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Ministry of Trade and Industry

e-norge

Strategy for Norway's ICT research 2003-2004

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The deployment of ICT is of vital importance for the development of industry and society in general, as well as playing a key role in boosting innovation and value creation. The national level of ICT knowledge is critical in defining the degree of use Norwegian society can derive from ICT. Research in this area calls for wide-ranging scope in order to achieve robust and future-oriented levels of ICT knowledge. This is the background for the choice of ICT as one of the priority themes in Norwegian research by the1999 White Paper on Research. ICT is important, and not simply as an independent science, but as a tool for deployment in other fields of research as well. Indeed, all other scientific and hi-tech disciplines will gain inspiration through prioritizing ICT research. Norwegian ICT companies on a world footing are currently enjoying the benefits of research carried out 15-20 years ago, and thus, in just the same way, current ICT research endeavours will be of long-term significance.

The objective of this strategy is to put ICT research firmly on the IT political agenda represented by the eNorway work, as well as clarifying ICT research's position within Norwegian research policy.

1. Political research priorities

The Government is investing in underpinning Norwegian research. Funding for research was increased by NOK 1 billion from 2001 to 2002, and the budget for 2003 will be granting around an extra NOK 640 million. This increase is following the Norwegian Parliament's decision in 2001 of intensifying research, for which 40% of the growth would be from public funding. Increased funding is in line with national political research priorities. Fundamental research is regarded as being of key importance. In addition, R&D fields have been targeted as thematic areas of investment: marine research, research on medicine and health, research in the intersection between energy and the environment and *ICT research*. In addition to this, there is much investment in functional gene research and new materials.

Attaining higher levels of quality is the main goal here. One key quality action was the launch of 13 centres of excellence (CoE) in June 2002. Two of these centres are directly linked to ICT research (*The Centre for Quantifiable Quality of Service in Communication Systems* at the Norwegian University of Science and Technology [NTNU] and *the Centre for Mathematics for Applications* at the University of Oslo [UiO]). Most of the other centres are also involved in applied ICT research within their own particular fields (cf. www.forskningsradet.no/fag/andre/sff/index.html).

Evaluation of Norwegian ICT research

In 2002, an international evaluation of Norwegian, government ICT research was carried out by the RCN (ISBN 82-12-01772-9), which confirmed the low level of investment in Norwegian ICT research. In spite of this, the environments were renowned for generally yielding good results, in addition to a high volume of ICT doctorates in relation to the population – even though this is inadequate in terms of satisfying academic and industrial requirements. It was emphasized that the increase in resources could yield exceptionally good results. Of the 56 research groups at evaluated universities and colleges (UaCs), nine were awarded the standing "excellent" and 19 "very good". In order for Norway to reach a high international level, it was recommended that these resources be increased and concentrated within the most appropriate Norwegian ICT environments. The majority of the research groups awarded the best marks in the international evaluation are within the more theoretical or calculation-oriented part of the ICT field of study. There are fewer within the technological areas. International research and technology development is driven forward here by major industrial players, so it is not surprising that Norwegian research environments find it more difficult to gain acclaim at the international forefront. At the same time, Norwegian industry is painfully lacking in ICT expertise of high international quality within these areas.

Companies in Norway invest considerably less in ICT R&D than their respective Nordic neighbours.

Definition of terms:

ICT research differentiates between what can be termed as three different technological ***core areas:***

- **Microtechnology and other technology forming the physical basis of ICT systems**
- **Technology for software development, information administration and user interfaces**
- **Communication technology and infrastructure**

These are referred to here in this strategy as the *three core areas.*

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Therefore, the expertise base within ICT is vulnerable and partly undercritical in terms of size, particularly within technological areas. The recommendations in the evaluation report are consistent with priorities made over recent years, e.g. the concentrated and long-term investment in strong environments by means of more funding in national microtechnology, the establishment of the Simula Research Laboratory at Fornebu, the strengthening of the bio-data processing and cryptology e-incubuses at the University of Bergen and the establishment of two centres of excellence. *However, investment in ICT research directed at industry and technology has been more diffuse.*

Scope of the ICT research

The ICT industry is enormously R&D-intensive, and other industries also invest heavily in R&D linked to ICT innovation, as shown in the second column in the table below (Source: The Norwegian Institute for Studies in Research and Higher Education – NIFU). Other figures, based on a broader definition of R&D, put the ICT industry's R&D investment at NOK 4 billion, or around 30% of Norwegian industry's collective investment in R&D (and NOK 1.5 billion or 10% for other industries' ICT R&D). These high estimations are dominated by R&D directly linked to product development – and just 1% of this investment is in the form completely new research, and around 10% is flagged as applied research.

Government R&D	Private R&D
Backbone and applied ICT R&D (UFD/RCN): NOK450 million	ICT industry R&D: NOK 2.5 billion
ICT R&D in different (RCN): NOK150 million	Other industries' ICT R&D: NOK 1 billion

The extent of *public ICT research* over recent years has been steady at around NOK 600 million, divided between NOK 200 million directly granted to UaCs and NOK 400 million earmarked for the RCN's budget. Of the latter amount, around NOK 250 million (or just under 10% of the RCN's total research funding) goes to basic and applied ICT R&D, while NOK 150 million is linked to R&D consisting of new key ICT innovations, but these are not the main emphasis here (i.e. these are contained in other R&D categories). This is apparent from the first column above. The figures above include around NOK 200 million ICT R&D carried out in Norway for foreign contractors (predominantly from the EU), but do not include ICT R&D carried out abroad for Norwegian contractors (predominantly ICT companies), which is estimated as well at around NOK 200 million.

ICT research and commercialization

Good ICT research can be recognized by its focus on the realization of new applications and products that are able to solve problems. This is the reason why the international ICT industry is at the forefront of research today. The vast proportion of R&D work within ICT is aimed at achieving results which can then be launched rapidly on to the market by means of new products and services. This is a strong incentive for companies to invest in R&D, although more often than not in the guise of projects with relatively short-term horizons and rather a low level of research. The risk here might be that if one focuses too closely on new applications of current technology, one might not see the coming technological generation shift.

An important challenge will therefore be to ensure the long-term aspect in both government and private ICT research. Encouraging spin-off from the UaC sector's ICT e-incubuses is equally important, as this has huge contributory potential in terms of industry-oriented product and technology development, and for early warning of technological paradigm changes. Amendments to the Act on the right to inventions devised by employees are expected to contribute to this as well.

2. ICT research in a European context

EU's *Framework Programme* is the key arena for the internationalization of Norwegian ICT research. Immense networking and funding opportunities abound here. The EU programmes are an international competitive arena, and it is crucial to stimulate Norwegian participation. The RCN reinforce their aid to this kind of participation (both during the application phase and for financing the remainder once EU funding has been granted).

Collaborative research work has also been initiated with a variety of international partners in, for example, the USA and Japan.

IST in the EU's Sixth Framework Programme for Research (FP6)

The IST programme (www.cordis.lu/ist) enjoys, and has enjoyed, the highest thematic priority within the EU's framework programmes. Its priority is carried on in the Sixth Framework Programme (FP6), in which IST is granted € 3.6 billion in funding for the period 2003-2006. The FP6 will initiate the launch of the European Research Area (ERA).

This means, i.a., a change from project thinking to "initiative thinking", with the aim of encouraging *breakthrough research*. Even though the EU programmes constitute around 5% of European countries' government research, the FP6 is to be used now in order to realize the ERA, and by doing so promote synergy through strengthened collaboration and coordination of the other 95%.

In FP5 it was the IST programme that received highest participation from small and medium-sized enterprises (SMEs). It is hoped that this will be carried on and reinforced in the FP6, but the changeover to new instruments requires organizational adaptations at both national and European levels so that SMEs will find taking part in the programme attractive.

Norwegian participation in the IST programme under the FP5 currently represents around 1.3% of the total funding granted, i.e. slightly below Norway's budget contribution of 1.84% of the project funds. There are Norwegian partners in around 140 of the more than 2,000 projects which have been initiated. Universities and institutions with the highest granted participation include SINTEF [The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology] (37), Telenor R&D (19), NTNU (10), the Norwegian Computing Center (8), UiO (6) and Statistics Norway (5). A handful of Norwegian enterprises were involved in at least three projects, including these three SMEs: Cognit, EPM Technology and SensoNor.

If we are to succeed in increasing Norwegian participation, we need to boost guidance to and provide stimulation for participating enterprises, which is the intention behind current efficiency drive for the RCN's instruments.

IST research visions in the EU

Through the vision of *"ambient intelligence"*, the needs and situation of the individual will be placed at the centre of the EU's IST research. Focus will be on three key areas:

- Miniaturization by means of microelectronics and microsystems
- Software technology, communication technology and infrastructure
- Knowledge-based technology and natural/intuitive user interfaces.

…and on three key areas of application:

- Security and trust
- Challenges within society and industry
- Tools and applications for advanced problem-solving for scientific and industrial activities.

These are significant points of departure for Norwegian ICT research as well. Indeed, in some areas, the EU's prioritizations can be said to be following several years of Nordic efforts, for example, networks, communication, eHealth etc. In other areas, the EU clearly has global ambitions, where it is natural for Norway to find its own suitable niches, e.g. within microelectronics, which the EU regards a strong European industrial base for semi-conductor technology as strategically important for industry. Norway has no equivalent industrial basis, although it possesses an interesting basis within the more application-oriented aspects of micro and nanotechnologies.

In the IST Work Programme for 2003-2004, 23 strategic priorities are listed, which naturally form a background for our challenges (cf. 3) and a basis for Norwegian priorities in this strategy (cf. 4). (www.cordis.lu/ist/fp6/fp6.htm).

3. National challenges for ICT research

The most significant challenges to research are linked to the following themes:

a) User-friendliness

Since ICT systems are becoming progressively more inclusively significant, the quality of software and good user interfaces (adapted for both users and user surroundings) is becoming ever more important in society and industry at large. The increasing complexity of ICT systems involves systems developed on a grand scale and the sorting and retrieval of vast quantities of information, preferably with a low response time, will be a key issue here. Options for exploiting language in the interaction with systems constitute yet another clear trend. Language technology and its infrastructure are regarded as being particularly important.

b) Security and trust

The increasing dependability on ICT systems is posing more stringent demands on their reliability, and users must have confidence in security solutions. Technologies, such as biometry and advanced cryptation techniques, will play a central part in identification and authentication. Secure and user-friendly electronic signatures are necessary for both increasing the volume and boosting confidence in electronic transactions. These solutions must be standardized and readily available if they are to be used. Norwegian investment in identification and security within computer communication (PKI) is a good example of this.

c) Mobility

Increasing emphasis on mobile communications and location and time-dependant access to the "Net" creates great challenges in creating seamless transfers between the different terrestrial and mobile networks. There will be increasing demands placed on the transfer capacity and assorted infrastructures. With ever increasing numbers of wireless terminals, we will also need better deployment of the frequency resources (i.e. increased capacity) in order to be able to provide and realize new mobile services and applications.

d) Intelligent surroundings and products

The miniaturization of equipment and components has been a decisive factor in ICT development. New borders are going to be razed continuously, partly through the research in nanotechnologies. Faced by increasingly complex microsystems and new communication technology, we will actually discover ourselves being more and more part of our

"intelligent surroundings" and surrounded by "thinking objects". This will be a strong and growing field in the ICT industry, and in which Norway can take an active part in forthcoming innovations and be instrumental in creating value within niche areas, in particular those linked to the national investment in microtechnology at SINTEF, UiO and the NTNU.

e) The area of multimedia and content represents a special challenge. As a research field, this really overlaps with automatic data processing and socio-scientific and humanistic subjects such as various media and aesthetic subjects, linguistics, pedagogies and psychology. New services and solutions are called for here, which will, in turn, require new methods for the production, distribution and management of content (read more in the Government's Strategy for electronic content www.enorway.org). The realization of ICT systems (distributed, web-based, multimedia etc.) which really challenge software and communication technologies will also be a key issue. This certainly creates a wide range of tasks within both basic and applied research (i.a. within the strategic priority "semantic knowledge-based systems" – cf. below).

4. Objectives and actions

The primary objectives for Norwegian national investment in R&D within ICT are to:

- cultivate conditions to promote the ***exploitation*** of ICT in order to encourage innovation and value creation
- lay the foundations to ensure that the ***Norwegian ICT industry*** is internationally competitive.

Being both proficient and knowledgeable within a broad range of technologies within the three *core areas,* and focusing research on key areas of application, as well as problems, is imperative.

There is a need within these core areas for regularly updating thematic priorities. One should give particular priority to areas with potential for value creation and innovation, stable Norwegian e-incubuses, as well as areas with great potential in terms of deployment within industry and society at large or potential for cultural value. This could, for example, be within the area of microtechnology in combination with new communication technology (mobility), or within ICT security. Another important area is multimedia and electronic content, where convergence and inter-disciplinary overlapping between the media will engender calls for new services and solutions.

A primary objective here is ensuring both increased capacity and raised levels of quality within national ICT expertise. This indicates a need for basic ICT research to be significantly underpinned annually over a longer period of time.

Both the ICT research environments and ICT industry have a central part to play in achieving the objective of getting Norwegian research up to the OECD average (currently 2.2%) of achieving the research's portion of the GDP. In 2001, this portion amounted to 1.62% (down from 1.65% in 1999), which was the lowest in the Nordic countries. The challenge is emphasized further by the EU having set even more ambitious goals (3% by 2010) to develop the ERA area into the world's foremost knowledge-based economy. This involves underpinning of all central aids within Norwegian *ICT research* – both government investment in the knowledge base and spurring on an already R&D-intensive industry to reaching new heights.

The new tax incentive scheme is of great importance to the ICT industry, confirmed by the onslaught of applications received in 2002. However, if this is to result in an increase in more long-term research in industry, it is of paramount importance that industries are able to reap proper benefit from other aids within industry-oriented R&D.

In order to contribute to this, the Norwegian Ministry of Trade and Industry is prioritizing a reinforced allocation of resources to *user-controlled, applied ICT research.*

The Ministry of Trade and Industry will furthermore give priority to the following of the 23 strategic priorities listed in the EU's IST Work Programme for 2003-2004 (The sequence here is *not a reference to priority, but merely reflects the position in the process from technology through to applications. The references to 3 a-e are linked to the challenges contained in point 3)*:

- **Microsystems and nanosystems** *(3 d)*
- **Broadband** *(3 a, b, d)*
- **Security and confidence** *(3 b)*
- **Mobile applications and services** *(3 c)*
- **Semantic, knowledge-based systems** *(3 a, e)*
- **IT in business and the public sector** *(3a,e)*
- **eHealth** *(3 a, e)*

Preliminary work to ensure strong Norwegian participation in the FP6 is important, both because the new instruments can present a particular challenge for minor players, and because experience from previous IST programmes has shown that Norway has a higher rate of success early on in the programme period.

The Government will take the initiative to host a European ICT conference in Norway by 2005, on a specific theme, e.g. *e*Health, which will be more closely defined in cooperation with the European Commission.

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