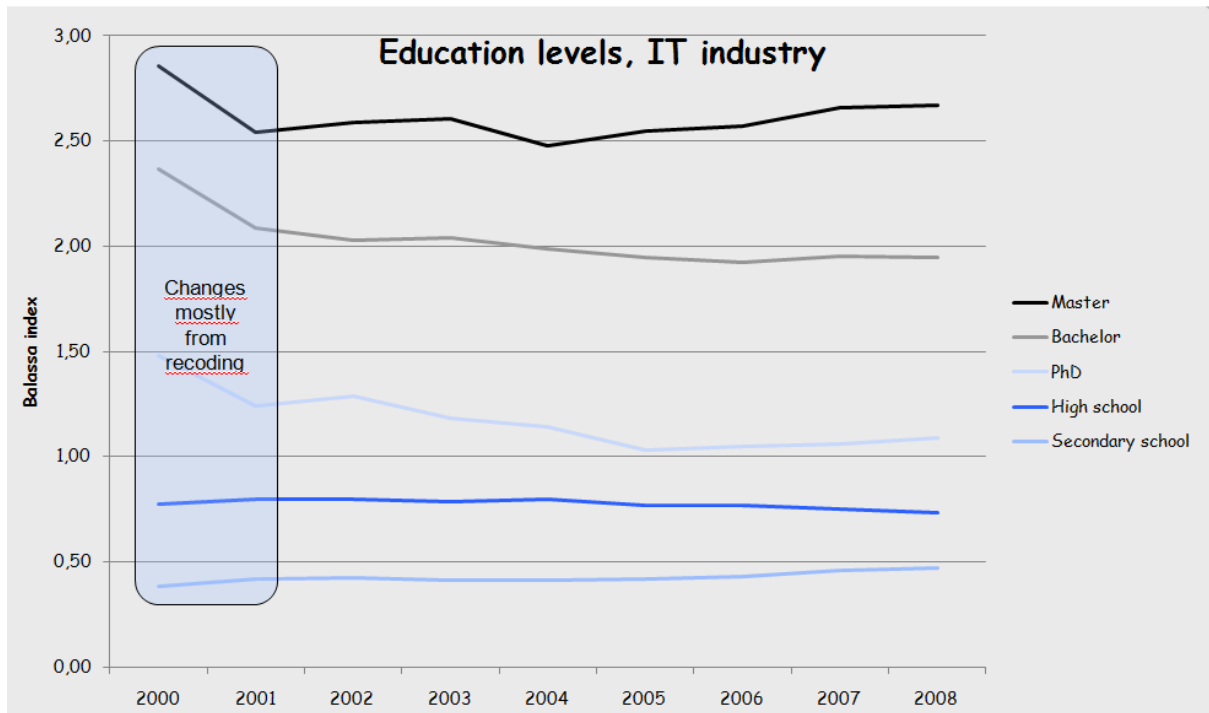


Figure 13: Education levels, IT industry, Balassa indices compared to Norwegian average

The relative education levels show that the IT industry has 2,7 times the average number of Master's degrees, close to double the level of bachelors, but just about average of Ph.D.s. This can be interpreted in a number of ways, the short version being that the industry is knowledge-based, but not research-driven (or, rather, that much of the research that drives it is done by people who do not bother to get a Ph.D. degree).

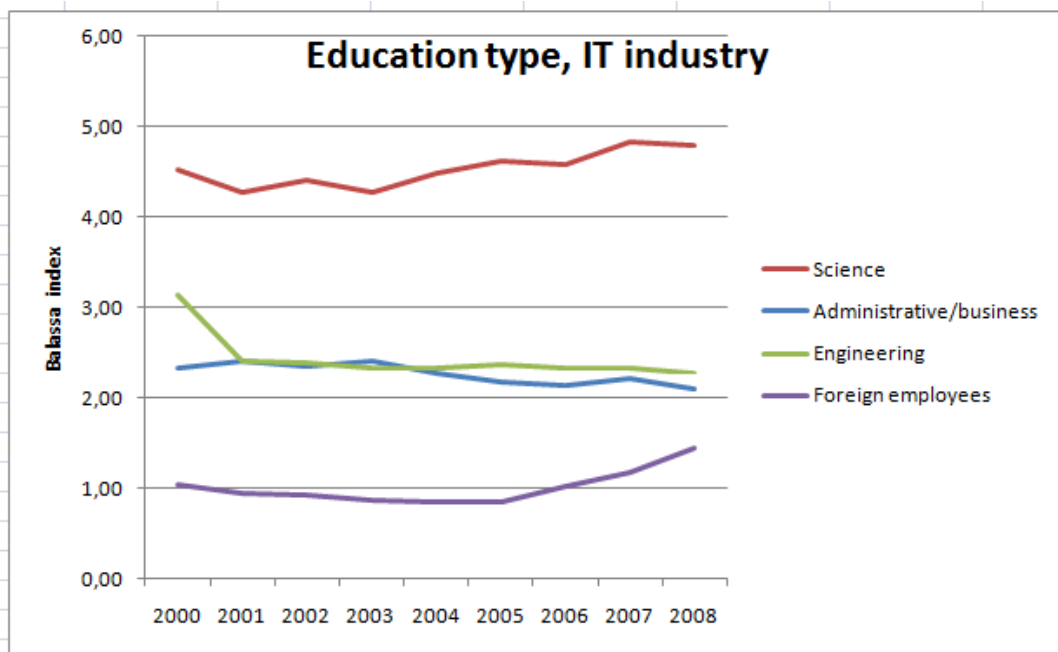


Figure 14: Education type, IT industry vs. Norwegian average, Balassa indices

In terms of type, the industry has close to five times the science-educated (that would be Master and perhaps Bachelor degrees in science from institutions such as NTNU and UiO) than non-IT, and about twice the number of people with engineering (mid-level institutions) and business administration background.

### ***Education – producing and distributing IT knowledge***

Though becoming more formalized, the IT industry is still an area where people to a large degree come in without formal education, or with non-IT educational backgrounds. Secondly, as the technology progresses extremely rapidly, continuing education, in various forms (including, perhaps dominant, self-study) is crucial for IT personnel to stay up to date. Hence, an overview of knowledge is developed and disseminated within the industry needs to take into account organizations and institutions outside the traditional educational apparatus. In our opinion, the mechanisms for spreading knowledge about information technology within the industry can be divided into five categories:

- *Research universities and research institutions*, educating (mostly) computer scientists. These are the institutions educating those with a “science” background in the figure above.) The two dominant institutions are the Institute for Informatics at the University of Oslo (ranked no. 1 in the Nordic countries, 6th in Europe and 48th in the world in Computer Science in 2010 Academic Ranking of World Universities<sup>63</sup>) and the Faculty of Information Technology, Mathematics and Electrical Engineering (IEM) at the Norwegian University of Science and Technology in Trondheim (NTNU). Together, these two educate about 80% of Norway’s Master students in computer science. The universities in Bergen, Tromsø and Agder have similar activities on a smaller scale, sometimes with more specialization<sup>64</sup>. Though engaged in practitioner education, these institutions see themselves primarily as research focused, with curricula either based on technology (geared towards theoretical aspects of computer science, frequently with a mathematical underpinning) or more process oriented, sometimes with theoretical backgrounds in sociology, psychology or social anthropology. Graduates from these institutions tend to go into software companies, consultancies, or high-tech companies utilizing information technology, or into academic or semi-academic positions.
- *Mid-level college institutions* – roughly, the institutions educating the “engineering” background in the above figure – trains IT practitioners at up to the Masters<sup>65</sup> level, with curricula either geared towards practical engineering (with underpinnings in natural sciences) and/or geared towards development on standard tools, project management, implementation, and use of IT in organizations (with theoretical underpinnings drawn from applied business and project management, for example). The most important actors here are the distributed university colleges (distriktshøyskoler) around Norway (including the very large University College of Oslo, as well as specialized IT institutions (some of them private) such as NITH, a private school educating IT practitioners up to Master level. Frequently, these

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<sup>63</sup> Published by Center for World-Class Universities and the Institute of Higher Education of Shanghai Jiao Tong University, China, <http://www.arwu.org/SubjectCS2010.jsp>

<sup>64</sup> The University of Tromsø specializes in search technology, concurrent computing, and telemedicine, for instance. These programs are small, however – in Tromsø’s case, about 20 students per year, with, in practice, open enrollment.

<sup>65</sup> A few, especially centrally placed, have created Master’s programs.

institutions collaborate with technology vendors, which provide infrastructure and teaching materials, as well as certifications on their tools. Candidates from these institutions tend to go into both technology providers and service providers, but this has also, traditionally, been where the companies that consume information technology have drawn their administrative IT personnel.

- *Industry interest organizations*, first among them the Norwegian Computer Association (Den Norske Dataforening), provides courses and seminars, either formally (often certified by vendors) or through interest groups that define their own agendas. Tekna, the Norwegian association of engineers, is geared towards individual industries and has only a relatively small ICT group. NITO, with 66000 members the largest technology-oriented association in Norway, does little in ICT itself, except for hardware-oriented engineering courses. (The other two main industry organizations, IKT-Norge and Abelia, are more geared towards advocacy on behalf of, respectively, technology vendors and a broader category of “knowledge-based companies”, and play a relatively small role in education, except as meeting places to discuss trends and industrial policy.)
- *Technology companies (vendors)*. Almost every technology vendor – those that sell tools – will have an educational activity, where the employees of their customers are trained. For some of the larger companies, these activities are indeed labeled as universities (Microsoft University, Oracle University) and have course programs and curricula. These activities are especially important when they are geared towards developers: The large technology companies are facing a two-sided market (Parker and Van Alstyne 2005) where success in the marketplace (i.e., to what extent customers will chose their technology) is highly dependent on what kinds of applied systems are being developed on them. Hence, all the major vendors invests heavily in partnership programs – in Norway, for instance Mamut ASA is frequently held up as a success by Microsoft, since Mamut writes its popular SMB administrative systems using Microsoft technology.
- *Research and advisory-oriented consultancies*, either independent or sponsored by major technology vendors, play an important part in educating CIOs and other top- and middle managers in large companies. These organizations span from the specialized Gartner corporation, whose evaluative technology reports (“golden quadrants”) detailing the merits and drawbacks of technology vendors’ offerings can sway markets and lead to major industry moves<sup>66</sup>; to McKinsey & Company, a strategy management consultancy whose lack of an implementation practice confers a neutral perspective. IDG (International Data Group) which runs an analysis arm called IDC and publishes Computerworld, is another example. Most of the large service providers run customer forums, some of them on a larger scale than others. And individual industry gurus – Peter Hidas from Gartner, Helge Skrivervik (independent), Bo Hjort Christensen (BI) – influence technology decisions through commentary and analysis.

### **Changes in the IT education market**

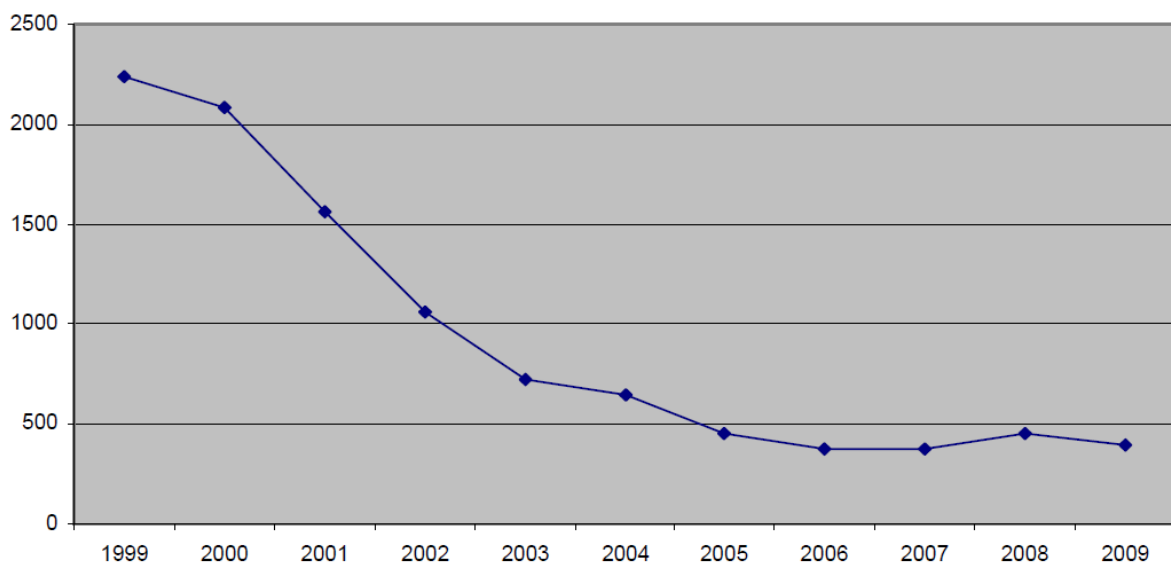
The nature of IT education has changed over time. Before IT became a subject in itself, IT workers were recruited from students in mathematics or engineering, or simply learned their trade on the job.

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<sup>66</sup> Microsoft’s acquisition of FAST in 2008 was said by some insiders to have been motivated by Microsoft’s desire to be in Gartner’s golden quadrant for search technology. Microsoft had the support and sales organization, FAST had the technology.

The first IT studies originated from faculties of mathematics or electrical engineering, with programming and systems engineering taught in technically oriented universities, such as the University of Oslo, Bergen or NTNU (then called NTH) in Trondheim. With widespread use of IT in business, business schools and local colleges started to offer degrees in IT, mostly with a focus on administrative systems and basic infrastructure maintenance. A number of large computer companies, with IBM and Microsoft in the lead, offered courses and certifications, often delivered through local colleges.

During the late 1980s, information technology became an important subject in business schools, especially at BI, where all full-time students were required to have their own PC in 1987. Following the influx of PCs and the gradual ascendancy of the Internet, a number of specialized schools in this market emerged (EDB-skolen, Den Polytekniske Høyskolen, Datahøyskolen, etc., constantly changing names, merging and spinning off units.) These schools, as well as the local colleges, enjoyed high demand and corresponding profits in the late nineties, as young people flocked to become part of the dot-com boom. A relatively short education with focus on fairly simple tools (HTML editing, web server configuration, basic database development, Javascript) would prepare the happy graduate for a very attractive job market, especially in the newly formed Internet specialty firms.



**Figure 15: Applicants for IT studies, outside Oslo, Bergen and Trondheim. From Olsen (2009)**

This did not last. While recruitment at the central universities remained relatively stable (though with falling entrance grades), students of information technology at the shorter post-secondary level fell more than 70% from 2000 to 2006 (Olsen 2009) to a level of less than 500 graduates per year. The dot-com crash meant that many of these candidates had neither the deep IT skills required to compete in a smaller market, nor the content-driven motivation need to keep themselves technologically up to date. Despite later upticks in demand, interest in IT studies at the intermediate level has not rebounded, as can be seen in the graph on the right.

At the higher levels of education, NTNU/IEM and UiO/IFI between them educate about 80% of Norway's master students in computer science. The main change in the higher levels of IT education has been the gradual growth of the University of Oslo, where the Institute for Informatics now is both the largest institute of the university, 2000 students, 400 of them at the Ph.D. level, and the

largest in Norway. NTNU has maintained an increasingly narrowing lead in terms of applicants' grades levels, but has faced larger problems in recruiting Norwegian Ph.D. students than IFI has. Both institutions, however, are concerned about lack of applications and, with that, lower acceptance thresholds. Said one senior NTNU academic:

When I started (early 80s) it was almost impossible to get in based on grades. [...] We were only 26 students [in computer science] at that time. As years progressed they increased the number of students. But there were no students applying so it almost collapsed. Students seem to go into the hardest studies they could get into. [...] Today it is not that difficult to get in. [...] In some courses there are failure grades on 75% so some students are happy they are passing the courses. [...] [The best] people do not look for job opportunities. They look for hard studies!<sup>67</sup>

Morten Dæhlen, former director of the SIMULA research lab and now chairman of IFI, is more optimistic. His institute is growing (the number of students has doubled since 2000), and though the acceptance grade levels are a little lower than at NTNU, their best students have better grades. IFI's approach to teaching is more research-oriented than at NTNU (which to a larger degree has classroom



Figure 16: IFI's new building, the Ole Johan Dahl house

teaching) and IFI also seems to benefit from being in Oslo, which has four times the population of the Trondheim area. IFI's new, 28,000m<sup>2</sup>, NOK 1b building (the Ole Johan Dahl house) is opening in the Fall of 2011 and will co-locate the whole institute, both faculty and master/Ph.D students, who previously were spread out across the campus. This will allow new approaches to pedagogy (such as identifying high potential students early and offering them a close relationship with researchers) and attract students to what Dæhlen envisions as a dynamic center for IT knowledge in Norway.

All the institutions that educate computer science candidates have various activities related to entrepreneurship, either formally (technology transfer offices, funding arrangements, incubator sites). The most visible of these is Gründerskolen<sup>68</sup> and its associated activities in Forskningsparken (the Research Park) associated with the University of Oslo. So far, however, NTNU has been the most successful originator of new companies, with Trolltech and FAST being the most well-known, and chip design companies such as Atmel and Nordic Semiconductor staying in Trondheim. At IFI/UiO, the list of companies originating at UiO includes Oslonett (one of Norway's first ISPs, sold to Telenor) as well as various smaller high-tech companies such as Pubgene (presentation engine for medical information), Squarehead (microphones), Novelda (developing nanoelectronic processors), Lividi (multimedia streaming) and Sonitor (indoor ultrasonic location tracking systems, using UiO patents).

<sup>67</sup> Interview November 2010.

<sup>68</sup> A collaboration between all the universities and many other higher education institutions in Norway, educating about 150 students per year.

## Research centers

A number of research centers and research organizations exist within the IT field, with SINTEF being the largest. The nature of research centers in IT have changed however, as illustrated by two very different research centers: Norsk Regnesentral, founded in 1952 and famous for being the originating organization of object orientation; and Simula Research Laboratory, founded in 2001 and located at IT Fornebu, a government-sponsored attempt at creating a physical cluster of small ICT-related companies at Oslo's former main airport.



### **Norsk Regnesentral – the traditional Norwegian research organization**

*Norsk Regnesentral, a relatively small research center with a proud history, illustrates the challenges of being small and local in an increasingly interconnected and international research setting.*

Norsk Regnesentral (Norwegian Computing Center) was formed in 1952 and represented a very early and strategic initiative from the University of Oslo and others in building up knowledge on computation. It has a proud history: The Simula simulation language, which formed the basis for the concept of object oriented programming, was created here in the late 1960s, but was never successfully commercialized. Located in the Oslo Research Park, NR has 75 employees, (of whom 67 do research,) revenues of 70MNOK in 2009 and profits of NOK 4.5m.

NR organizes its experts in three areas: DART, which does research in information security, e-Inclusion, and multimedia; SAMBA, doing statistical analysis, pattern recognition and image analysis; and SAND, doing statistical analysis of reservoir data. The customers are mainly Norwegian companies, such as Storebrand (insurance), Nycomed (pharma), Kongsberg Simrad (subsea technology), Statoil, and Norsk Tipping (betting). NR has very long-term relationships with these customers – new knowledge is generated by NR coming up with interesting research questions, which they explore with support from the customers.

NR faces a number of challenges, mostly related to the lack of public funding for hiring more researchers, as well as the very Norwegian focus of the institution. It may have an underserved reputation of being in decline – particularly in the general IT research. Also, it does seem to lack a strategy of commercialization of its developed tools and methods. Among its customers and users, however, it has a very strong reputation for competence and quality – but is also seen as vulnerable.

### **[ simula . research laborator ] SIMULA Research – the internationally connected research initiative**

*Simula Research, a research organization connected to the University of Oslo, reflects an investment in excellence that is rare in a Norwegian setting. Results have so far been excellent, but the center's visibility outside the academic world is limited – and its dependence on single researchers a source of worry.*

Simula Research is a research center, located at Fornebu, Oslo's former airport just outside the city center. This location was developed as a research and technology part, with Simula as the most tangible results. Connected to the University of Oslo, Simula is well funded (primarily from public sources), and does research within ICT in three main areas: Software engineering, scientific computing, and network and distributed systems. Academically, the center has had success: On of its researchers, Magne Jørgensen, has been crowned "the world's most productive ICT researcher" four years in a row; it has built models of the human heart to understand how errors in signaling can cause arrhythmia, and constructed technology for providing resilience in communications networks.

Observers describes Simula's main competitive advantage as having enough money to attract internationally renowned researchers, that they only do research (though they have students, both masters- and doctoral – from UiO and other places) and that they have been very good in picking research areas that do not conflict with what UiO/IFI is doing. Researchers are hired by international headhunting, and the key areas to concentrate on are chosen by an international advisory board.

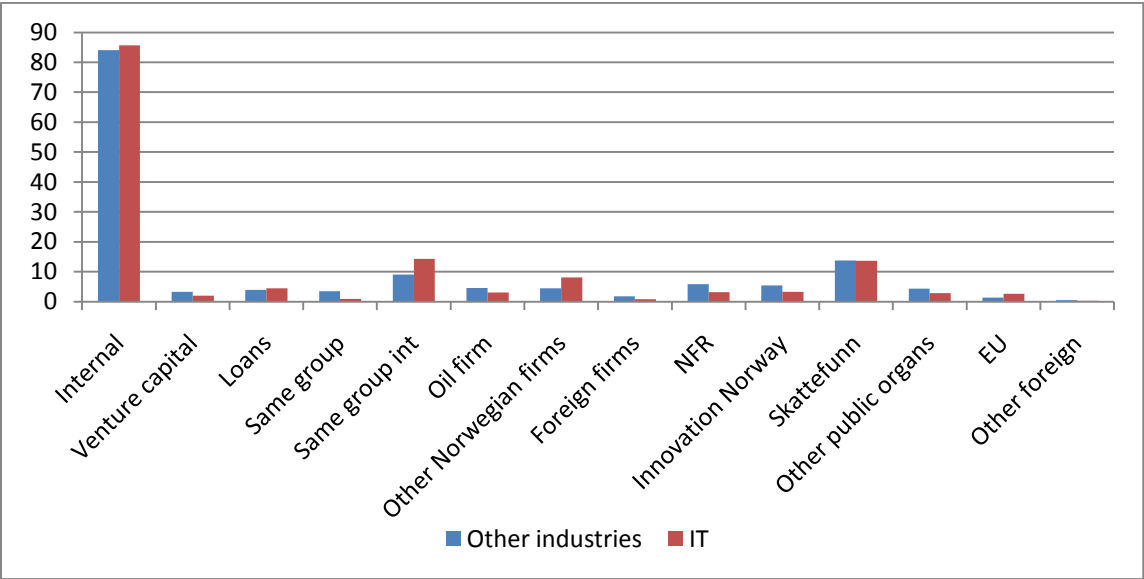
Future challenges include the long-term role of Simula, its relationship to the UiO as the number of Ph.D. and Master students grow, and managerial challenges of handling 120 different and very individual researchers.

The difference between Norsk Regnesentral and Simula reflects the changes in the IT industry – while Norsk Regnesentral is focusing on applied (though academically based) research in a Norwegian setting, Simula is, at least at this point, focusing on basic research in a very international setting. The differences may lie in age of the organization – since the Norwegian labor market, also in academia, tends to lead to people staying in the same organization once they have achieved the equivalent of tenure, recruitment of new blood and new perspectives can be difficult unless the organization is constantly growing. The international focus and strong funding of Simula should, at least in the beginning, lead to more circulation of people and ideas – international researchers (and, for that matter, managers and consultants) move to a much larger degree than Norwegian ones, partly for cultural reasons, partly because their set of options is much wider than just Norway.

Research centers such as Norsk Regnesentral and Simula have not, in Norway, been sources of substantive new companies, though some commercialization has taken place and is a formal activity of both (as well as most other research organizations and universities.) NTNU and to a certain extent the University in Tromsø have been the most successful here, not least because there is some private capital associated with the area, in the form of venture capital companies.

*The role of R&D*

The IT industry is R&D intensive, but differs both in funding and focus from non-IT companies.



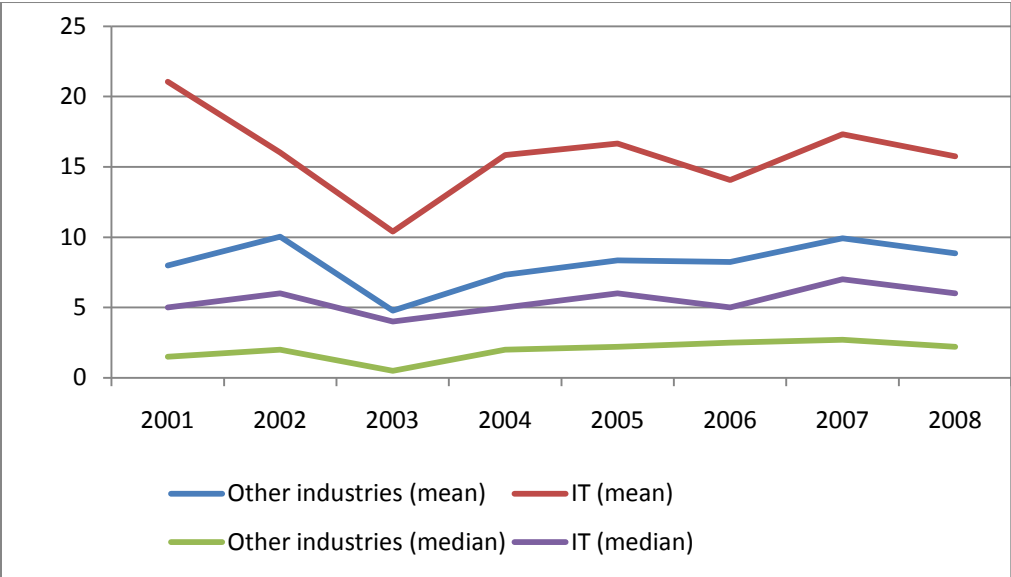
**Figure 17: Sources of financing of R&D, IT vs non-IT industries**

The IT industry uses internal financing, either in the firm itself or from the same group of companies, or other firms to a larger extent than non-IT industries. A common approach is to develop new technology or extensions to current technology for one customer and then selling it as a product or service – often as a series of consulting contracts – to other companies.

The IT industry receives significantly less funding from the public sources of financing (NFR and Innovation Norway) but uses the much more general and automatic Skattefunn (a tax rebate for R&D investments). There reasons for this problem (to the extent that it is a problem) probably lies both

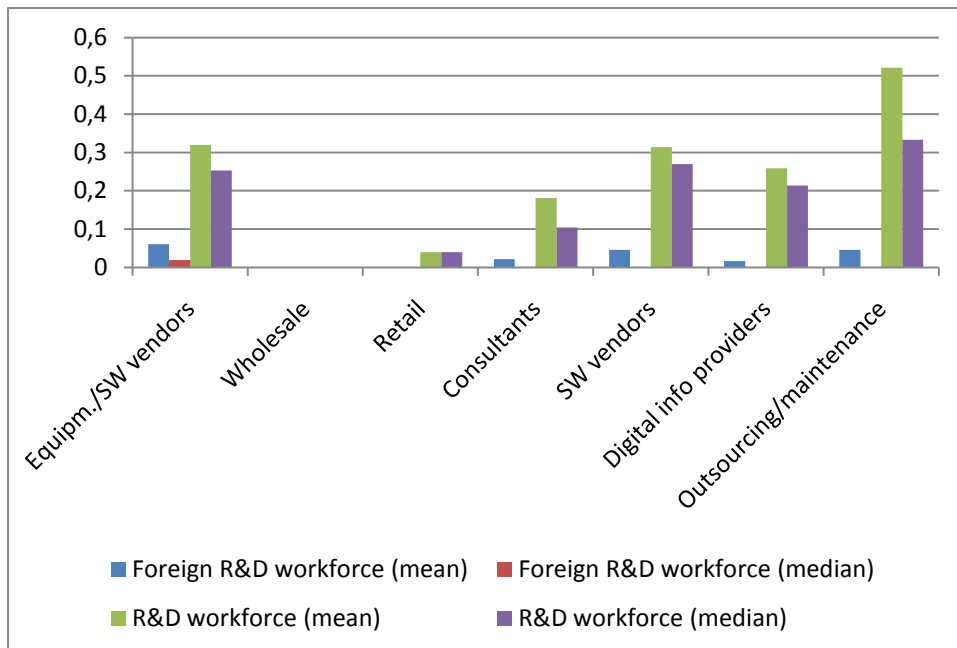


with the source and the recipient. The main sources of research funding, Norges Forskningsråd (basic research) and Innovasjon Norge (applied research and development) does not prioritize IT in anything other than words (as stated even in a 2006 government analysis (FAD 2006)). The recipients, on the other hand, may not have the time to apply for and receive the funding, since the technology evolution – and the concomitant business models and strategic foci – moves much faster than the lengthy application process, with all its documentation requirements and conflicting goals, allows. They may also lack many of the external attributes necessary to secure funding under more directed programs – location in a remote area, gender equality (at least in numbers) or focus on a non-commercial area or even a particular technology. Lastly, the technology evolution, particularly the availability of cheap servers, open source software and online resources, may mean that the transaction cost of applying for research funding may be too great for the amount necessary, at least to develop a proof-of-concept prototype.



**Figure 18: R&D staff IT vs. other industries**

The IT industry is R&D intensive, as seen from the figure above. Both the mean and the median of the proportion of R&D staff vs. other staff is significantly higher than in non-IT industries – though that should not surprise anyone, given that much R&D is software development and configuration even in non-IT industries.



**Figure 19: Distribution R&D personnel per category**

This is reflected in the distribution of R&D workers in the IT industry categories – foreign R&D workers are, no surprise, found in software and equipment vendors as well as outsourcing companies: The very purveyors of outside technology inside Norway.

### ***Ownership Attractiveness***

Ownership of companies in the Norwegian IT industry vary by type of company and stage of evolution, but has many of the attributes common to business in Norway in general: A large component of state ownership, few large companies, and many small ones. There are few IT companies listed on the Oslo Stock exchange, and the two main ones (Atea and EDB Ergo Group) are really collections of companies, in EDB Ergogroup's case with significant state ownership. A number of smaller companies are listed, but trading in their shares is low, often because employees and management hold significant portions of the shares and hold on to them. As mentioned elsewhere, most of the technology producing companies that have reached any size have been acquired by foreign companies seeking to add their technology to their portfolio – with the exception of VISMA, which has been acquired by a London-based private equity company.

As for funding for growth, the individual elements of the traditional Silicon Valley model of seed capital, angel funding, venture capital investment, various intermediary stages and then IPO can all be found in Norway. There are associations of investors and some smaller venture capital companies with a focus on IT, but overall the investment community is small and does not involve itself directly with the running of companies. A study from the turn of the century (Reitan and Sørheim 2000) concluded that Norwegian investors in general were relatively poorly capitalized compared to Sweden and UK, lack experience in running companies themselves, and invests more in startups than in mature companies. One reason for this may be that the private investor market accounted (in 1999) for less than 30% of GDP, whereas it was close to 100% in Sweden.

That study preceded the dot-com bubble, during which a number of IT investors, amateurs and professionals alike, were badly burned. Some made money, however, and sold before the 2001 drop in the stock market, and from these came a few new venture capital companies, such as Alliance Ventures.

It is still the case that Norway lacks competent capital for IT investments, leading to Norwegian IT companies seeking more general funding and, to the extent that they can find superior valuation for their technologies, will find that either abroad or by being acquired by a larger corporation. The typical Silicon Valley angel investor – a person with technical expertise, experience in running a startup, capital from previous exits as well as time and interest in finding and funding new technology startups – is a rare specimen in Norway, almost to the point where they can be individually named. Although ICT is recognized as a distinct investment category by most venture capital firms and investors, only a few Norwegian venture capital firms – Alliance Venture, Ferd Venture, Northzone and Viking Ventures – have sizeable current investments in IT and actively manages ICT as a primary field for investments.

As mentioned, need for capital in a typical IT start up is low, partly because the technology is cheap and increasingly can be scaled up in small increments. Lack of entrepreneurial zeal, however, may also be an issue. A typical IT startup in Norway is founded by a group of people wanting to work together around a technology or customer problem. Funding comes from public sources (perhaps Innovasjon Norge or a similar state-owned innovation fund) and private investors, but primarily from the managers themselves. Funds for technology development comes from customers for doing bespoke development. This often leads to companies growing slowly because they are, in essence, consulting companies with few resources for turning their solutions into saleable products. (The dot-com bubble was an aberration here – it provided many startups with enormous amounts of capital and investors requiring them to spend it – mostly on marketing of services with high network externalities). Frequently companies align themselves with a technology platform and get much of their technology input from the formal company partnership program – examples include Microsoft, Oracle, SAP or the open source community.

The founders see the startup as successful if it makes money and provide their owners/managers a good lifestyle and interesting work, and typically keeps the company at a size where it is manageable by the founders without having to recruit professional managers. If they do, it is either because the company is in a crisis (as was the case with Linpro in 2005) or because the founders want to concentrate on the technology and recruit someone to do the boring, managerial work. As the founders grow older, they seek an exit strategy and find it in being acquired by a larger company – Visma CEO Øystein Moan, for instance, has identified this type of company as a very good way of acquiring technologies and customer relationships.

As a consequence, venture capital firms are focused on supporting companies in the seed and early growth stages, and lack financial muscle and experience when taking the company much beyond 150-200 employees and/or into sizeable international expansion. Likewise, with the possible exception of Ferd, there is little experienced capital and initiative in Norway when it comes to managerial buyouts. (One exception is the rather daring founder and chairman of SuperOffice, who delisted the company and took it over with NOK300m in personal debt in 2008.)

In other words –it is relatively easy to start IT (and technology) companies in Norway, but hard to expand them beyond a certain size. The stock market prices general IT companies according to revenues (and, at present, relatively poorly) but does not, in general, price specialty companies well (though it may be quick to pump money into IT companies on news of financial changes, new customer contracts, etc.)

### **Environmental concerns**

Apart from power consumption and the occasional worry about recycling of metals and other compounds used in hardware, the IT industry is not seen as a polluter in any sense. Most annual reports conclude that the industry does not pollute or otherwise damage the environment.

The industry is instead frequently seen as a possible solution to environmental problems, sometimes referred to as “green IT”. While the industry consumes much electric energy (for instance, Google has located several of its data centers close to hydroelectric and other supply sources) and reducing the need for electricity, primarily for cooling, is an important consideration when designing facilities (Barroso and Hölzle 2009), the industry’s own use of energy is overshadowed by the possible use of information technology to help reduce energy consumption. Examples include:

- Use of information and communications equipment to replace physical travel, i.e. using videoconferencing for meetings.
- Lowering energy transmission losses<sup>69</sup> by moving bits instead of technology, i.e., locating large data centers near hydroelectric power plants (particularly on the West coast of Norway), allowing customers.
- Lowering energy use by optimizing the transmission of electric energy itself, by replacing traditional electricity meters with “smart” meters, which read electricity consumption on an ongoing basis and optimizes local energy use based on various parameters, including the ability to do regeneration, i.e. the customer generate electric energy and selling it back into the electric grid
- Use of technology to optimize transportation and production activities – for instance, DNV’s Synchroport project<sup>70</sup>, designed to optimize the speed of cargo transportation to by setting up a port slot reservation system, claims a potential of lowering the energy consumption in international shipping by as much as 8.7%<sup>71</sup>. (This project was awarded IKT Norway’s “Green IT” prize in 2010.)
- Use of technology to optimize administrative processes – the Altinn project, initiated by the Norwegian government and developed chiefly by Accenture, claims to have replaced 50 million paper forms with electronically transmitted forms since its inception (reference).
- Use of technology to enable new forms of energy utilization and production: A system for laser-scanning bioenergy-producing forests from airplanes makes accurate measuring energy-density possible<sup>72</sup>. This again enables accurate pricing of this resource, and can create a market for its production and harvesting.

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<sup>69</sup> Long-distance transportation of electricity is subject to losses due to cable resistance. Losses in long-distance transmission and distribution have been estimated by the US Energy Information Administration as high as 6.5% of the total energy entered into the electricity grid.

([http://tonto.eia.doe.gov/ask/electricity\\_faqs.asp#electric\\_rates2](http://tonto.eia.doe.gov/ask/electricity_faqs.asp#electric_rates2), accessed January 26, 2011)

<sup>70</sup> <http://www.grieg.no/companies/grieg-logistics/rd-projects/the-synchroport-project>, accessed January 26, 2011.

<sup>71</sup> “Bedre samhandling mellom skip og land”, *Dagens IT*, 15. june 2010

<http://www.dagensit.no/k/smarterenorge/article1915230.ece>, accessed January 26, 2011

<sup>72</sup> “Måling av bioenergi med flybåren laserskanning”, *Dagens IT*, 15. june 2010,

<http://www.dagensit.no/k/smarterenorge/article1911793.ece>, accessed January 26, 2011)

# Industry and public policy implications

## *Industry future challenges*

In summary, the Norwegian IT industry provides a general purpose technology (Basu and Fernald 2008), where value creation is more visible in the industries that use it than in the technology industry itself. The industry is largely located in Oslo, finances its R&D out of own funds or general tax refund programs, and does not to a large degree partake in more long-term research funding. This is partially because much of the funding is contingent on location in rural areas, partially because the technology evolves faster than the time it takes to acquire the money. IT companies, in particular services companies, (with exceptions) maintain links with universities mainly because they want to recruit students, not because they need the research muscle of the faculty. It is an industry where everyone competes and collaborates – there are few, if any, long-term collaborative patters. However, cohesion as an industry is somewhat hampered by the unwillingness of some of the foreign-owned, large companies to collaborate because they are bitter competitors abroad – and the tendency of the industry to run after any contract as soon as times turn tough. Thus, the IT industry scores relatively low on several cluster dimensions, in particular knowledge dynamics.

In short, the IT industry in Norway does not see itself as a knowledge cluster, nor does it act like one, partially because there are few problems the industry faces that are shared by all its actors. Of issues raised when interviewing leaders, five challenges arise:

1. *Recruitment*: There is a deep lack of available talent – every company we talked to were looking to hire, but found it difficult to find people with the right qualifications (primarily, computer science and other technical qualifications), with sufficient quality and ambition.
2. *Impact of low-cost, foreign competition*: Norway's high cost levels (particularly for support staff) and perceived unwillingness to pay for skills and education out of the ordinary results in both a brain drain (smart technologists moving abroad) and gradual offshoring of specifiable activities<sup>73</sup>.
3. *Public obscurity*: Despite the size, profitability and connection to (presumably glamorous) high technology of the industry, the Norwegian public (and politicians) knows little about what the industry does and how it creates value. Instead, impressions are formed based on a combination of consumer technology news and horror stories of system development overruns, particularly in the public sector.
4. *Lack of knowledgeable capital*. While the situation is better than it was 10 years ago, in particular because the Norwegian venture capital industry is better organized and knows funding at the venture stage. However, there is a lack of investment capability when a company needs to expand globally. The Oslo Stock Exchange, in particular, knows little about technology, and has few IT companies listed. Consequently, Norwegian technology companies are acquired by foreign, larger technology companies when they reach a certain size.

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<sup>73</sup> Both 1. and 2. are somewhat mitigated by the increasing ability to hire well educated foreigners, particularly from Eastern Europe and Asia, but also, lately, from the United States, to come to Norway. Though Norway has an egalitarian pay structure compared to Silicon Valley, its high living standards, public health availability and political stability is attractive to newly educated foreigners with small children.

5. *Lack of customer ordering and implementation competence.* Though the technology becomes better and more widespread, customers (especially in the public sector) do not have the competence to intelligently procure information technology, and very often also the motivation to use it, especially if the new technology requires changes in procedures or organizational structure.

These issues – experienced by the industry as a whole in relation to their customers and the Norwegian society – mirrors, more or less, the traditionally complex relationship between IT managers and their business counterparts in corporations. Companies tend to be polarized between those who see IT as a strategic resource and those who see it as a cost (Earl and Feeny 1994), and harmony in the relationship between IT and business is achieved when both sides agree on what the role of IT is: A strategic facilitator of organizational change or an operational tool for cost reduction and productivity improvements. The operational view is by far the most prevalent: Most business leaders see IT as an operational, indeed administrative, issue, and is not interested in thinking about IT unless there is an operational crisis, a threat by an IT-enabled competitor, or a new technology (Internet interface, social network participation, SMS customer coordination) becomes so common that not engaging in it will seem backward. The IT side of the relationship is often happy to have things this way – lack of customer ambition means a simpler life, with simpler demands. If anyone complains that service is slack or IT is not used to its fullest advantage, the IT side can always say that they cannot deliver what hasn't been ordered. IT-savvy (Weill and Aral 2005) companies, on the other hand, have IT departments and CIOs with initiative and vision, who demand – and get – both the attention and the resources needed to utilize the technology to the fullest.

As a body, the Norwegian IT industry needs to display that initiative. The industry needs to come together and create a public understanding of its worth as the key to future welfare as well as its attractiveness as a long-term career option. To do this, the industry needs to *jointly* document and exemplify how it creates value in the Norwegian society. This is an undertaking that will require collaborative efforts rather than today's beauty contests in front of potential employees and customers. Most importantly, it needs to attract talent outside the traditional male, engineering-oriented candidate pool, something that will require concerted effort, much earlier than after the students are halfway through their Bachelor educations.

To do this, the industry would benefit from trying to portray itself as urban, cool and interesting, a person with technical competence coupled with cultural dexterity. As this report shows, the IT industry employee can believably be portrayed as an urbanite sipping latte and programming social network software on a tablet in a coffee shop at Grünerløkka (a bohemian part of Oslo) rather than the more traditional image of a suburbanite with a station wagon maintaining ERP systems for an anonymous multinational. The technology-enabled career is one with attractive prospects. Increasing the admission competition for studying IT – and ceasing to recruit copies of themselves – should be one of the industry's highest priorities.

Lastly, the industry needs to address the thorny problem of improving productivity – in particular, decision making productivity – in the public sector. At present, the industry competes for projects without questioning their rationale and organization, instead blindly signing up for whatever request for proposal that comes along. To avoid costly overruns, incompatible systems and poor service, the

industry – as a cohort – needs to make its organizational as well as technical competence available to society in general and policy makers in particular. In short – faced with a lucrative but harebrained proposal, the industry should – collectively – turn it down rather than accept it and then claim they just did as they were told.

### ***Public policy implications – towards the industry***

Public policy towards the IT industry has been characterized by a quite fruitful neglect: The industry has not (despite entreaties from its interest organizations) been offered much help, nor had many restrictions from the government<sup>74</sup>. This is partially because of lack of knowledge – most politicians are not aware of the issues facing the industry, and when they deal with it, they do it based on relatively short-term, technology specific issues (open source technology, physical location of data centers) rather than with a long-term view of what the role of IT should be in Norway.

A productive public policy of IT in Norway would need to recognize that

- value creation from IT happens outside the IT industry – but that this doesn't make the industry less important. The value of the IT industry is never going to be a high number of employees – firstly because the industry already is hampered by lack of available technological talent, secondly because new IT companies will not have many employees even if they grow quite big. As recently pointed out by Tyler Cowen (2011), Facebook currently has 600 million users and 2,000 employees.
- Norway is a very small country which, in many cases, can do with one system rather than several (reducing the need for induced competition) and small and simple systems rather than complex ones. Hence, the public should focus on keeping things simple.
- The IT industry is best supported by addressing the problems felt by the industry (lack of general financing, lack of talent) rather than forcing it to respond to relatively short-term political interests such as focus on particular technologies or geographical distribution
- The centralization of IT to Oslo is not a problem – the relative provinciality of Oslo and other areas towards the rest of the world is.

The IT industry does not really need public help – it is used to constant change, people and companies are flexible, and despite occasional financial setbacks (dot-com crunch, 2008 financial crisis) companies respond by focusing on their business rather than running for help.

*Centralization of IT to Oslo is not a problem – the relative provinciality of Oslo in the IT world is.*

In the long term, the industry is growing both in size and value creation per employee.

It should, however, be understood that a significant minority of Norwegian IT companies – the technology creators – compete internationally, and should have the same ability to maximize their chance of success as are offered Norwegian soccer teams: The ability to recruit from anywhere and sell to anyone. The one key challenge to the industry, mentioned by almost everyone, is shortage of talent – in particular, shortage of the very best talent, the people who not just understands new technology but have the ability to create it. Though the IT industry in Norway cannot be portrayed as

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<sup>74</sup> Datatilsynet (the Norwegian Data Inspectorate), charged with upholding the Data Register Act of 1978, is a very active exception.

a knowledge cluster, it certainly can become one if it reaches critical mass – and that will, most likely, happen in the Oslo region.

Norwegian IT creating companies tend to provide a very specific technology (search, teleconferencing, mobile data compression, technical development libraries) and are sold to international companies when they reach a certain size, partially because the Oslo Stock Exchange does not price technology companies much higher than consultants. Many of the high-tech companies that remain in Norway are here because they have a significant public ownership component. While loath to recommend more public ownership, we should at least recognize the paradox – and do what we can to make sure that companies that are sold out retain their value-creating capability, primarily in technology development.

Lastly, the biggest challenge – and opportunity – for value creation with IT in Norway lies in increasing the productivity in the public sector, as well as in the companies dealing with it. At current, much of the government interface has been moved onto the Web, and much productivity has been created by digitizing the exchange of information between government and citizen. However, two large problems remain:

- The public-government interface is still modeled on paper – in effect, the bureaucracy has been exported to the individual citizen, by moving forms online. This needs to change so that the dialogue between the government and the citizen is based on what is easy for the citizen, not what is easy for the bureaucrat.
- While the interface has been improved, much remains in the back-office. Far too often, the individual citizen is left with the coordination between government agencies that do not coordinate – though they, in principle, have the information to do so.

Making this happen is key to solving the problem of an aging population and an increasingly more expensive welfare state.

Norway's challenge is to convert the enthusiasm with which the population adopts new technologies into an equally strong enthusiasm for government and business to adopt their processes and services to the new technology. One way of doing this could be to create a powerful office of technology integration – like the current DiFi directorate, but with power to direct and implement rather than recommend. The US government's CIO for the Federal Administration might be an example for emulation here – both the institution and their very ambitious and unambiguous strategies and implementation plans (Kundra 2010).

Let the final recommendation for the government then be that a post of Minister of IT is created, empowered to reorganize, automate and digitize all aspects of public service provisioning, with a goal of making life better for every citizen and with the added benefit of enabling Norwegian IT companies to export the resulting knowledge and technology to countries less blessed with a strong economy and a technologically enthusiastic population.



# Appendices

## *Data sources*

Data sources for this study have been

- Financial data from a selection of the 400 largest IT companies, 1999-2009
- Results from a questionnaire survey of IT companies, 170 respondents
- 39 cases describing IT (or IT-enabled) companies, written by M.Sc. students (see next page for company list)
- Formal interviews with 17 executives in IT (and IT-enabled) companies in Norway
- Interviews/conversations with 23 executives in Norwegian and foreign IT companies, academics and industry observers
- Comments and discussions on blog posts with hypotheses about the Norwegian IT industry

### **Cases created for this study:**

Ahmed, Faysal; Axel Heinz and Clementine Jullien: *Accenture*

Berget, Petter Tore; Vibeke Fugle Mailund: *Altinn/Accenture*

Durieux, Zoe and Adrian Lebherz: *Atea*

Gjermshus, Anders and Anders Karl Westman: *Basefarm*

Felloni, Andrea and Hani Khoury: *Cap Gemini*

Beyer, Martine and Catherine Norby Kleven: *Chartis*

Ashraf, Bilal Mohammad and Mohit Ghildiyal, *Devoteam Da Vinci*

Kristensen, Trond Sveum; Maxwell Labadie and Elin Madeleine Westereng Olsen: *DNB*

Chai, Hongliang and Mari Helmer: *EDB/Ergo*

Karlsen, Trine: *ePocket*

Jenny, Christoph and Ian Russel Stendera: *EVO*

Amundsen, Vegard André and Erik Lopez Fedde: *FAST/Microsoft Search*

Bolling, Jørgen, Sindre Stokke and Tommy Torjesen: *Funcom*

Hotvedt, Fam Gjerløw and Vibecke Lien: *Funcom*

Fuglem, Berit Margrethe and Åshild Elton Jacobsen: *The Grimstad technology cluster*

Pyakurel, Swagat Raj: *IFI*

Lind, Christine and Andriy Shmyhelsky: *Integrasco*

Lystad, Haakon and Thomas Øyehol: *Iterate*

Orten, Christian and Frederico Valente Lopes de Almeida: *Linpro/Redpill*

Brodtkorb, Andreas and Siren Sundby: *Mamut*

Eilertsen, Gustav, Johan Hennig-Olsen and Keith Herbert Peavy: *Masterstudies*

Morkemo, Trygve: *Meltwater*

Hambardzumyan, Sergey and Hilde Marie Wold: *Norsk regnesentral*

Farkvam, Magnus and Ayna Alkhan Yusubova: *NTNU*

Aigozin, Dastan and Vadym Ivanenko: *Opera (desktop)*

Fitiariana Rosida: *Opera in Indonesia*

Amundsen, Mai Juliett Butters and Niraja Upadhyaya: *Opera*

Hagen, Petter, Amund Balke Hveem and Magnus Kristiansen: *Playfish*

Alster, Michal and Kristine Lind: *Questback*

Natvik, Astri Marie and Anne Marte Sletto: *Sats/EVO*

Brennsletten, Marit Plassen, Robert Ivan and Ingrid M.L. Larsen: *Schibsted/VG/Finn.no*

Willard, Eivind Thorsrud: *Simula*

Berg, Pernille and Iselin Haug: *Sintef*

Dubourcq, Thomas Louis, Natalia Stiris and Marie Brun Svendsen: *Tandberg*

Giske, Christoffer, Torbjørn Rommetveit Gløppen and Signý Jóna Hreinsdóttir: *Telenor*

Hansen, Christoffer and Christoffer Ness: *Think Global*

Haraldsson, Cecilia, Adele Joanne Mariathan and Carolin Reukauf: *Trolltech/Nokia*

Nhat, Ngo Thi Kim and Xi Zheng: *Visma*

# Norway

## Key indicators

Population (millions), 2009.....	4.8
GDP (PPP) per capita (PPP \$), 2009 .....	51,985
GDP (US\$ billions), 2009 .....	378.6

Global Competitiveness Index 2010–2011 rank (out of 139)	14
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## Networked Readiness Index

Edition (No. of economies)	Score	Rank
<b>2010–2011 (138)</b> .....	<b>5.2</b>	<b>9</b>
2009–2010 (133).....	5.2	10
2008–2009 (134).....	5.5	8
2007–2008 (127).....	5.4	10
2006–2007 (122).....	5.4	10

256

## Environment component 5.6 6

### Market environment 5.3 8

1.01 Venture capital availability* .....	4.3	2
1.02 Financial market sophistication* .....	6.1	9
1.03 Availability of latest technologies* .....	6.7	3
1.04 State of cluster development* .....	4.7	18
1.05 Burden of government regulation* .....	3.4	58
1.06 Extent & effect of taxation* .....	3.6	63
1.07 Total tax rate, % profits.....	41.6	74
1.08 No. days to start a business .....	7	20
1.09 No. procedures to start a business.....	5	22
1.10 Freedom of the press* .....	6.8	3

### Political and regulatory environment 5.9 8

2.01 Effectiveness of law-making bodies* .....	5.2	10
2.02 Laws relating to ICT* .....	5.6	5
2.03 Judicial independence* .....	6.2	13
2.04 Efficiency of legal system in settling disputes* .....	5.8	4
2.05 Efficiency of legal system in challenging regs* .....	5.3	9
2.06 Property rights* .....	6.1	9
2.07 Intellectual property protection* .....	5.6	16
2.08 Software piracy rate, % software installed.....	29	15
2.09 No. procedures to enforce a contract.....	33	38
2.10 No. days to enforce a contract.....	280	8
2.11 Internet & telephony competition, 0–6 (best).....	6	1

### Infrastructure environment 5.5 8

3.01 Phone lines/100 pop. ....	37.1	30
3.02 Mobile network coverage, % pop. covered.....	n/a	n/a
3.03 Secure Internet servers/million pop. ....	1,011.2	9
3.04 Int'l Internet bandwidth, Mb/s per 10,000 pop. ....	269.1	12
3.05 Electricity production, kWh/capita.....	28,954.3	2
3.06 Tertiary education enrollment rate, % .....	73.2	15
3.07 Quality scientific research institutions* .....	5.0	23
3.08 Availability of scientists & engineers* .....	5.1	18
3.09 Availability research & training services* .....	5.5	14
3.10 Accessibility of digital content* .....	6.4	6

## Readiness component 5.1 20

### Individual readiness 5.5 20

4.01 Quality of math & science education* .....	4.1	64
4.02 Quality of educational system* .....	5.0	19
4.03 Adult literacy rate, % .....	99.0	14
4.04 Residential phone installation (PPP \$).....	110.8	97
4.05 Residential monthly phone subscription (PPP \$) .....	17.8	101
4.06 Fixed phone tariffs (PPP \$) .....	0.05	32
4.07 Mobile cellular tariffs (PPP \$).....	0.10	10
4.08 Fixed broadband Internet tariffs (PPP \$) .....	33.5	62
4.09 Buyer sophistication* .....	4.5	12

### Business readiness 4.9 13

5.01 Extent of staff training* .....	5.5	3
5.02 Quality of management schools* .....	5.2	19
5.03 Company spending on R&D* .....	4.4	17
5.04 University-industry collaboration in R&D* .....	4.9	20
5.05 Business phone installation (PPP \$).....	110.8	78
5.06 Business monthly phone subscription (PPP \$) .....	18.1	80
5.07 Local supplier quality* .....	5.6	12
5.08 Computer, communications, & other services imports, % services imports .....	36.6	45

### Government readiness 4.8 26

6.01 Gov't prioritization of ICT* .....	5.4	27
6.02 Gov't procurement of advanced tech.* .....	4.2	33
6.03 Importance of ICT to gov't vision* .....	4.8	24

## Usage component 5.0 11

### Individual usage 5.7 10

7.01 Mobile phone subscriptions/100 pop. ....	111.4	48
7.02 Cellular subscriptions w/data, % total .....	19.1	43
7.03 Households w/ personal computer, % .....	87.6	4
7.04 Broadband Internet subscribers/100 pop. ....	34.0	4
7.05 Internet users/100 pop. ....	92.1	2
7.06 Internet access in schools* .....	5.9	15
7.07 Use of virtual social networks* .....	6.3	4
7.08 Impact of ICT on access to basic services* .....	5.5	16

### Business usage 4.2 16

8.01 Firm-level technology absorption* .....	6.2	6
8.02 Capacity for innovation* .....	4.7	13
8.03 Extent of business Internet use* .....	6.0	12
8.04 National office patent applications/million pop. ....	258.1	11
8.05 Patent Cooperation Treaty apps/million pop. ....	144.8	14
8.06 High-tech exports, % goods exports .....	4.1	54
8.07 Impact of ICT on new services and products* .....	5.8	7
8.08 Impact of ICT on new organizational models* .....	5.5	4

### Government usage 5.0 14

9.01 Gov't success in ICT promotion.....	5.2	18
9.02 ICT use & gov't efficiency* .....	5.3	19
9.03 Government Online Service Index, 0–1 (best) .....	0.74	7
9.04 E-Participation Index, 0–1 (best).....	0.50	21

\* Out of a 1–7 (best) scale. This indicator is derived from the World Economic Forum's Executive Opinion Survey.

Note: For further details and explanation, please refer to the section "How to Read the Country/Economy Profiles" on page 159.

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