# EUROPEAN ICT R&D LANDSCAPE

## Report on National Priorities and Programmes

Information Society Technologies

CISTRANA

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# Executive Summary

One of the objectives of CISTRANA is to sketch the European ICT R&D landscape. This report will identify Member and Associated States' national R&D policies, priorities and programmes in the field of ICT, in order to fill the acknowledged information gap. The challenges of this effort stem from the evident fragmentation of the European landscape, comprising of a wide variety of national landscapes, as public research in Europe is currently mainly conducted at the national level.

Our study indicates that there seems to be a strong consensus across the studied countries of the importance of ICT as a R&D policy priority. Further, the analysis identifies the following ICT sub-themes as the most common policy level priorities, thus providing fertile ground for cooperation: telecommunications, micro- and nanotechnology, software technologies, optoelectronics, eGovernment, eHealth, eBusiness and eCommerce, e-Education and eLearning, as well as Security and Safety.

Major variation exists in how different countries operationalize the importance of ICT. Moreover, the approach each country takes to using their palette of different instruments to support R&D is inextricably linked with their 'national reality' and specifically to the identified needs of the countries' industrial base.

Our analysis also looks at the landscape of national ICT R&D programmes, the main operational instruments. On this level, a number of mega-clusters, such as micro-nano, communications, and software can be identified, where large amounts of national funding are directed. Germany, Finland, France, Spain, and the Netherlands are the countries where major flows of R&D funding are channelled through programme-based instruments of defined scope. Until now, the cooperation between national ICT programmes has rarely taken a concrete form through joint calls. Most cooperation currently takes place at the project level through EUREKA.

In addition to programmes, other national mechanisms to support ICT R&D are identified in this study. These mechanisms include: enabling networking, equipment and the establishment of new infrastructures, general research and development funding, incubation services, venture capital and other schemes. In addition to programme level cooperation, these support schemes can also provide future opportunities for cooperation.

Based on the findings of this study it is evident that common European ICT R&D policy priorities exist. This creates a solid basis for future cooperation activities, and current CISTRANA activities are already taking the next steps in this direction.

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# 1. Introduction

One of the objectives of CISTRANA is to sketch the European ICT R&D landscape. This report will identify Member and Associated States' national R&D policies, priorities and programmes in the field of ICT, in order to fill the acknowledged information gap. The challenges of this effort stem from the evident fragmentation of the European landscape, comprising of a wide variety of national landscapes, as public research in Europe is currently mainly conducted at the national level.

It is evident that the various national actors and procedures in many countries have recently undergone something of a transformation. France has set up the new National Research Agency (ANR), the Swedish and Norwegian R&D systems have undergone some significant changes, Austria has created a new research promotion agency (FFG) with merger of four previously separate agencies, Romania has established a national funding agency, while Hungary has undergone a major reform process (including the establishment of new governmental bodies – such as the National Office for Research and Technology NKTH) - to name but a few. Such changes do not however suggest that any sort of harmonisation process in relation to national procedures is underway, or that these changes were intended to facilitate the rise of multi-national research programmes. Many of the actual possibilities to collaborate are firmly linked to general national policy and to national R&D funding structures in particular, while the aim of CISTRANA is to identify the ICT specific implications thereof.

In addition, a further aim of CISTRANA is to identify topics for collaboration within the field of information and communications technology. As a hypothesis, collecting data on ongoing national R&D funding initiatives enables us to identify common priorities as well as the possible common interest base from which to begin negotiations on multi-national collaboration, within the context of variable geometry and based on voluntary participation.

# 2. Data and methodology

In order to cater for the systematic collection of basic data in a common format and structure, the following survey questionnaires were designed by Tekes as the task leader, in close collaboration with the Consortium.

1) Questionnaire on the national policies related to R&D in the field of information and communications technology (ICT), including the main actors responsible for forming the national strategies and policies
2) Questionnaire on the national R&D programme procedures in the field of ICT
3) Questionnaire on the national R&D programmes in the field of ICT
4) Questionnaire on other than programme-based activities to support R&D in the field of ICT
5) Questionnaire on the national R&D databases in the field of ICT

The questionnaires were pre-tested with programme managers in the CISTRANA Consortium organisations. Four members of the Consortium were responsible for the information collection (Country Group Responsible organisations, CGR). Each CGR was assigned with information collection duties for a pre-defined country group. In addition, the national authorities of each country identified National Support Organisations (NSO), which had been communicated to the Consortium by the responsible Steering Committee member, in order to ensure the high quality and reliability of the information received.

The questionnaires and information collection were planned in the last quarter of 2004, while the CGRs began the first phase of the information collection by contacting the National Support Organisations during the winter of 2004-2005. The questionnaires returned by the end of March 2005 built up the primary data which was analysed in the interim report (September 2005). The second phase of the information collection task was conducted following the interim report, and comprised of a validation and information up-date process.

The interim report was first internally reviewed by the members of the CISTRANA Consortium, after which systematic feedback was invited from the Steering Committee responsible for the accuracy of the country-specific information provided, in order to allow systematic validation and to ensure the reliability of the analysis.

As it is likely that the national systems will evolve over time, further up-dates will be integrated into the IST Research Portal[1], which is set up as part of the CISTRANA project.

The conclusive remarks in this report also draw on the contributions made in a series of workshops[2], organised by CISTRANA during the period November 2005 – March 2006. The workshops focused on the following themes:

1. National policy priorities and RTD programmes in the field of ICT
2. Programme impact assessment in national IST initiatives
3. Best practice in multi-national programme collaboration
4. Portals for information dissemination and taxonomies for classification
5. Design of national IST programmes in the context of ERA coordination

[1] http://www.portal.cistrana.org/
[2] For further information, see http://www.cistrana.org/

## 2.1. Analytical framework

This report aims to describe the complex phenomena referred to as *the European ICT R&D landscape* from a top-down perspective.

The first part of the report refers to a number of statistical sources, laying the grounds for an understanding of the variety of contexts where national policies and R&D programmes operate. First, a general picture of the trends in research and development expenditure is drawn, after which the ICT industries as part of the business enterprise sector are looked at. Following on from this, the development of the ICT market as a prominent driver of growth is presented. The statistical overview concludes with a selection of information society indicators, giving perspective to the country-specific levels of 'ICT literacy'.

The top-down analysis commences with a synthetic presentation of the national policy organizations operating in the field of ICT R&D. Thereafter, the report moves into a discussion of European policy priorities by describing the IST (Information Society Technologies) programme priorities of the EU Framework Programme for RTD.

While the statistical review and the review of European policy priorities are based on external sources, the presentation of the national policy organizations and the following chapters are primarily grounded on the above-mentioned information collection conducted by CISTRANA.

The policy analysis proceeds with the identification of national ICT R&D policy priorities, listing strategic focus areas and exploring potential research areas for cooperation.

Regarding the national programme procedures, a synthesis of the phases identified in the sample of national programmes is presented.

The final part of the report deals with the targeted survey-based information on national R&D programmes in the field of ICT. Initially, the 20 largest individual programmes (by volume) are presented via a clustering approach. The R&D programme analysis proceeds by looking at the programme data from selected technology-oriented perspectives, derived from the policy analysis. Finally, an overview of other than programme-based support schemes is presented.

# 3. Statistical review

The background statistics referred to in this chapter are based on the most recent publicly available sources.

## 3.1. Trends in Research and Development expenditure

The Lisbon strategy set the target that by the year 2010 the EU should achieve a research intensity of at least 3% of GDP. Furthermore, the business sector should be responsible for 2/3 of the total R&D expenditure.

According to the most recent statistics[3], R&D expenditure as a percentage of GDP ('research intensity') in 2004 in the EU25 countries was 1.90% (the equivalent percentage being 1.92% in 2003).

Between 2001 and 2004 there was an average annual rise of 1.3% in R&D expenditure (EU25). In the US this percentage was -0.1%, and in Japan 1.8% between 2001 – 2003. However, judging by the research intensity, it was higher in the US (2.59% of GDP in 2003) and Japan (3.15% of GDP in 2003). According to Israeli data[4], the figure for Israel was as high as 4.8% in 2002.

In 2003, 54% of the total EU25 R&D expenditure was financed by the business sector, while in the US the business sector covered 63% and in Japan and Israel 75%.

As for the highest research intensity in the EU in 2004, Sweden (3.74% of GDP) and Finland (3.51%) occupied the top positions. The next most research intensive countries were Denmark (2.63%), Germany (2.49%), Austria (2.26%), and France (2.16%). The countries with the lowest research intensity were Malta (0.29%), Cyprus (0.37%), Latvia (0.42%), and Slovakia (0.53%).

The annual average R&D expenditure growth rates during the period 2001 to 2004 were highest in Estonia (16%), Cyprus (15%), Lithuania (12%), and Spain (10%, between 2001-2003), whereas R&D showed a declining trend in Portugal (-4%, between 2001 -2003), Belgium, Slovakia and Sweden (-2%).

In 2003, the largest shares of R&D expenditure, financed by the business sector, were found in Luxembourg (80%), Finland (70%), Germany (66%), Sweden (65%), Denmark (61%) and Belgium (60%).

[3] Eurostat news release 156/2005 – 6 December 2005
[4] http://www.cbs.gov.il/mop/mop_2004/mop04eng.htm

**Table 1: Research and Development expenditure (Source: Eurostat news release 156/2005 – 6 December 2005)**

**Research and Development expenditure**

| | R&D intensity, R&D expenditure as % of GDP | | | R&D expenditure[1] | | R&D expenditure financed by business sector, as % of total |
|---|---|---|---|---|---|---|
| | 2001 | 2003 | 2004 | 2004 (mio euro) | Annual average growth rate in real terms (%) 2001-2004 | 2003 |
| **EU25** | 1.93 | 1.92 | 1.90p | 195 042p | 1.3 | 54.3 |
| **Belgium** | 2.17 | 1.92 | 1.93p | 5 465p | -2.3 | 60.3 |
| **Czech Republic** | 1.22 | 1.26 | 1.28 | 1 100 | 4.5 | 51.5 |
| **Denmark** | 2.40 | 2.59 | 2.63p | 5 112p | 4.3 | 61.3 |
| **Germany** | 2.46 | 2.52 | 2.49p | 55 100p | 0.8 | 66.3 |
| **Estonia** | 0.73 | 0.82 | 0.91p | 83p | 15.6 | 33.0 |
| **Greece** | 0.64 | 0.62 | 0.58p | 967p | 1.1 | 30.7 |
| **Spain** | 0.92 | 1.05 | : | 8 213* | 10.2 | 48.4 |
| **France** | 2.20 | 2.18 | 2.16p | 35 648p | 0.9 | 50.8 |
| **Ireland** | 1.12 | 1.16 | 1.20 | 1 780 | 7.3 | 59.1 |
| **Italy** | 1.11 | 1.14 | : | 14 769* | 1.3 | : |
| **Cyprus** | 0.26 | 0.35 | 0.37p | 46p | 15.2 | 19.8 |
| **Latvia** | 0.41 | 0.38 | 0.42 | 47 | 8.6 | 33.2 |
| **Lithuania** | 0.68 | 0.68 | 0.76 | 137 | 12.2 | 16.7 |
| **Luxembourg** | : | 1.78 | : | 426* | 3.6 | 80.4 |
| **Hungary** | 0.95 | 0.95 | 0.89 | 721 | 1.5 | 30.7 |
| **Malta** | : | 0.27 | 0.29p | 12p | 1.4 | 18.6** |
| **Netherlands** | 1.81 | 1.76 | 1.77p | 8 657p | -0.1 | 50.9 |
| **Austria** | 2.04 | 2.19p | 2.26p | 5 346p | 5.1 | 43.9 |
| **Poland** | 0.64 | 0.56 | 0.58 | 1 139 | 0.4 | 30.3 |
| **Portugal** | 0.85 | 0.78 | : | 1 020* | -4.3 | 31.7 |
| **Slovenia** | 1.56 | 1.54p | 1.61p | 418p | 4.6 | 59.3 |
| **Slovakia** | 0.64 | 0.58 | 0.53 | 174 | -1.8 | 45.1 |
| **Finland** | 3.38 | 3.48 | 3.51 | 5 253 | 4.0 | 70.0 |
| **Sweden** | 4.27 | 3.98 | 3.74 | 10 426 | -2.1 | 65.0 |
| **United Kingdom** | 1.89 | 1.88 | : | 30 092* | 2.2 | 43.9 |
| **Bulgaria** | 0.47 | 0.50 | 0.51 | 99 | 8.2 | 26.8 |
| **Croatia** | : | 1.14 | : | 292* | 6.7 | 42.1 |
| **Romania** | 0.39 | 0.40 | 0.40 | 235 | : | 45.4 |
| **Turkey** | 0.72 | 0.66** | : | 1 280** | -1.0 | 41.3** |
| **Iceland** | 3.08 | 2.97 | 3.01 | 297 | 1.7 | 43.9 |
| **Norway** | 1.60 | 1.75 | : | 3411* | 5.2 | 49.2 |
| **China** | 1.07 | 1.31 | : | 16 444* | : | 60.1 |
| **Japan** | 3.07 | 3.15 | : | 119 748* | 1.8 | 74.5 |
| **United States** | 2.71 | 2.59p | : | 251 577p* | -0.1 | 63.1 |

: Data not available

p: estimated or provisional data

EU25: Eurostat estimate

Exceptions to the reference year: * 2003, ** 2002.

% annual average growth is for 2001-2004 except for Luxembourg: 2000-2003; Turkey: 2001-2002; Spain, Italy, Portugal, United Kingdom, Norway, Japan and USA: 2001-2003; Croatia: 2002-2003; Malta: 2002-2004.

Luxembourg: Data for the higher education sector correspond to 2001

Hungary: Including expenditure not allocated to R&D units

USA: Excludes most or all capital expenditure

China, USA and Japan: OECD data

1. Preliminary data.
2. R&D expenditure is expressed in million current euro while the annual average growth rates in real terms of R&D expenditure are calculated from expenditure expressed in million constant 1995 Purchasing Power Standard (PPS). PPS is an artificial currency that reflects differences in national price levels that are not taken into account by exchange rates. This unit allows meaningful volume comparisons of economic indicators over countries. Aggregates expressed in PPS are derived by dividing aggregates in current prices and national currency with the respective Purchasing Power Parity (PPP).

## 3.2. ICT industries as a part of the business enterprise sector

The EU Lisbon Strategy emphasises investment in research and development to generate new innovations. The ICT sector itself makes a central contribution to growth and jobs, while the application of ICT can support productivity and growth throughout the economy, leading to business innovations in all industrial and service sectors.

Investment in research and development is important for the ICT sector enabling it to continue to grow in the short and long term. To this end, ICT companies are investing about 10 % of sales in R&D[5]. However, as Figure 1 illustrates, investment levels in the ICT manufacturing and service sectors differ markedly across the EU Member States. Some countries, notably Ireland and Finland, are highly specialized in ICT. In these countries, the level of R&D investment in the ICT manufacturing and ICT services industries constitutes over 60 % of the total business enterprise sector's R&D expenditure.

In many EU Member States, the level of R&D investment by ICT companies is about 20 – 40 % of the total investment of the business sector, which shows lower specialization than in Korea, Canada, the USA and Japan. Differences in the relative importance of the ICT sector are to a great extent explained by the competitiveness of ICT companies, which reveals the need to increase R&D investments both in ICT manufacturing industries and in the service sector as well as in respect of ICT applications.

[5] OECD Key ICT indicators 2005, http:// www.oecd.org/sti/ICTindicators

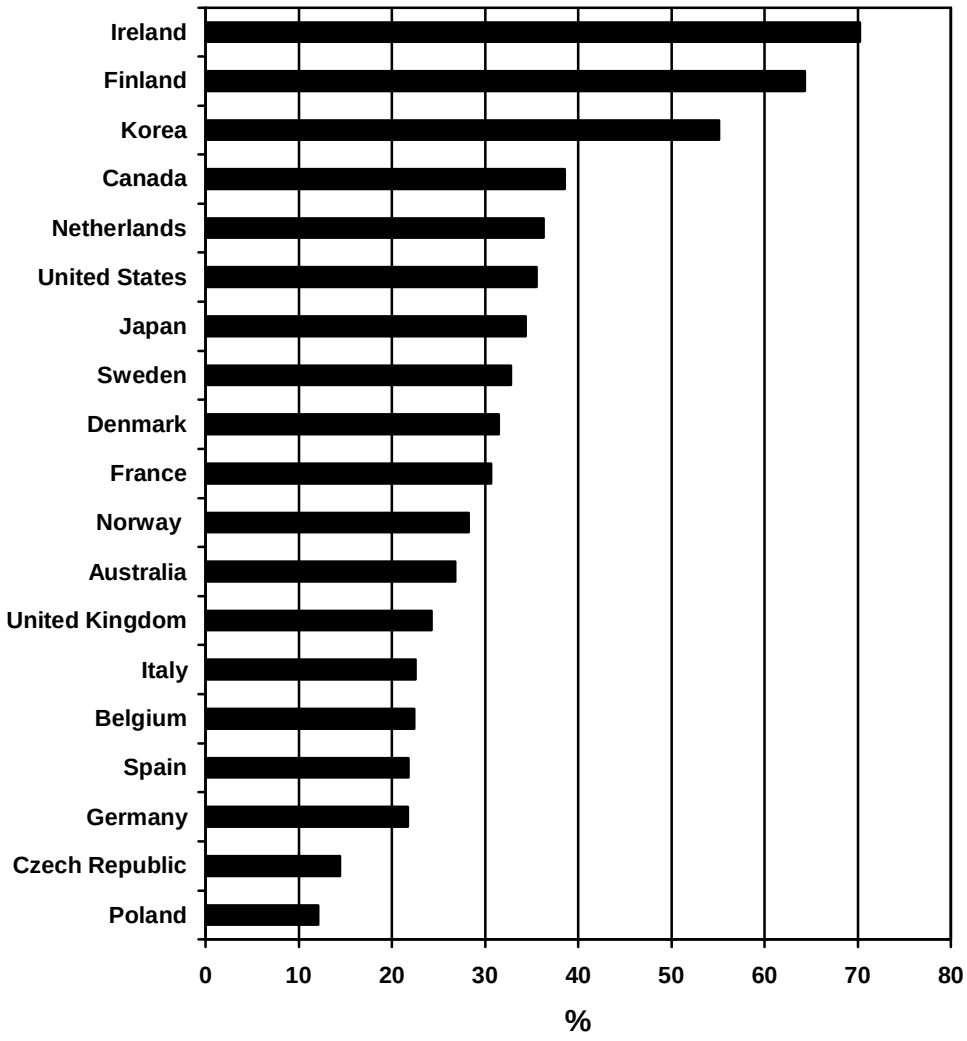


**Figure 1: R&D expenditure in ICT manufacturing and ICT services industries as a percentage of the business enterprise sector R&D expenditure (Source: OECD Key ICT indicators 2005, R&D expenditure in selected ICT industries, 2003 or latest year available)**

## 3.3. ICT market development

According to the European Information Technology Observatory (EITO)[6], the EU ICT market is expected to reach a growth of 3.2% in 2006. With an estimated share of 33.6%, Europe will have the largest ICT market worldwide in 2006. However, the fastest growth can be seen in the so-called “rest of the world”, especially in Asia, that is expected to lead with a 6.8% growth rate followed by the US (3.9%).

[6] http://www.eito.org, press release 23 February 2006.

The market for information technology (IT) in the EU will show a healthy growth of 4.4% in 2006. The market will benefit primarily from the relative strength of the IT services and software sectors. The computer hardware market, on the other hand, will show a more moderate growth of 2.8% in 2006. Telecommunications market will continue to grow less strongly than IT. The market is forecast to increase by 2.2%.

The EITO estimates that the strongest growth in the EU ICT market in 2006 can be observed again in the new EU member states. The growth rate for Slovakia is predicted to be as high as 7.6%. The 4.2% rate for the UK is the highest among the Western member states.

## 3.4. Information Society indicators

The figures provided by the information society indicators show us how the use of information and communications technology is spread across 33 countries. These indicators do not reflect national ICT policies directly, but they do illustrate how citizens and companies use ICT products and services as well as suggest the opportunities and weaknesses of ICT in each country.

Figure 2 shows that there is not much variation in the use of mobile phones across the 33 countries, apart from Luxembourg's high usage figure (there are more connections than people) and some of the countries that have a considerably lower level of mobile phone usage (Romania, Liechtenstein, Turkey, Bulgaria and Poland). Although, when comparing these figures e.g. with the USA and Japan, all 33 countries perform relatively well. In 2002 there were 49 mobile phone users per 100 persons in the USA and 64 per 100 persons in Japan.

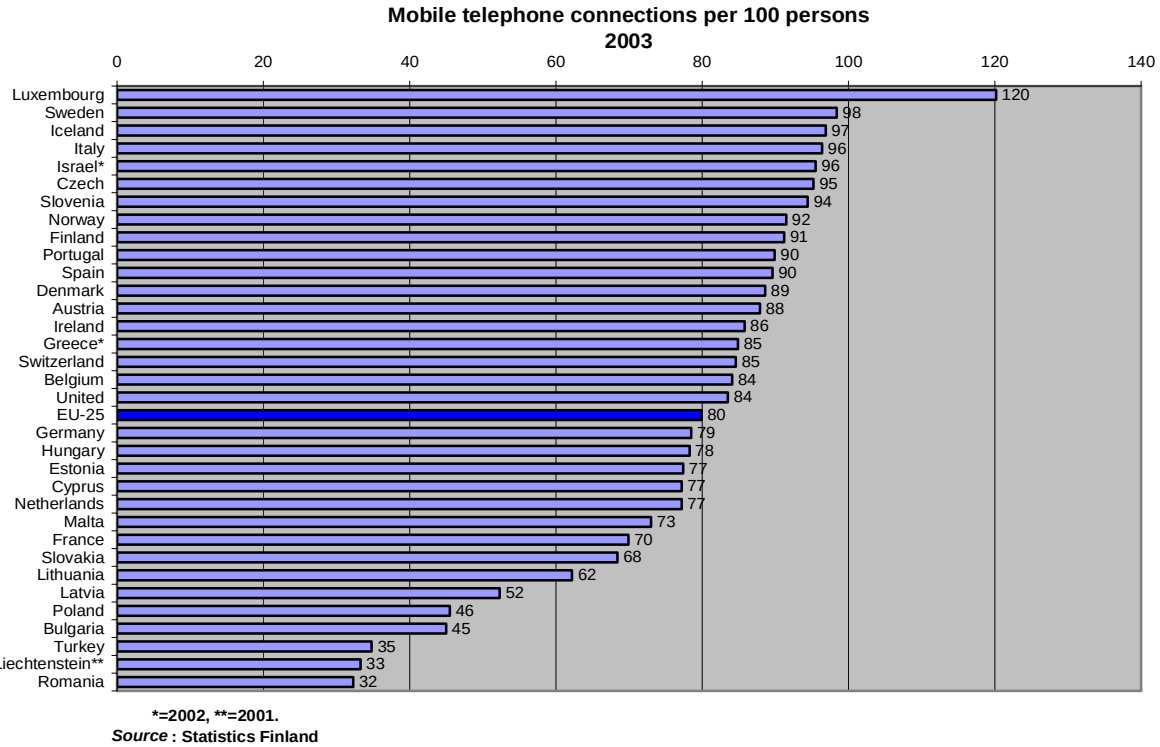


**Figure 2: The use of mobile telephones**

The use of personal computers shows significant differences across the 33 countries (see Figure 3). Basically, the quantity of personal computers indicates the citizen's ability to access information (via the internet or to gain access to information creation and processing). In this matter, Switzerland assumes the top position with Turkey, Romania and Greece the lowest positions.

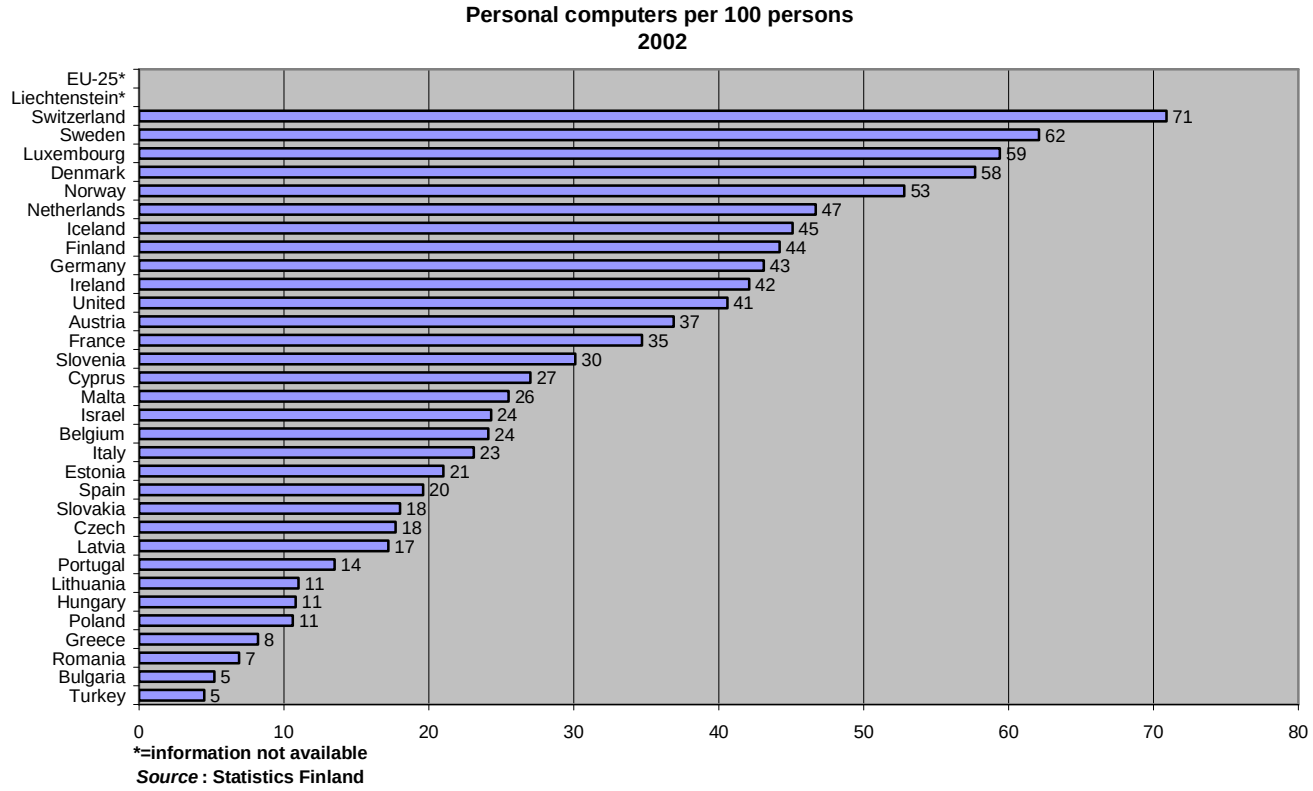


**Figure 3: The use of personal computers**

In the diffusion of broadband technology (see Figure 4), which indicates the citizen's ability to access fast internet connections, a group of countries can be identified that have considerably higher figures (over 13 lines/100 persons) in respect of broadband connections. These countries include Denmark, Iceland, the Netherlands, Switzerland and Belgium. Access to fast internet connections judged by this measure is most difficult in Greece, Turkey, Slovakia, and the Czech Republic.

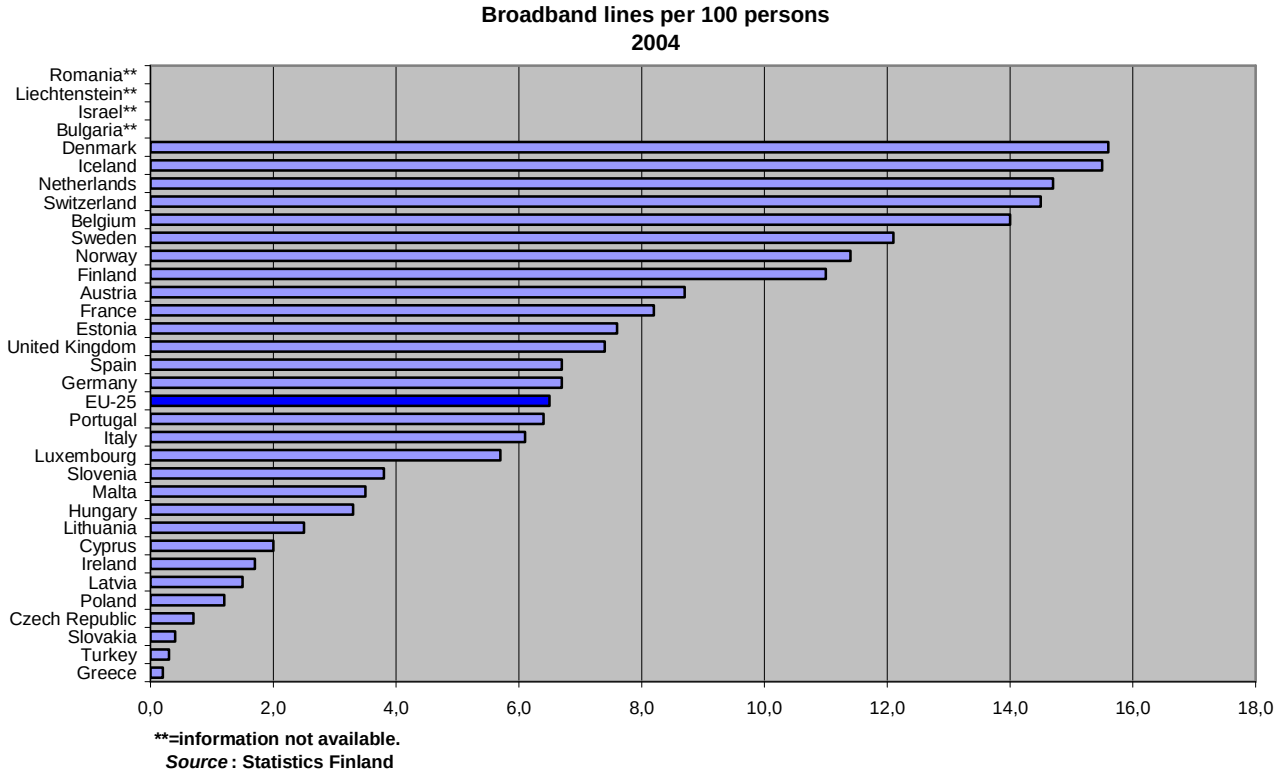


**Figure 4: The use of broadband connections**

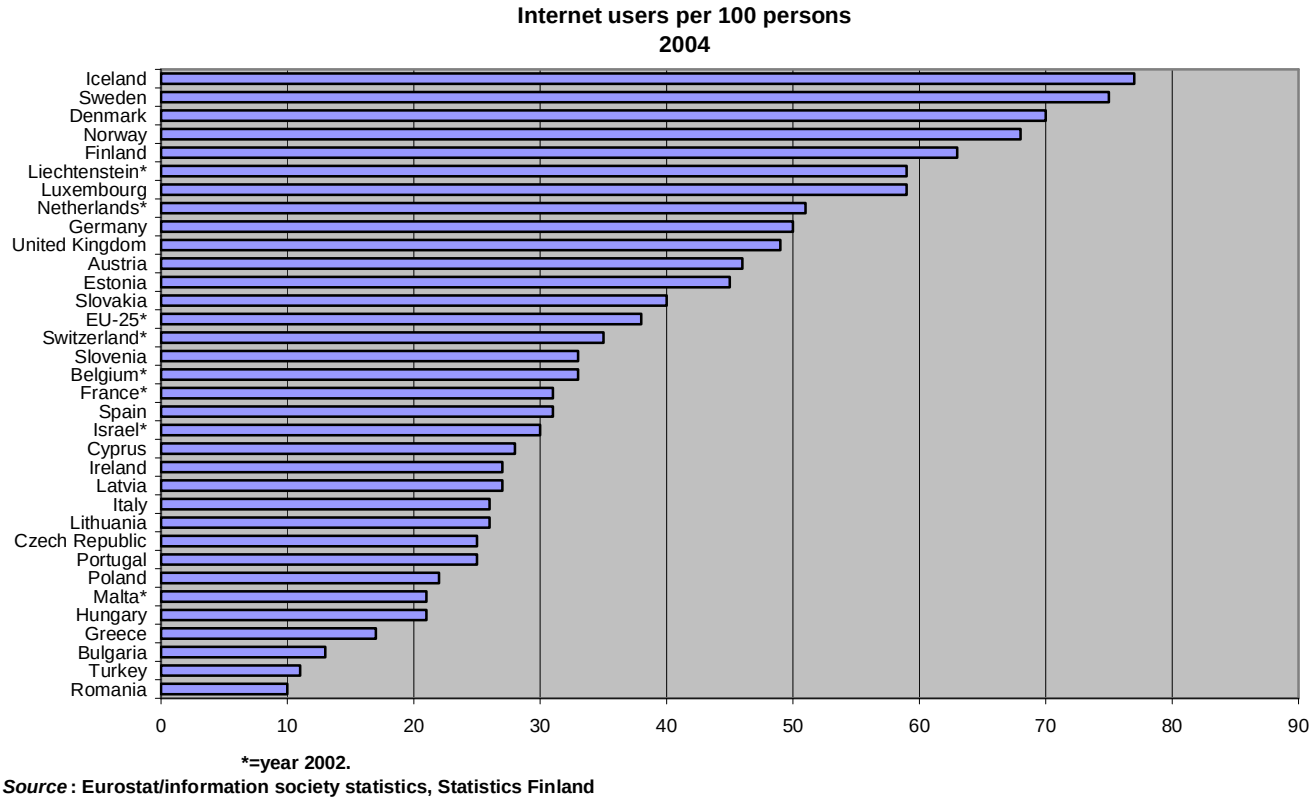


**Figure 5: Internet users**

Regular use of the internet is most common in Iceland, Liechtenstein, Sweden, Denmark, Finland, the Netherlands and Norway (see Figure 5). In those countries over 50 percent of citizens use the internet on a more or less on regular basis. The lowest numbers of internet users are in Turkey, Bulgaria and Romania.

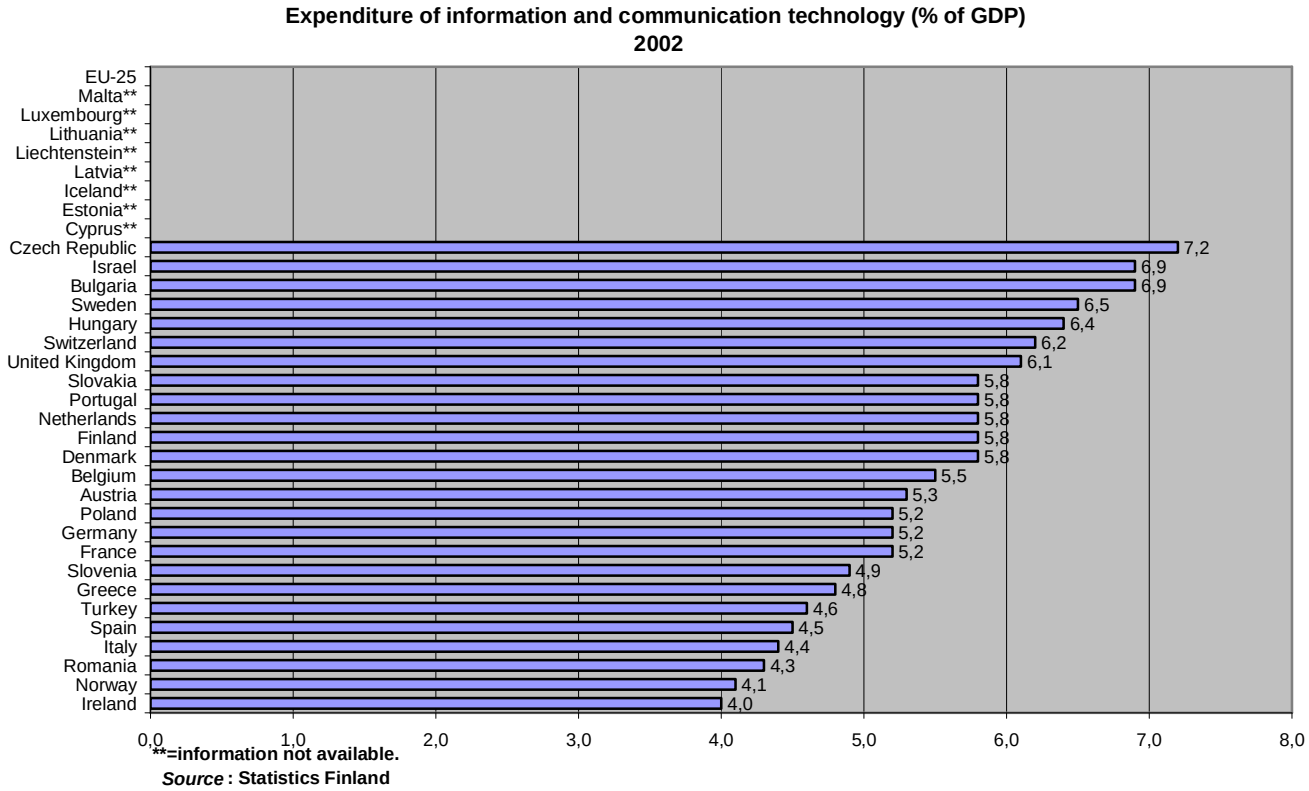


**Figure 6: Expenditure on ICT**

Expenditure on information and communications technology is quite evenly distributed across the countries examined (see Figure 6), although there is variation between both ends of the scale (the Czech Republic's expenditure 7.2 % and Ireland's 4.0 % of GDP). This indicator illustrates the enthusiasm shown by citizens' and companies' and their readiness to use ICT, though it could also indicate the high cost of ICT products and services.

The Global Information Technology Report[7] series of the World Economic Forum gathers information and monitors the progress of networked readiness in more than 100 countries, highlighting the policy, institutional, and structural obstacles that prevent countries from fully attaining the benefits of ICT. The Networked Readiness Index is constructed by subindex components of Environment, Readiness and Usage. The latest rankings (see Table 2) show, that among the countries examined in this report, Bulgaria and Poland score lowest. Nordic countries hold four of the top six positions in the rankings as they post among the highest ICT penetration rates. Finland, Denmark and Sweden follow Iceland in third, fourth and sixth place respectively.

[7] WEF Networked Readiness Rankings 2004. Global Information Technology Report 2004–2005. World Economic Forum. Available online: http://www.weforum.org/pdf/Global_Competitiveness_Reports/Reports/GITR_2004_2005/Networked_Readiness_Index_Rankings.pdf

**Table 2: WEF networked readiness rankings 2004**

**The Networked Readiness Index Rankings 2004**

| NRI RANK | COUNTRY | SCORE |
|---|---|---|
| 1 | Singapore | 1.73 |
| 2 | Iceland | 1.66 |
| 3 | Finland | 1.62 |
| 4 | Denmark | 1.60 |
| 5 | United States | 1.58 |
| 6 | Sweden | 1.53 |
| 7 | Hong Kong | 1.39 |
| 8 | Japan | 1.35 |
| 9 | Switzerland | 1.30 |
| 10 | Canada | 1.27 |
| 11 | Australia | 1.23 |
| 12 | United Kingdom | 1.21 |
| 13 | Norway | 1.19 |
| 14 | Germany | 1.16 |
| 15 | Taiwan | 1.12 |
| 16 | Netherlands | 1.08 |
| 17 | Luxembourg | 1.04 |
| 18 | Israel | 1.02 |
| 19 | Austria | 1.01 |
| 20 | France | 0.96 |
| 21 | New Zealand | 0.95 |
| 22 | Ireland | 0.89 |
| 23 | United Arab Emirates | 0.84 |
| 24 | Korea | 0.81 |
| 25 | Estonia | 0.80 |
| 26 | Belgium | 0.74 |
| 27 | Malaysia | 0.69 |
| 28 | Malta | 0.50 |
| 29 | Spain | 0.43 |
| 30 | Portugal | 0.39 |
| 31 | Tunisia | 0.39 |
| 32 | Slovenia | 0.37 |
| 33 | Bahrain | 0.37 |
| 34 | South Africa | 0.33 |
| 35 | Chile | 0.29 |
| 36 | Thailand | 0.27 |
| 37 | Cyprus | 0.25 |
| 38 | Hungary | 0.24 |
| 39 | India | 0.23 |
| 40 | Czech Republic | 0.21 |
| 41 | China | 0.17 |
| 42 | Greece | 0.17 |
| 43 | Lithuania | 0.13 |
| 44 | Jordan | 0.10 |
| 45 | Italy | 0.10 |
| 46 | Brazil | 0.08 |
| 47 | Mauritius | 0.08 |
| 48 | Slovak Republic | 0.03 |
| 49 | Jamaica | −0.03 |
| 50 | Botswana | −0.10 |
| 51 | Indonesia | −0.13 |
| 52 | Turkey | −0.14 |

| NRI RANK | COUNTRY | SCORE |
|---|---|---|
| 53 | Romania | −0.15 |
| 54 | Morocco | −0.17 |
| 55 | Namibia | −0.21 |
| 56 | Latvia | −0.23 |
| 57 | Egypt | −0.24 |
| 58 | Croatia | −0.25 |
| 59 | Trinidad and Tobago | −0.28 |
| 60 | Mexico | −0.28 |
| 61 | Costa Rica | −0.29 |
| 62 | Russian Federation | −0.36 |
| 63 | Pakistan | −0.38 |
| 64 | Uruguay | −0.39 |
| 65 | Ghana | −0.41 |
| 66 | Colombia | −0.42 |
| 67 | Philippines | −0.43 |
| 68 | Vietnam | −0.46 |
| 69 | Panama | −0.47 |
| 70 | El Salvador | −0.49 |
| 71 | Sri Lanka | −0.49 |
| 72 | Poland | −0.50 |
| 73 | Bulgaria | −0.51 |
| 74 | Gambia | −0.52 |
| 75 | Kenya | −0.62 |
| 76 | Argentina | −0.62 |
| 77 | Uganda | −0.63 |
| 78 | Dominican Republic | −0.65 |
| 79 | Serbia and Montenegro | −0.65 |
| 80 | Algeria | −0.66 |
| 81 | Zambia | −0.68 |
| 82 | Ukraine | −0.68 |
| 83 | Tanzania | −0.71 |
| 84 | Venezuela | −0.72 |
| 85 | Macedonia | −0.73 |
| 86 | Nigeria | −0.73 |
| 87 | Madagascar | −0.77 |
| 88 | Guatemala | −0.78 |
| 89 | Bosnia and Herzegovina | −0.86 |
| 90 | Peru | −0.91 |
| 91 | Georgia | −0.94 |
| 92 | Mali | −0.96 |
| 93 | Malawi | −0.98 |
| 94 | Zimbabwe | −1.02 |
| 95 | Ecuador | −1.08 |
| 96 | Mozambique | −1.11 |
| 97 | Honduras | −1.19 |
| 98 | Paraguay | −1.20 |
| 99 | Bolivia | −1.25 |
| 100 | Bangladesh | −1.30 |
| 101 | Angola | −1.36 |
| 102 | Ethiopia | −1.52 |
| 103 | Nicaragua | −1.61 |
| 104 | Chad | −1.69 |

The European Commission's benchmarking report on the online availability of public services[8] measures the percentage of online sophistication (extent to which it is possible to provide the service electronically) of basic public services available on the internet and also the percentage of public services fully available online in the 25 EU member states, plus Iceland, Norway and Switzerland.

[8] *Online availability of Public Services: How is Europe Progressing?* Web Based Survey on Electronic Public Services. Report of the 5th measurement October 2004. Capgemini. European Commission. http://europa.eu.int/information_society/eeurope/2005/doc/all_about/online_availability_public_services_5th_measurement_fv4.PDF

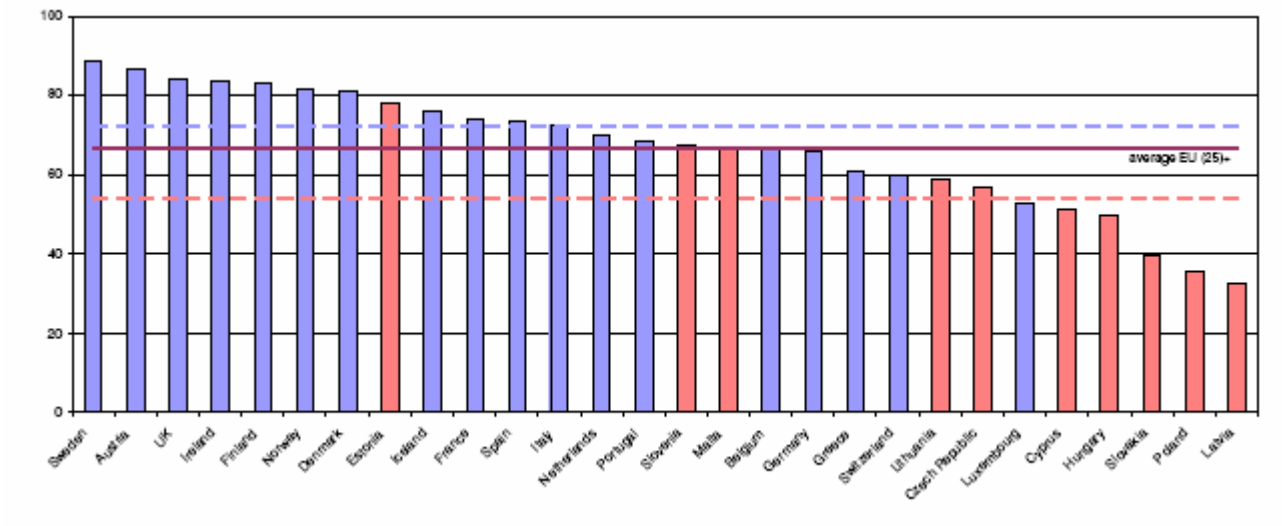


**Figure 7: Online sophistication of public services**

The country rankings show that the online sophistication of public services is most advanced in Sweden (89%). 7 countries reach a score higher than 80% (Sweden, Austria, the U.K., Ireland, Finland, Norway and Denmark). Only 4 countries score less than 50% and none of them belong to the EU 15 countries.

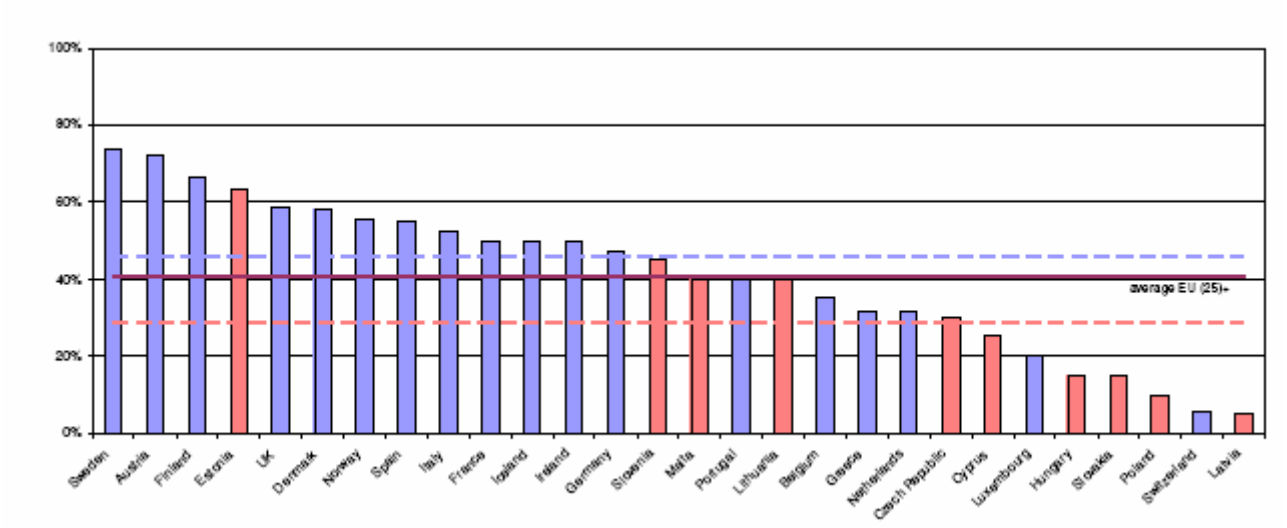


**Figure 8: Full availability online**

In terms of the percentage of services that offer complete electronic case handling the 3 best performing countries are not the same as those for the online sophistication indicator. The highest scores here are to be found in Sweden (74%) and Austria (72%), whilst in Finland, 67% of the services offer full electronic case handling. As for the 10 new EU member states, Estonia is among the leading group, three are aligned with the average while the remainder are lagging behind.

The following is a summary classification of average IST performance across 33 countries. Average performance is calculated on the basis of each country's rank in each of the indicators shown above (except expenditure on ICT). In this procedure, if a country is ranked in the top group of the three-part classification it will score three points, if it is ranked in the middle group it will score two points and if it's ranked in the lowest group it will score just one point. All points are then summed up, after which it is possible to calculate the average IST performance of each country. For example, those countries in the top group of the three-part classification in every indicator will have an average of

three while the countries in the lowest group in every indicator will have an average of one. Again the three-part classification is a useful device helping us to divide the countries into well-performing, medium-performing and low-performing countries. Boundaries in this classification are determined by identifying the gaps in the dispersion of average figures, which gave a more meaningful picture for this classification than just an evenly distributed trichotomy.

**Table 3: Average IST performance of countries**

| **Well-performing countries*** | **Medium-performing countries**** | **Low-performing countries***** |
|---|---|---|
| Austria | Belgium | Bulgaria |
| Denmark | France | Cyprus |
| Estonia | Italy | Czech Republic |
| Finland | Ireland | Greece |
| Germany | Liechtenstein | Hungary |
| Iceland | Luxembourg | Latvia |
| Israel | Portugal | Lithuania |
| Netherlands | Spain | Malta |
| Norway | Switzerland | Poland |
| Slovenia | | Romania |
| Sweden | | Slovakia |
| United Kingdom | | Turkey |

*=average is 3.00 – 2.25
**=average is 2.14 – 1.86
***=average is 1.57 – 1.00

It is noticeable that all of the Nordic countries are among the top 10 countries in every respect (except Denmark in the use of mobile telephones). This indicates that information society performance is very high in the Nordic countries both in infrastructure and in usage terms. The lowest performing countries (countries that score the lowest points in every measure) are Bulgaria, Latvia, Romania, Slovakia and Turkey.

# 4. Policy Organizations in the Field of ICT

The organizations responsible for the national ICT strategies and policies in 30 countries are presented in the table 4 below. These organisations were obtained from the survey responses and in some of the cases from the documents and websites of the respective country where no response on the survey was given.

It is possible to distinguish between different kinds of organizations in the strategic coordination, policy formulation and research funding of ICT.

***Science Council*** is a typical governmental advisory body responsible for dealing with strategic issues related to science and technology matters. Councils are often chaired by the prime minister or operate under the direction of the prime minister. Other members are usually ministers, academics and corporate representatives.

***Ministry level*** consists of different ministries or governmental organs that have some kind of coordination and policy making responsibility in the field of R&D or ICT policy.

***Financing and Implementation agency*** usually provides funding for more applied research or acts as an executive organization for government strategic outlines and programmes. These agencies normally support industry–research collaboration

***Basic research funding organization*** provides funding for more basic research and serves as an expert organization in science and scientific research.

**Table 4: Organizations responsible for ICT policy**

| Country | Science Councils | Ministry level | Financing and implementation agencies | Basic research funding org. | Others |
|---|---|---|---|---|---|
| Austria | The Austrian council for Research and Technology Development | 1. Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT)<br>2. Federal Ministry for economic affairs and labour<br>3. Federal Ministry for science and culture | The Austrian industrial research Promotion Fund (FFF) | The Austrian Science Fund (FWF) | |
| Belgium | The Federal Council of Science Policy (FCSP) | The Federal Office for Scientific, Technical and Cultural Affairs; Ministry of Flanders Science and Innovation Administration (AWI)(Flemish Region); Directorate-General of Technology, Research and Energy (DGTRE)(Walloon Region;<br>the Brussels-Capital Region Ministry (Brussels Region) | Institute for the Promotion of Innovation by Science and Technology (IWT)(Flemish Region); Directorate-General of Technology, Research and Energy (DGTRE) (Walloon Region);<br>the Brussels Enterprise Agency (Brussels Region) | Fund for Scientific Research | The Inter-ministerial Commission for Federal Science Policy (ICSP) |
| Bulgaria | | The Ministry of Education and Science | the State Agency for Information Technologies and Communications (from October 2005)<br><br>ICT Development Agency (existed until October 2005)<br><br>The National Science Fund | | |
| Cyprus | | | Planning Bureu | | Research Promotion Foundation |
| Czech Republic | Research and Development Council of the Czech Republic | Ministry of Education, Youth & Sport, Ministry of Informatics, Ministry of Industry & Trade, | Grant Agency of the Czech Rep. | Academy of Sciences of the Czech Rep. | |

| | | | | | |
|---|---|---|---|---|---|
| | | Ministry of Transport, Ministry of Health | | | |
| Denmark | The Danish Council for Strategic Research | Ministry of Science, Technology and Innovation | | | |
| Estonia | Research and Development Council (TAN) | The Ministry of Education and Research, The Ministry of Economic Affairs | | Estonian Academy of Sciences | |
| Finland | The Science and Technology Policy Council of Finland, The Information Society Council | The Ministry of Trade and Industry, The Ministry of Transport and Communications, The Ministry of Education | Tekes, the Finnish Funding Agency for Technology and Innovation, The Finnish Nat. Fund for R&D (Sitra) | The Academy of Finland | |
| France | | Ministry of Research, Ministry of Industry | National Research Agency (ANR) | | |
| Germany | | The Federal Ministry of Education and Research (BMBF), The Federal Ministry of Economics and Labour (BMWA), The Federal Ministry of The Interior (BMI) | | | |
| Greece | | General Secretariat for Research and Technology of The Ministry of Development | | | Managing Authorities of the Programmes of Information Society and Competitiveness |
| Hungary | The Science and Technology Policy Board (TTPK), The Research and Technology Innovation Council (KTIT) | The National Office for Research and Technology (NKTH) under the supervision of the Ministry of Education and the Ministry of Economy and Transport. NKTH reports directly to the government. | The Agency for Research Fund Management and Research Exploitation (KPI) | The Hungarian Academy of Sciences (HAS), National Scientific Research Fund Programme (OTKA) | |
| Iceland | The Science and Technology Policy Council | | The Technical Development Fund | The Research Fund | |
| Ireland | | | Enterprise Ireland | The Science Foundation Ireland (SF) | |
| Israel | | The Ministry of Industry, Trade & Labour, The Ministry of Science & Technology | | The Israel Science Foundation (ISF) | |
| Italy | | Ministry of Innovation & Technology | | The Italian National Research Council (CNR) | Committee of Ministers for the Information Society |
| Latvia | The Latvian Council of Science | The Ministry of Education and Science | | The Latvian Academy of Sciences | |
| Malta | Malta Council for Science & Technology (MCST) | Ministry for Information Technology and Investment | | | |
| Netherlands | | The Ministry of Economic Affairs, The Ministry of Education, Culture and Science | SenterNovem | | |
| Norway | The Research Council of Norway | The Ministry of Trade and Industry, The Ministry of Education and Research, The Ministry of Transport and Communications, The Ministry of Modernisation | | | |
| Poland | | The Ministry of Science and Higher Education | | | The Telecommunications and Post Regulatory Authority (URTip) |
| Portugal | | | | | The Innovation and Knowledge Society Mission Unit (UMIC) |
| Romania | | The Ministry of Communications and Information Society | | | |
| Slovakia | | The Ministry of Education, The Ministry of Transport, Post and Telecommunication | Agency for Support of Science and Technology in Slovak, Department RTD of the Section for Higher Education, Agency KEGA | The Slovak Academy of Science, Agency VEGA | |
| Slovenia | Science and Technology Council | The Ministry of Higher Education, Science and Technology | Slovenian Research Agency | | |
| Spain | | The Ministry of Education and Science (MEC), The Ministry of Industry, Tourism and Trade (MITYC), The Ministry of Health and Consumers | | | Interministerial Commission for Science and Technology |
| Sweden | The Swedish Research Council | | Swedish | The Swedish | The Invest in |

| | | | | | |
|---|---|---|---|---|---|
| | | | Governmental Agency for Innovation Systems (VINNOVA) | Foundation for Strategic Research (SSF) and The Knowledge Foundation (KK) | Sweden Agency and The Swedish Trade Council |
| Switzerland | Swiss Science and Technology Council (SWTR) | State Secretariat for Education and Research, Federal Office for Professional Education and Technology | The Commission for Technology and Innovation (CTI) | The Swiss National Science Foundation (SNF) | |
| Turkey | | | TUBITAK | | |
| UK | | The Department of Trade and Industry (DTI), The Ministry of Defence, The Department of Health, The Department for Transport, The Department for Education and Skills, The Department for Culture, Media and Sport | Office of Science and Technology (OST), Engineering and Physical Sciences Research Council (EPSRC) | | |

In most cases ICT policies are formulated in ministries that are responsible for education and science affairs though other ministries are also widely identified as ICT policy makers, especially the Ministries of Trade and Industry and the Ministries of Transport and Communications. It is however particularly interesting to note here that ***Romania*** and ***Malta*** have both established specific ICT-related ministries.

The reason why such a wide range of ministries are involved in the policy process is that different ministries have their own sector specific goals. For example, ministries responsible for health care policy coordinate and finance eHealth projects while ministries responsible for tourism affairs supervise the projects that support the use of ICT in the tourism business.

In many cases, science councils have been identified as key ICT policymakers although it seems that these councils do not monitor closely or participate in the implementation process of strategic issues, as those duties are generally seen as the responsibility of the ministries involved or of the financing and implementation organizations.

In almost every case R&D funding organizations are identified as policymakers even though their official role is to be purely implementation organizations. This perception can best be explained by the fact that these organizations are quite independent and therefore by financing and funding ICT-related R&D they play a key role in policy formulation. For example in the case of ***Finland*** the Technology Programmes launched by Tekes, the Finnish Funding Agency for Technology and Innovation play a strategic role in policy making by providing nearly €200 million financing per year to specific sectors of technology or industry.

In several countries a committee or council type organization has been established for information society development purposes. These organizations are typically inter-ministerial which provides an opportunity to commit different ministries to IST development acts and to generate more solid strategies.

# 5. European policy priorities

The following summary is based on the European Commission's publications (http://europa.eu.int/information_society/, http://www.cordis.lu/).

European research activities in the ICT sector can best be analysed through the European Union's RTD programmes. Most of the activities are structured around consecutive four to seven year programmes, the so-called Framework Programmes. The Sixth Framework Programme (FP6) sets out the current priorities - including the Information Society Technologies (IST) priority - for the period of 2002-2006. The Seventh Framework Programme (FP7) is to cover the years 2007-2013. These programmes and their Strategic Objectives aim at building technical and scientific excellence, as well as European industrial strength in selected priority areas and will lead to the IST Vision: "anywhere anytime natural access to IST services for all".

EU policy priorities are divided into several levels. **The applied IST research** or **application level** addresses major societal and economical challenges. These shortlists of challenges represent the priority selection based on foresight work:

Towards a global dependability and security framework

This strategic objective aims at building technical and scientific excellence, as well as European industrial strength in security, dependability and resilience of systems, services and infrastructures, whilst meeting European demands for privacy and trust.

ICT research for innovative Government

To modernise and innovate public administrations at all levels, to foster good governance, to provide citizens and industries with new service offers, and thus create new public value.

ICT for Networked Businesses

To develop software solutions adaptable to the needs of local/regional SMEs, supporting organisational networking and process integration as well as improving adaptability and responsiveness to rapidly changing market demands and customer requirements.

eSafety - Co-operative Systems for Road Transport

To develop and demonstrate Co-operative systems for road transport that will make transport more efficient and effective, safer and more environmentally friendly.

Integrated biomedical information for better health

Research and development on innovative ICT systems and services that process, integrate and use all relevant biomedical information for improving health knowledge and processes related to prevention, diagnosis, treatment, and personalisation of health care.

Technology-enhanced Learning

The objectives are to explore interactions between the learning of the individual and that of the organisation as well as to contribute to new understandings of the learning processes.

Access to and preservation of cultural and scientific resources

The aim is to develop systems and tools which will support the accessibility and use over time of digital cultural and scientific resources.

Advanced Grid Technologies, Systems and Services

To advance the current generation of Grids towards the knowledge Grid and complete virtualisation of Grid resources. To foster uptake and use in business and society.

ICT for Environmental Risk Management

This Strategic Objective covers ICT aspects of services for GMES (Global Monitoring for the Environment and Security) end-users and those aspects that are relevant to the monitoring, the preparation and the response phases of environmental risk/crisis management co-ordinated at the European level.

eInclusion

To mainstream accessibility in consumer goods and services, including public services through applied research and development of advanced technologies.

Strengthening the Integration of the ICT research effort in an Enlarged Europe

To develop and validate innovative and efficient ICT-based systems and services in key application areas for the societal and economical development of the enlarged Europe, with a view to strengthening the integration of the IST European Research Area.

Collaborative Working Environments

To develop next generation collaborative working environments, thereby increasing creativity and boosting innovation and productivity.

**The technology level** manages the communication, computing and software technologies and fosters the broadband development to the affordable and thus consolidated reach of all Europeans. Mobile and Wireless Systems and Platforms Beyond 3G remains the European selected RTD priority area for consumers and mobile workers not only to access but seamlessly connect to current and future services. Networked Audiovisual Systems remains the main human natural interface to communicate with peers and services. The transformation to IP-based communication environment challenges the connectivity, availability and quality of services. Software and Services is to remain one of the fastest growing industries (notably SMEs) but will be challenged in more globalised and service-oriented markets. This requires advanced capabilities in the engineering and management of software systems, services and applications, and is to be addressed by creating and extending open and interoperable platforms, methodologies, middleware, standards and tools. The results will enable the design and management of complex software systems and, particularly, the simple and low-cost creation of new types of services and applications, including those for the mobile user. The ICT products remain a large variety of hardware products and systems that are engaged with software. The development of these Embedded Systems requires a new generation of technologies, methods and tools for modelling, design, implementation and operation of hardware/software systems embedded in intelligent devices. An end-to-end systems vision should allow building cost-efficient ambient intelligence systems with optimal performance, high confidence, reduced time to market and faster deployment. These large systems and proposed infrastructure need to be developed and validated technologically and commercially in networking testbeds that can be analyzed separately.

**The components and microsystems level** development focused on several building blocks that are essential in developing the hardware infrastructure and terminals. The fast pace of development in physics and electronics has fostered miniaturisation of components and systems. The life cycles of the products are shortened and constantly challenged by the manufacturing costs of new products. Micro scale electronic development finds ever more applications and integration with real world application fields such as autonomous robotic systems, mass storage systems, visualisation and combined bio-, nano- and information systems. The newest transformation into the nano-scale and nanoelectronics radically transforms the process technologies through the integration of a large number of new materials, and to master the design technologies for achieving competitive systems-on-chip and systems-in-package with increasing functionality, performance and complexity. This should be obtained without compromising on reliability, energy consumption and the cost of such systems. Photonic components have been a

focus area in advanced materials, solid-state sources and micro- and nano-scale photonic devices, and in relation to integrating photonic functions into micro/nanoelectronics components ('Photonic system on a chip'). Major application contexts aim at information technologies for health care and life science as well as communications and Infotainment.

To connect all these levels to human capital **the knowledge and interface technologies level** addresses continuing questions. The key development areas are focused on Multimodal Interfaces, Semantic-based Knowledge and Content Systems, and Cognitive Systems. These aim to develop a seamless infrastructure where knowledge can flow and be enriched in all languages and forms. This knowledge capital could then be used in developing artificial systems that interpret real world complex data and make fast and accurate decisions.

Even with careful foresight and planning the future is very unpredictable. There should always be room to react more quickly to the opportunities and challenges that emerge. These activities are fostered in Future and Emerging Technologies (FET). FET complements the other objectives of IST with research from a more visionary and exploratory perspective. Specifically, FET's purpose is to help new IST-related science and technology fields to emerge and mature, some of which will become strategic for economic and social development in the future. The research typically supported by FET is of a long-term nature and involves high risks that are compensated by the promise of major advances and large potential impact. It aims at opening up new possibilities and setting trends for future research programmes, making FET a 'nursery' of novel research ideas and the IST's pathfinder activity.

**The Seventh Framework Programme** further looks towards strengthening a competitive convergent information economy in Europe. The EU Commission's proposal[9] concerning the seventh framework programme of the European Community for research, technological development and demonstration activities covers the following ICT technology pillars:

*–Nano-electronics, photonics and integrated micro/nano-systems*
*–Ubiquitous and unlimited capacity communication networks*
*–Embedded systems, computing and control*
*–Software, Grids, security and dependability*
*–Knowledge, cognitive and learning systems*
*–Simulation, visualization, interaction and mixed realities*

Application research areas included in the proposal for FP7 are:

*–ICT meeting societal challenges*
*–ICT for content, creativity and personal development*
*–ICT supporting businesses and industry*
*–ICT for trust and confidence*

[9] Amended proposal for the decision of the European Parliament and the Council concerning the 7th Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013). Brussels 28.06.2006.COM (2006) 364final. http://ec.europa.eu/research/future/documents_en.cfm.

# 6. National ICT R&D policy priorities

This chapter presents the strategic focus areas and potential R&D areas for cooperation within the ICT sector. Data concerning official governmental policies in 33 countries in the field of ICT was gathered via a number of questionnaires sent to each country's correspondent person of whom 25 replied. Complementary data designed to fill in the missing replies and information was gathered from the web pages of each country's national institutions responsible for ICT policy, from the EU's Trendchart database and from the brochures that were received in addition to the questionnaires. Data concerning the ICT policies in Lithuania, Liechtenstein and Luxembourg was not readily available (there were no responses to the survey and no useful complementary information was obtained) and therefore those countries are not presented in all comparisons and tables.

The questionnaire included questions about:
1a) *The most important and recent official national policies and strategies related to R&D in the field of ICT*
1b) P*riority of ICT in comparison to other fields of R&D*
1c) *Strategic focus areas within the ICT sector*
2) *Organisations responsible for national policies in the field of ICT and the roles of these organisations in policymaking*
3) C*ontact addresses of the most relevant organisations and relevant web addresses on the national research policies in the field of ICT*

Responses gathered via questionnaires reflect the policy strategies formulated either within the context of new laws or R&D action plans executed or prepared in the field of ICT. Specific R&D programmes are also often referred to as policy strategies. In some cases as with Ireland and the Netherlands, recent official policies include the establishment of new authorities in the field of ICT.

According to the data, all of the countries that replied consider ICT to be one of the priorities or key technologies in R&D policy or at least consider ICT to be important (ICT has wide coverage in national R&D programmes) even though ICT has no priority over other technologies.

## 6.1. Strategic focus areas within the ICT sector

In many cases ICT policy is adopted from the application and utilisation point of view. It is seen, that new advanced ICT products and services will generate revenue and high-quality employment opportunities, increase efficiency and consequently the digital economy will bring growth and competitiveness to the nation. Similar conclusions are expressed in the Fraunhofer et al. report[10] where it is stated that "*increasingly, ICT-specific policies take into account the use of ICT by consumers, commercial users and the public sector. The focus is now on widespread application and adoption of ICT rather than on basic R&D or networking within the ICT sector*". Many of the R&D policy programmes are aimed at information society development, although they include a variety of specific technology fields and also basic research.

[10] Fraunhofer, TNO, LL&A 2004. Benchmarking national and regional policies in support of the competitiveness of the ICT sector in EU. Prepared for European Commission, Directorate-General Enterprises.

Table 5 presents the most important official ICT policy priorities identified from the survey responses. By means of these technology themes it is possible to define 4 strategic areas on which at least 8 countries have recently focused. Through the application and utilisation themes, on the other hand, it is possible to define 5 strategic areas on which at least 8 countries have recently focused.

**Table 5: The most important official ICT policy priorities identified from the survey responses**

| Technology Themes | Austria | Belgium | Bulgaria | Cyprus | Czech Republic | Denmark | Estonia | Finland | France | Germany | Greece | Hungary | Iceland | Ireland | Israel | Italy | Latvia | Malta | Netherlands | Norway | Poland | Portugal | Romania | Slovakia | Slovenia | Spain | Sweden | Switzerland | Turkey | United Kingdom |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Telecommunications (including communications infrastructure) | X | | X | X | X | | | X | X | X | X | X | X | | X | | X | X | X | X | X | | X | X | | | X | X | | |
| Micro- & Nanotechnology | X | | | | X | X | | X | X | X | | | | | | | | | | X | | X | | X | | | X | X | | X |
| Software technologies | X | | X | X | | | | X | X | X | | | | | X | X | X | | | X | | | | X | | | X | | | |
| Optoelectronics | | | | X | | | | | | X | X | | | | X | | | | | X | X | | | | | | X | X | | X |
| **Application and utilisation themes** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| eGovernment | X | | X | | | | X | X | | | | X | X | | | X | | X | X | | X | X | X | X | | | X | | | |
| eHealth | | | | X | X | | | X | | | | X | X | | | X | | | | X | X | X | | X | | | X | X | | X |
| eBusiness & eCommerce | X | | | X | | X | X | X | | | X | X | X | | | X | | | X | X | | X | X | X | | | | | | |
| e-Education & eLearning | X | | X | X | | | | | | | X | | X | | | | | | | X | X | | | X | | | | | | |
| Security & safety | | | X | X | X | | | X | X | X | | | X | | | | | | X | | | | | | | | X | | | |

The focus areas mentioned above potentially contain a wide variety of technologies and application possibilities while they can also overlap on technological grounds. For example, optoelectronics can be used in the overall development of telecommunications systems (for its pervasive nature) while nanotechnology is applicable in almost every aspect of ICT. 'Software technology' is also a quite vague concept and R&D policies pursuing overall software development can have many forms and technical objectives in practice. Therefore it is useful to elaborate further on potential cooperation areas with data concerning specific ICT policy programmes. On the basis of the programme data, three focus areas with at least two countries involved can be included within the area of 'telecommunications': *wireless and mobile technologies, optical technologies* and *new internet technologies*. From the 'software technologies' theme it is also possible to elaborate three focus areas which are: *user friendly interfaces, software engineering and massive data processing*.

Some countries have adopted specific policies in line with their specific industrial competence. For example, Germany is currently supporting the development of high definition flat displays and its application for the automobile industry. Recent ICT programmes in Greece aimed to improve support systems for athletic events due to the 2004 Olympics being held in Athens.

It is interesting to note however that a significant variation often exists between the official policy objectives and the R&D programmes actually launched. It is, however, difficult to

reliably conclude whether official policy goals are exaggerated or whether they realistically frame the R&D efforts of a particular country. Many of the R&D programmes are 'bottom-up', which means that no focus areas are selected beforehand while appropriations are decided per call. Official national priority setting may, on the other hand, narrow the scope of funding areas in the selection process. Another reason for the variation is that the concept of a 'programme' may include different actions, not necessarily only R&D funding programmes, and meaning that they are not necessarily identified in the R&D programme survey responses. One example here is the Government's Information Society Policy Programme in Finland, which does not directly provide funding for R&D projects, though it is an important tool in the government's ICT policy, including actions targeted on legislation, administration and the coordination of the government's ICT policy.

Policy priority areas identified via the questionnaire data seem, for the most part, to be in line with the European Commission's 7th framework proposal (see chapter 5), although a number of focus areas do gain more explicit policy support than others as presented in Table 5.

## 6.2. Exploration of potential R&D areas for cooperation

According to the survey data the most suitable cooperation areas in terms of the technology themes could thus be:

- **Telecommunications**– *priority area in 20 countries*
- **Micro- and nanotechnology** – *priority area in 12 countries*
- **Software technologies** – *priority area in 12 countries*
- **Optoelectronics** – *priority area in 9 countries*

From the application and utilisation point of view the most suitable cooperation areas could be:

- **eGovernment** – *priority area in 14 countries*
- **eBusiness and eCommerce** – *priority area in 14 countries*
- **eHealth** – *priority area in 13*
- **Security and Safety** – *priority area in 9 countries*
- **e-Education and eLearning** – *priority area in 8 countries*

It seems that many countries closely follow the EU's ***eEurope***[11] action plan policy priorities which are: Broadband, eBusiness, eGovernment, eHealth, eInclusion, eLearning and

[11] The eEurope 2005 Action Plan was launched at the Seville European Council in June 2002 and endorsed by the Council of Ministers in the eEurope Resolution of January 2003. It aims to develop modern public services and a dynamic environment for e-business through widespread availability of broadband access at competitive prices and a secure information infrastructure. See: http://europa.eu.int/information_society/eeurope/2005/index_en.htm

Security. Questionnaire responses show, that eGovernment and eBusiness development schemes in particular have been widely adopted within 30 countries. In total, 14 countries have an eGovernment development in focus while 13 have eBusiness in focus.

According to the Fraunhofer et al. report[12] the problem for policy benchmarking in a context like that of the EU member states and regions is that different countries and regions can have fundamentally different structural relationships within the ICT sector. The type of relationship will determine the choice of policy and the criteria for assessing policy effectiveness. In this respect three basic groups of EU member states (EU15) can be classified:

- ***Independents*** – States in which there is a significant and established domestic ICT producer sector that is technologically capable of developing and/or providing most ICT product requirements and that is a major supplier in both domestic and export markets (ICT sector accounts for 2.5% - 4% of GDP)
- ***Intermediates*** – States that are mainly importers of ICT goods and services (particularly goods), but that otherwise are substantial recipients of ICT sector inward investment with high levels of domestic value-added and that have significant independent production and export capabilities in selected ICT product/service areas. (ICT sector accounts for 1.5% - 2.5% of GDP)
- ***Dependents*** - States that are mainly importers of ICT goods and services (particularly goods), that receive mainly lower value-added ICT sector inward investment (manufacture rather than design) and that have limited or no significant independent production and export capabilities (ICT sector accounts less than 1.5% of GDP).

**Table 6: Classification of EU states with regard to the development of their ICT sector (Source: Fraunhofer, TNO, LL&A 2004. Benchmarking national and regional policies in support of the competitiveness of the ICT sector in the EU. Prepared for European Commission, Directorate-General Enterprises)**

| Independents | Intermediates | Dependents |
|---|---|---|
| Finland | Austria | Greece |
| France | Belgium | Luxembourg |
| Germany | Denmark | Portugal |
| Italy | Ireland | |
| Netherlands | Poland | |
| Sweden | Spain | |
| UK | | |

It is clear that the starting positions of various countries differ in all ICT policy focus areas. For example, Romania (which is still partly in the liberalization process of the ICT sector) and the Netherlands (which holds one of the top positions in every IST indicator) are countries that are both focusing on developing communications infrastructure though their starting points for this policy differ a great deal. The classification presented above does not however seem to relate to the official strategic focus areas within ICT policy in different countries, meaning that there is no evidence that independent countries are focusing on certain areas and dependent countries on other areas. On the other hand, the classification can highlight the nature and starting position of policy programmes in each focus area.

For the choice of potential future cooperation themes it is useful to look more closely at the possible cooperation areas, the development state of the ICT sector in each country and

[12] Fraunhofer, TNO, LL&A 2004. Benchmarking national and regional policies in support of the competitiveness of the ICT sector in EU. Prepared for European Commission, Directorate-General Enterprises.

the country's IST performance (introduced in chapter 3.4.). The conclusions presented below do not imply that a country's IST performance and ICT development state have a causal connection to the choice of future R&D efforts. However, these factors are of relevance in identifying the country's starting position in the context of developing R&D programmes in certain ICT focus areas.

***Telecommunications***

In some of the responses, the areas of communications infrastructure and telecommunications were distinctively expressed, although they are concepts which are closely linked. As part of the communications infrastructure usually belongs to the telecommunications category, these interrelated topics are bound together here under the telecommunications title. When the areas of communications infrastructure and telecommunications are integrated, there are altogether 20 countries which have set this field as an official policy priority.

Emphasis on the development of telecommunications in policy responses were mostly expressed without any specific focus area. There are altogether 14 countries that have indicated telecommunications as one of their official focus areas including Austria, Cyprus, France, Finland, Germany, Greece, Hungary, Iceland, Latvia, Norway, Poland, Slovakia, Sweden and Switzerland. A starting point for possible cooperation in countries like Belgium, Iceland, France, Finland, Germany, Sweden, Norway and Switzerland is, that in these countries the level of network readiness is already high, the information society is well established and they have significant domestic technological capacity, therefore the R&D is more likely to be focused on developing new technologies in telecommunications. On the other hand, countries that do not yet have such an advanced information society or domestic technological capacity (Cyprus, Greece, Hungary, Latvia, Poland and Slovakia) are more likely to be funding infrastructure development and the utilisation of new technologies in telecommunications.

12 countries including Austria, Bulgaria, the Czech Republic, France, Germany, Hungary, Israel, Malta, the Netherlands, Poland, Romania and Switzerland have stated that communications infrastructure development is an official ICT policy priority. As an outcome of elaborating this theme with R&D programmes conducted in each country it is possible to add Cyprus, Finland, Greece, Slovenia and Spain to this list although they have not stated this as official policy priority though they are conducting R&D programmes in this area and are therefore possible cooperators. Exploring these countries it is noticeable that while Finland, Germany and the Netherlands, for example, are focusing on the development of wireless and mobile technologies, they also excel in IST performance, their ICT sector is well developed and they have an established domestic producer sector. In these countries (we can also add France here) the starting point for cooperation in wireless and mobile technology development is more likely to be in the strengthening of an already well established industry and in developing more value-adding applications. On the other hand, for countries like Bulgaria, Greece, Hungary, Poland and Romania, which are not performing as well on IST indicators and where the ICT sector is not as developed, the starting point for communications infrastructure development and cooperation is likely to be based more on building and establishing communications networks and industries.

***Micro- and nanotechnology***

Although it is disputable that micro- and nanotechnology is a discipline in ICT, 12 countries have indicated this as one of the focus areas in national ICT policy, including Austria, the Czech Republic, Denmark, Finland, France, Germany, Norway, Portugal, Slovakia, Sweden, Switzerland and the United Kingdom. Generally speaking, micro- and nanotechnology refers to the design and production of extremely small (micro- and

nanoscale) electronic devices. From this concept it is important to distinguish nanoscience which refers to the scientific discipline seeking to increase our knowledge and understanding of nanoscale phenomena, i.e. science on the scale of 0.1 nm to 100 nm. From the countries mentioned above, France and Switzerland explicitly promote research on nanoscale sciences at a more general level.

Micro- and nanotechnology is one of the R&D cooperation areas where the country's IST performance and the development stage of the ICT sector do not necessarily have great significance. According to the EU Commission's report[13] on nanotechnology, Europe has recognised the potential of nanotechnology at an early stage and has developed a strong knowledge base in nanosciences with some of the brightest minds in the field. Despite this, nanotechnology is still waiting to see a commercial breakthrough and therefore it has not developed into an established industry in any country. It is worthwhile then to continue to put effort into R&D cooperation in the area of micro- and nanotechnology. However, the relative levels of the public funding of nanotechnology in each country vary a great deal. An estimation in the Commission's report notes that Switzerland, for example, spent 3.4€ *per capita* on nanotechnology while Portugal, on the other hand, spent only 0.04€ *per capita*.

### *Software technologies*

Within software technologies it was useful to distinguish three areas; user friendly interfaces, software engineering and massive data processing. Altogether, 12 countries have expressed this field (or software development in general) as a focus area in ICT including Austria, Bulgaria, Cyprus, Finland, France, Germany, Israel, Italy, Latvia, Norway, Slovakia and Sweden. With respect to the three focus areas identified from the programme data, it is also possible to add the Czech Republic, Greece, the Netherlands, Slovenia and Spain to this list. So in the end we have 16 out of 30 countries focusing on developing software technologies.

From the policy responses it is difficult to assess, apart from the elaborated areas, what kinds of focus this concept embodies or what the criteria are for cooperation in this field. For example in Finland the focus is on developing software intensive products and systems while in other countries the focus is expressed more or less as "general software development". In most cases it is impossible to clarify whether these policies are targeted at the development of software industries, at the applications of software in other industries or on simply developing software technology itself. Software engineering is a good example of the development of software technology itself. It is a discipline concerned with specifying, designing, developing and maintaining software applications by applying the technologies and practices of computer science, project management, and other fields. Five countries including the Czech Republic, Finland, Germany, the Netherlands and Spain have set this as a focus area.

### *Optoelectronics*

Optoelectronics is clearly one of the most distinctive ICT technology fields identifiable from the policy responses. Optoelectronics is a technology field which is all-pervasive in nature and the applications of optoelectronics extend throughout our everyday lives, including the fields of computing, communication, entertainment, education, electronic commerce, health care and transportation.

[13] Towards a European strategy for nanotechnology, Communication from the Commission, Brussels 2004. See: http://europa.eu.int/comm/research/industrial_technologies/pdf/nanotechnology_communication_en.pdf

Nine countries have stated this to be one of their focus areas in respect of ICT including Cyprus, Germany, Greece, Israel, Norway, Poland, Sweden, Switzerland and the United Kingdom. Switzerland however differs from the rest of these countries in that they conduct research in advanced areas of quantum photonics, while Poland has set up a programme for the development of 'blue optoelectronics' in the hope of creating the fundamentals for a new industry branch.

### *Other technology themes*

Exploring other possible cooperation areas in terms of these technological grounds reveals an interesting technological *niche* of image, sound and language technologies. Six countries have set this theme as one of their focus areas in ICT policy, including Cyprus, France, Greece, Hungary, Switzerland and the United Kingdom. On the basis of the programme data, it is also possible to add Slovenia to this list.

### *Application and utilisation themes*

As stated previously, a country's official policy in the field of ICT is often expressed from the application and utilisation point of view. Here it is useful to clarify some of the concepts and application areas which were introduced above. *eHealth* refers to healthcare practices which are supported by electronic processes and communication. *eGovernment* refers to more efficient public services delivering and improving the relationship between citizens and their government. *e-Education and eLearning* refer to the integration of advanced information and communication technologies into the educational system, while *eBusiness and eCommerce* refer to the process of selling products or services via the web and to developing tools and components for the adoption and integration of modern business and inter-business strategies, such as SCM (Supply Chain Management), CRM (Customer Relationship Management) etc.

### *eGovernment*

When examining more closely the 14 countries that have an eGovernment development in focus (Austria, Belgium, Estonia, Iceland, Italy, Finland, Hungary, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia and Sweden) it is useful to take into account the online sophistication level of each country (which is one of the major factors when determining the citizen-government relationship) as one possible starting point for cooperation. Of the countries mentioned above, Sweden, Austria, Finland, Estonia, Iceland, Italy, the Netherlands, Portugal, Malta, and Belgium reach the EU (25) average on online sophistication of public services. Hungary, Slovakia and Poland clearly fall below that average. The latter group of countries is also not performing very well when measured against other IST indicators. The starting point for eGovernment cooperation between countries that already show advanced online sophistication and IST performance is more likely to focus on deepening and broadening the scope of government services (fully) available for people and on embedding the new practices among citizens. Countries with a lower performance here are more likely to be in the process of developing more efficient public services by promoting the use of information technology in public bodies and establishing communications networks and websites to deepen the citizen-government relationship.

### *eBusiness and eCommerce*

Altogether, some 14 countries have adopted eBusiness and eCommerce as a policy priority including Austria, Cyprus, Denmark, Estonia, Finland, Greece, Hungary, Iceland,

Italy, the Netherlands, Portugal, Romania, Norway, and Slovakia. On the basis of the data gathered on the programmes, it is also a priority area in Slovenia. For a successful mobilisation of eBusiness products, services and practices one determinant factor is a country's IST performance, especially the use of computers and the internet as well as the diffusion of broadband connections. In this sense the starting point for cooperation between countries may differ. Countries that are performing well in terms of IST indicators are more likely to be interested in taking advantage of existing communications networks and thus in developing suitable commercialisation opportunities in eBusiness while, on the other hand, countries that are not performing well in terms of the IST indicators (the use of computers, internet and broadband is low) may be more interested in developing tools and practices designed to motivate companies and citizens to use the internet and modern network tools for business purposes.

***eHealth***

The eHealth theme is one of the policy focus areas in 13 countries including the Czech Republic, Cyprus, Finland, Hungary, Iceland, Italy, Poland, Portugal, Norway, Slovakia, Sweden, Switzerland and the United Kingdom. Again, it is possible to add Slovenia to this list on the basis of the programme data. Once again the country's performance measured by IST indicators and the development of the ICT sector can have an effect on the cooperation starting point. Countries like Finland, Iceland, Italy, Norway, Sweden, Switzerland and the UK already have the technological capacity to develop new healthcare practices and medical equipment and also accessible web services via their well established information societies.

***Security and Safety***

Security and safety issues in ICT are, in part, connected to other application themes, especially in eGovernment and eBusiness and are present in more or less every aspect of the development of reliable and safe communication networks. Altogether, 9 countries have adopted security and safety issues as a policy priority in ICT including Bulgaria, Cyprus, the Czech Republic, France, Finland, Germany, Iceland, the Netherlands and Sweden.

Security and safety is an area in which IST performance or the development state of the ICT sector does not necessarily bring any implications on possible R&D cooperation starting points. Security and safety is an issue that has become increasingly important whether we are thinking about network construction, spam control, reliable network services or the prevention of terrorist acts.

***e-Education and eLearning***

There are, altogether, 8 countries that have e-Education and eLearning as one of the policy priorities including Austria, Belgium, Cyprus, Greece, Iceland, Norway, Poland and Slovakia. As in the case of eBusiness, in respect of the successful mobilization of e-Education practices and services, one of the most influential factors here can be a country's IST performance. In some countries where the use of computers, the internet and broadband connections is very low (Greece, Poland and Slovakia), the starting point for e-Education development is quite different from that in countries that perform very well in terms of IST indicators, such as Austria, Iceland and Norway.

***Other applications and utilisation themes***

Exploring other ICT application themes, it is noticeable that six countries are focusing on Internet access and internet literacy, three countries on transport and logistics and two on

culture and tourism. Culture and tourism may be an interesting cooperation area in ICT. Although there are only two countries (Iceland and Greece) which include this area as a policy priority, the development of ICT powered cultural and tourism services may be one important area in those countries where culture and tourism are significant sources of national income.

### *CONCLUSIONS*

According to the survey data, ICT is widely accepted as an important area in national R&D policy.

The most fertile ground for cooperation in ICT is in areas of (measured by the explicitly indicated policy priority):

- Telecommunications (20 countries)
- Micro- and nanotechnology (12 countries)
- Software technologies (12 countries)
- Optoelectronics (9 countries)

- eGovernment (14 countries)
- eBusiness and eCommerce (14 countries)
- eHealth (13 countries)
- Security and Safety (9 countries)
- e-Education and eLearning (8 countries)

In most of the cases dealt with here, ICT policy priorities are expressed from the application and utilisation point of view, while they generally aim at the development of the information society.

The development state of a country's ICT sector or its IST performance does not have an effect on the official strategic focus areas within ICT policy in different countries. There is no indication that well developed countries are focused on certain areas while less developed countries focus on other areas.

The development state of a country's ICT sector and of its IST performance can however have implications for different countries' starting points in future R&D cooperation acts. Therefore, it is important to assess the technological capacity and the diffusion of new technologies of each possible participant country in future cooperation programmes.

# 7. National R&D programme procedures

The national programme processes are presented in this chapter. Analysis of the processes is focused on three stages of action: the initiation of the programmes, their implementation and finally, their evaluation. The various stages and the factors observed at each stage are presented below.

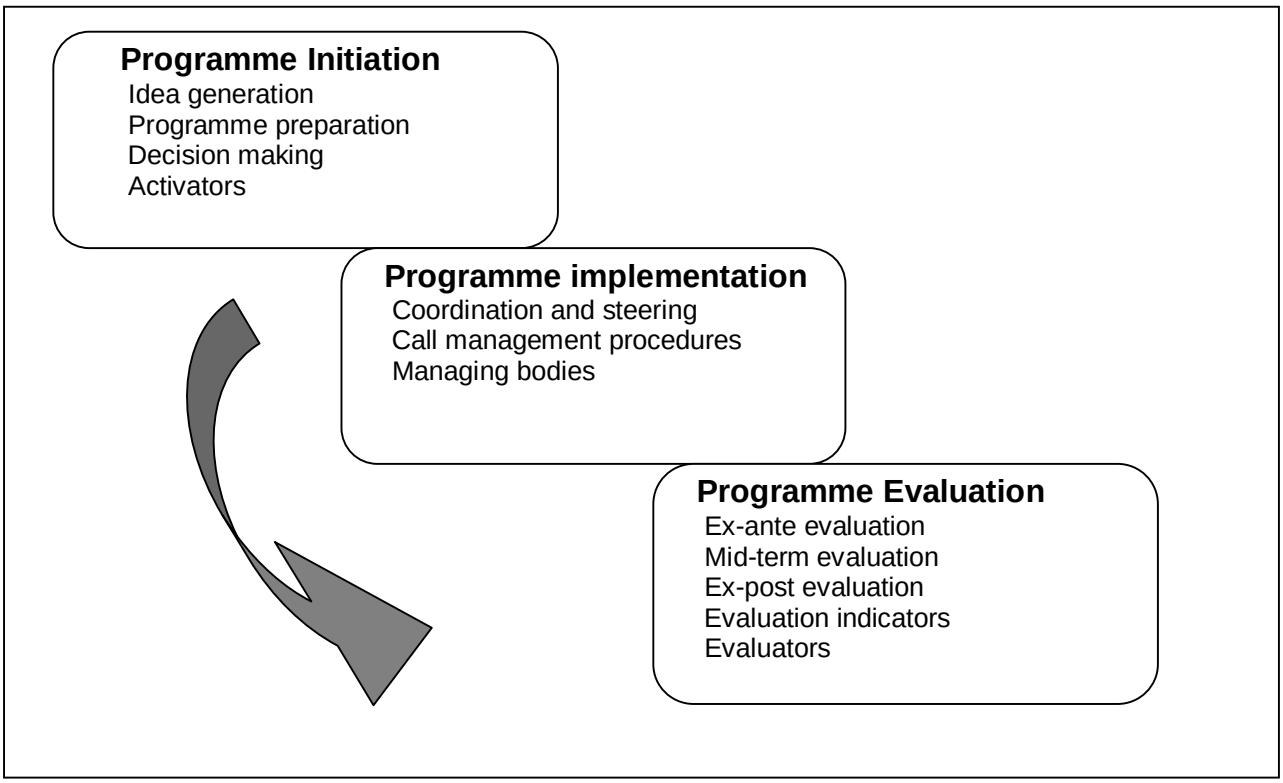


**Figure 9: Stages of Programme Processes**

As a part of the survey, respondents were asked to describe the process(es) and activities in the national R&D programme life cycle. Information was asked about (1) the programme planning phase, (2) the programme implementation phase and (3) the programme evaluation phase.

(1) In respect of the planning phase, respondents were asked to identify: How a programme is initiated? Where does the idea come from? What kinds of actions are taken, and *by whom,* during this phase? And, *who* makes the decision to launch a programme?
(2) Regarding the implementation phase, respondents were asked to identify: What kind of management structure does a programme have? *Who* are the key players involved, and what are their duties?
(3) Finally, in relation to the evaluation phase, respondents were asked to identify: Whether the programmes are evaluated? If so, *by whom,* and at which point is the evaluation conducted? And, what are the indicators on which these evaluations focus?

Where there are several funding organisations in a particular country, respondents were asked to describe the procedures of the main national funding organisations separately. Altogether 22 countries delivered a response to this questionnaire. Most of the countries delivered one description of the national R&D programme process, with the description being based on the procedures of one main funding organisation. Austria, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Poland and Switzerland delivered several descriptions. These descriptions related either to the procedures of separate organisations or to the procedures conducted in different programmes within the same funding organisation. Some of the responses described the establishment of competence centres and networks. Those procedures are not discussed further in the context of this report unless they form a part of the R&D programme which includes research funding. In the case of both Greece and Hungary's Operational Programmes, the programme processes originate from the EU Commission's general rules and regulations on the Community Support Framework Programme.

***Programme initiation***

The general idea and the specific initiative to set up a specific R&D programme often came from several sources depending on the country, the funding organisation or the particular programme concerned. Respondents identified a variety of sources and programme initiation was seen as a consequence of certain events, practices and institutional premises, including:

- Suggestions from the research community
- Suggestions from industrial actors and interest groups
- Promotion by ministries and governmental agencies
- Research priorities in the EU (framework programmes and structural funds)
- Suggestions from the experts in funding organisations
- Government reports and resolutions
- Completion of, or follow-up to a previous programme
- National priority or strategic importance
- Legal act
- Strengthening existing competences
- Scientific challenges identified at the international level
- Emerging market needs
- Open competition
- Societal discourse

The research community (universities and research centres) was in many of these cases identified as the original initiator of the programmes. There were 14 programmes altogether in which both the basic idea and the framework of a programme were initiated by or at least with the assistance of the scientific research community. Industrial actors (companies and industry associations) and governmental ministries and agencies were also seen to have major influence in initiating particular programmes. In some cases, ideas for programmes are based on initiatives derived jointly from the research community, industrial actors and governmental organisations. The procedures involved in the organisation of these exploratory "think-tanks" are scantly identified. In the case of the German Aerospace Centre and the Academy of Finland, basic ideas emerged from the results of workshops where the science and the business communities and relevant stakeholders interface.

As the idea for a programme emerges and a rough framework for its content has been identified, the actual preparation and the detailed elaboration of scope, principles, benefits, feasibility and applicability of the programme can begin. In some of the responses

received this practical planning phase was described in great detail. Some examples of the responses received are presented below:

> The preparation of *Tekes Technology Programmes* in Finland continues with a feasibility study after the need for a particular programme is identified. In this phase a qualitative analysis is made, especially focusing on the industry's involvement and the potential national benefits. The programme framework is evaluated in the discussions within *Tekes* as well as in discussions with the industry and other key players in the field. Based on the results of the feasibility study, *Tekes technology directors* make the decision to start the programme preparation or close the case. In the preparation phase the programme need is analysed in more detail (technology push, market pull and industrial commitment) and after that the practical planning of the programme starts. Activities in this phase include e.g. one to three studies (normally outsourced), deep discussions with the industry and research parties, seminars and sometimes a call for expressions of interest. The decision to start the programme is made by the *Tekes board,* which consists of members from the Ministry, industry and academia.
>
> In the case of the *German VDI Technologiezentrum* FPOT – programme (funding programme for optical technology) the essential elements in the planning phase were the open, multi- and interdisciplinary approach and the direct dialogue between business and science. Two large-scale workshop series were held involving hundreds of experts (researchers, producers and users of optical technology). The strategy process led to the "German Agenda – OT for the 21st century" and this postulation was taken up by the Ministry of Education and Research (BMBF) which set up the FPOT funding programme. The preparation of the FPOT was steered and managed by the responsible unit of the BMBF and supported by VDI as the responsible programme administrator. Advice during all phases of programme development was provided by a programme board/steering committee consisting of high level representatives from research and industry appointed by the BMBF.
>
> In the case of the *Research Council of Norway* new proposals for possible programmes are presented to the governing body of the Research Council, in order to decide whether the Research Council should initiate a further programme planning process based on the proposal. In any case, a new programme will only be launched after having been defined in a planning process operated by the administration of the Research Council and guided by a group of appointed external experts and stakeholders. Special studies may be commissioned during this planning stage. At the conclusion of this planning process there will normally be an external hearing process where relevant stakeholders and research institutions are asked for comments and reactions. The preliminary plans for a new programme are then amended and a recommendation (to launch or not) is submitted to the appropriate governing bodies of the Research Council. If this leads to a positive decision, the proposed new programme will be included in the budget of the Research Council. If the next (annual) budget proposition from the government is favourable to the proposal and adequate funds have been allocated, the programme will be officially launched by the appropriate governing body of the Research Council.

Procedures presented in the survey responses show that the research community is also well represented in the more detailed planning phase of the programmes. In at least 10 of the procedures described, programme planning is conducted with assistance from academia or public research institutions. In addition, the industry and other line ministries (which are not the owners of the programmes or directly involved with the focus area of the programme) are often taken into account in programme formulation.

It is interesting to note however that cooperation efforts in respect of possible national or international co-financiers for a programme were made in only one case (*the Academy of Finland*). This illustrates rather well that no systematic approach to national and/or international cooperation exists in the programme planning phase, at least when clarifying the potential financiers and possible partners for a programme. This can set major challenges for achieving coordination of national ICT programmes with each other.

The decision to launch a programme is usually made by the funding organisation itself. This data shows that the typical financier or owner of the programme (as sometimes defined) is a ministry, agency, foundation or science council, which also has the power to make the final decision. When a ministry makes the final decision to begin a programme it is usually the financier and the initiator of the programme. One exception to this is to be found in Germany, where the decision is made on the ministerial level on behalf of the subordinate agencies. Where the decision is made within the funding agency or science council, the decision maker is the board or board of directors of that particular organisation. The composition of the board was not identified in most of the descriptions provided, but in the case of the Finnish *Tekes* board, it consists of members from the Ministry, industry and academia thus ensuring the broad representation of different parties in the final decision making process, while in the case of the *Hungarian Scientific Research Fund (OTKA)* the decision is made by the OTKA Committee, which includes representatives of the Hungarian Academy of Sciences, various ministries, experts proposed by higher education conferences and scientific colleges, as well as the representative of the National Office of Research and Technology.

In some cases the decision is made outside of the funding organisation or with the assistance of a horizontal organisation on the interim measure. These cases include the Austrian *ZIT* where the decision is made by the Steering Committee of Vienna Business Agency, the *Israel Science Foundation (ISF)* where the decision is made by the Israeli Academy together with ISF's Board and Council and in The Latvian Council of Science where the decision is made by an expert Commission set by the Council

In respect of the launching of an extensive programme, such decisions are usually made at a higher political level. In Bulgaria's *IS National Scientific Programme* and in Poland's *Blue Optoelectronics Programme* the decisions to begin these programmes were taken by the Council of Ministers. In the case of the Swiss *National Research Programmes* such decisions are made by the Swiss Federal Council.

### *Programme implementation*

After the final decision to begin a programme is made and appropriate governmental or budgetary funding is allocated, the programme implementation phase begins and a respective management structure is established to carry out the various implementation tasks. These tasks include e.g. opening the calls for proposals, advising the applicants, evaluating the project proposals and results, auditing the programme funding, monitoring the progress of the programme and the dissemination of information. The management structures and/or implementation procedures of a number of programmes are presented below:

> In the Bulgarian National Science Fund, programme implementation is managed by the National Science Fund supported by an **Expert Panel** comprised of representatives from interested line ministries, the research institutes of the BAS and the universities. The National Science Fund launches calls for project proposals. The Expert panel selects the project proposals on the basis of the results of the evaluation procedure. The evaluation procedure includes three steps: checking eligibility, evaluation by independent experts according to a set of criteria and panel sessions. Retained projects are implemented by various consortia which may also include foreign partners. The eligible organisations include the institutes of the BAS, industry SMEs, and NGOs, etc. Each project is managed by a **Project Manager**. The Project Manager periodically reports on the project's progress to the Expert Panel. The Expert Panel prepares monitoring reports for the Monitoring Board, which is assigned by the National Science Fund. **The Monitoring Board** takes decisions and recommendations with respect to project implementation (e.g. to fund the next phase of implementation, to reject the project

implementation, etc.). The evaluation, selection, and implementation processes are administrated by **the Secretariate** of the National Science Fund.

In French *RNTL* programmes, the **Steering Board** has 35 representatives from public research, industry or professional organisations in the software domain. It has responsibility for strategic orientations, calls for tender, publication and the selection of projects. The **Executive Board** of 10 senior managers of public research, industry or professional organizations in the software domain is in charge of the management of programme activities: evaluation of proposals, technical and strategy workshops, annual conference, etc. The **Programme Manager** is responsible for managing the programme in accordance with the decisions taken by the Steering Board and the Executive Board. The Ministries of Research and of Industry make funding decisions and ensure the administrative follow up of projects.

In the case of the German "GEOTECHNOLOGIE" –programme, the programme's **Steering Committee** is responsible for the strategic management of the programme, for the definition of the objectives, the evaluation of the funding recommendations of the expert committee, and the evaluation of the programme (6 representatives of research). The **Expert Board** on Geoinformation Systems is responsible for evaluation of pre-proposals and proposals, funding recommendations, and the evaluation of research activities and results (5 representatives of research in the field of information and geoinformation technologies). The **Coordination Office** is responsible for the public relations of the programme and contacts between the BMBF and the DFG, and between research and industry. *Projekttraeger Juelich* is a **project management organisation**, responsible for the budget of the programme, administrative and scientific supervision of funded projects, final funding recommendations, while the German Ministry of Education and Research, being the financier, makes final funding decisions.

**The Council** of the *Israel Science Foundation (ISF)* is responsible for defining the policy and objectives of the ISF. It consists of twelve members. **The Academic Board** is responsible for the scientific management of the ISF. It consists of six members: the chairperson, three distinguished professors in charge of the applications received in the areas of exact sciences and technology, life sciences and medicine, social sciences and humanities, the academy director and the PBC representative. **The Executive Committee** oversees the management of the foundation and its programmes. It consists of three members. **The Professional Committees** consist of 55-60 revolving professional committees; each consists of 3-12 members, all of whom are recognized experts in their fields.

The implementation procedures vary depending on the country, the funding organisation and the programme involved. In most cases an organisational committee-type structure, managing and handling the implementation of the programmes, is in place. This is often the case when a well-established and independent funding organisation independently handles the programme processes from initiation to implementation. This procedure usually includes some outsourcing of the tasks involved, e.g. the project selection or evaluation of the project proposals.

### *Committee-type implementation*

In this procedure, implementation tasks are assigned to different kinds of committees e.g.; steering committees (or boards), scientific committees, monitoring committees, executive committees, expert boards (or juries) and programme managers. The tasks of these **steering committees** can include: strategic management of the programme, initiating partnerships, disseminating information and the promotion of the programme, final decision on the projects, goal setting of the programme, monitoring the programme or individual projects, organising the evaluation of individual projects or for the whole programme, setting the evaluation criteria and announcing the call for tender. The tasks of the **scientific committees** include the scientific evaluation of the proposals and the elaboration of calls for proposals and priorities in the respective research areas. **Monitoring committees** usually take decisions and make recommendations in respect of project implementation and supervise the progress of the programme. **Executive committees** are in charge of the evaluation of proposals, technical and strategy

workshops, funding recommendations and the overall management of the funding organisation's programmes. The tasks of the **expert boards and juries** include reviewing the implementation process and evaluating or selecting project proposals. **Programme managers** are usually responsible for the promotion of the programme, and for managing the programme based on the superior committee's decisions. There is no clear distinction in respect of the division of labour between the different committees. Depending on the programme or financier, the tasks of the committee are case-specific. It can be seen that the tasks of the scientific committees always relate to the scientific issues of programme implementation and evaluation, and that the representatives of the committee are well-established members of the national or international scientific community.

Programmes or funding organisations applying this kind of management structure include: the Austrian ZIT-programme, the Bulgarian National Science Fund, the Research Promotion Foundation in Cyprus, the Danish Ministry of Science, Technology and Innovation, the Estonian Science Foundation, Tekes technology programmes in Finland, the Academy of Finland, French RNTL programmes, French ACI programmes, Hungarian OTKA –programmes, Israel's Science Foundation, the Malta Council for Science and Technology, the Dutch BSIK programme, the Research Council of Norway, Slovakian National Programmes, the Swiss National Science Foundation and TUBITAK-programmes in Turkey.

The distinctive feature of these committees is that their representatives usually do not come from the funding organisation, but rather from industry, academia or other governmental agencies, and in the case of the expert boards, from abroad. In addition, the programme manager may also come from outside the funding organisation (e.g. in the case of Tekes).

Not all of the programme implementation procedures are conducted in the committee – type described above. In some cases the whole management organisation is outsourced while responsibility for steering and decision making is reserved to the funding organisation.

#### *Outsourced implementation*

Although some of the duties in a more conventional committee-type management structure are outsourced, in the outsourced-implementation model, the practical management of the programme is handled outside of the agency or ministry that initiates or finances the particular programme. The programme management organisation can be a private company e.g. the Austrian ZIT programme, a subordinate government agency or institute e.g. German programmes or a consortium of organisations e.g. the Latvian Council of Science where the programme executor was the winning consortium of the programme competition. The tasks of these organisations can include: giving feedback on project ideas, evaluating the proposals, networking, monitoring, PR, financial administration, funding recommendations, preparing and publishing documentation and information on calls and the general organisation of programme implementation.

#### *In-house implementation*

It is also possible to identify an implementation procedure where all programme management tasks are done ***in-house***. The programme administration and *ex-post* and interim evaluation of the proposals and projects are done within the funding agency. This is the case with the Austrian Industrial Research Promotion Fund and with the Slovenian Research Agency.

### *Joint management*

In major and governmentally pervasive programmes implementation is arranged on a **joint management** basis. In the case of the Austrian K-Ind and K-Net programmes, programme operations are jointly managed between three institutions. The operational programmes of Greece and Hungary are also jointly managed between several independent organisations all of which represent different administrative branches.

### *Programme evaluation*

The descriptions listed above show that evaluation is an important and recurrent operation in the programme processes. There are ***ex-ante* evaluations** made when the selection and approval of the projects and participants to the programme are current. **Interim evaluations** of the programmes and individual projects are conducted while the programmes are running. Finally, ***ex-post*** evaluations of the individual projects and of the results and impacts of the programmes are assessed after the project or programme ends (immediately or later). Here are short descriptions of the evaluation procedures of a few of the programmes:

In the *Austrian Research Promotion Agency,* the *ex-ante* evaluation (selection) of projects as well as their final audit (1 year after the end of the project at the latest) is made by the FFG Division 1 staff (technical and economic experts / auditors). *Ex-post* evaluations are conducted by external independent experts (KMU Forschung Austria) 4 years after the end of the project. The following indicators are used by the *ex-post* evaluators: economic success of the project (additional turnover, revenues from licenses, turnover maintenance etc), multiplier effects (input/output), labour market effects (created, safeguarded, eliminated jobs), F&E effects (number of patents, F&E cooperation), additionality (would the project have been undertaken also without public support), customer satisfaction.

In the case of *Bulgarian National Science Fund* the Expert Panel selects the project proposals on the basis of the results of the evaluation procedure. The evaluation procedure includes three steps: checking eligibility, evaluation by independent experts according to a set of criteria and panel sessions. The programme may be internally evaluated once a year after consultation with external experts. The main indicators are the programme objectives and the level of their achievement, the programmes' relevance to the national research priorities, activities, results and impacts.

The Finnish *Tekes Technology Programmes* may be evaluated during or after the programme implementation phase. There may be an internal evaluation, but typically each technology programme is evaluated by external evaluators. *Tekes'* Evaluation and Quality Unit outsources the evaluation. The reports of the external evaluations are public. The main indicators to be studied are: the level of research and technology, industrial relevance; the objectives of the programme, success in attaining them; programme activities, management of the programme; results and impacts.

In French *ACI programmes* each proposal is refereed by at least two members of the Scientific Committee (SCC). External referees can also be involved in this evaluation phase. The experts concentrate only on the scientific quality of each proposal. The SCC then proposes a list of projects which can be accepted on the grounds of their scientific quality to the STC. Based upon this evaluation and the available budget, a final list of accepted projects is made and these projects receive funding. Each ACI maintains a website where all the information concerning the projects and the workshops is posted. Furthermore, at the end of each year the ACI director reports on the actions undertaken: number of projects received/accepted, individual and total funding, etc. In addition, a public workshop is organized every year where the accepted projects present their results (prototypes, publications). Each project also undergoes a final review in the presence of the members of the SCC.

In the *Israel Science Foundation (ISF),* the evaluation of grant applications combines individual, external expert peer reviews and subsequent discussions in broader professional committees. The professional committee members receive the proposals and a list of potential reviewers who are suitable for judging each proposal. A list of eight reviewers is chosen for each proposal. The goal is to receive at least three evaluations for each of the submitted proposals. Each reviewer is requested to evaluate the proposal according to its originality, innovation, importance and implications; the adequacy of methods and the suitability of the researchers' scientific background to the project. In the concluding professional committee meeting, each member brings his recommendation for those proposals assigned to him. Each professional committee member presents both the comments of the external peer reviewers and his own recommendations for the proposals (assigned to him). After further deliberation, the professional committee classifies and rates the proposals. Written summaries of the professional committees' deliberations and their final recommendations are then brought before the Area Chairman. The Area Chairman considers the various recommendations and submits them with his own comments to the ISF Academic Board. The Board, in turn, submits its recommendations to the ISF Council for final approval. Excellence is the one and only criterion used for selecting the programmes to be funded. There is no budgetary pre-allocation by discipline. The grants are allocated progressively according to the overall ranking. The main contents of the peer reviews are forwarded to the applicants, while the reviewers' identity remains anonymous and all discussions are kept strictly confidential.

*The Research Council of Norway* has established programme evaluation guidelines, which ensure that a certain part of the programme portfolio will be subject to evaluation by external experts. The decision to conduct an evaluation of a certain programme will be taken by the governing bodies of the Research Council or at the executive level of the Research Council. The initiative to conduct an evaluation may also be taken by the Programme steering board. Evaluation by external (national or international) experts will normally take place at the end of the programme period. Long-term programmes may be subject to an external mid-term review, and this may be stated as a condition in the decision to launch the programme. The evaluations focus on the main success indicators set out in the programme plans, while the adequacy of these indicators will also be assessed. The operational efficiency of the programme (management) forms a part of the evaluation. Programmes have to submit annual reports on their achievements to the relevant governing bodies of the Research Council, so that the progress of the programme can be monitored (internal evaluation).

### *Ex-ante evaluation*

Evaluation descriptions show, that *ex-ante* evaluation of the project proposals are conducted within the funding organisation, by the superior governmental body, or by the national or international external evaluators. In those cases where evaluation is undertaken by the organisation itself or by the superior body, the evaluating team consists of experts from outside the funding organisation. In some cases the proposal evaluation tasks are divided between several organisations. E.g. in German VDI-programmes, the evaluation of proposals is made by the ministry concerned, the funding agency and external referees. In the Israel Science Foundation, the evaluation of grant applications combines individual, external expert peer reviews, and subsequent discussions in broader professional committees, with the goal being to receive at least three evaluations for each of the submitted proposals.

*Ex-ante* evaluation criteria and indicators identified in the descriptions included:

- Technological relevance
- Scientific quality of proposal (e.g. adequacy of methods)
- Relevance for the programme
- Rationale for the strategy and its overall consistency
- Composition of the research consortium
- Proposers' suitability, performance and prospects
- Market prospects
- Possible externalities
- Eligibility of projects

- Originality of the proposal
- Innovativeness of the project
- Expected impacts
- Employment prospects
- Environmental aspects
- Equal opportunity aspects

These indicators have been taken from the evaluation processes of Austria (FIT-IT), Bulgaria (NSF), Hungary (ECOP) and Israel (ISF) where the evaluation indicators were expressed. Although these examples do not give a very extensive picture of the *ex-ante* evaluation criteria of collected data, they do show that the indicators used cover a wide-ranging area of evaluation information.

### *Interim evaluation*

Interim evaluation of the programme is undertaken either with evaluation of the implemented projects (which provides information on the course of the programme), or with more extensive mid-term or annual evaluation procedures concentrating on the progress of the whole programme and which may also assess features other than simply the results of the individual projects (e.g. financial auditing). Interim evaluation is usually conducted when the programme (or a project) lasts several years. The indicators for interim evaluation basically follow the goals set in the *ex-ante* evaluation phase. The interim assessment also functions as a tool for monitoring, while progress of the programme and the programme plan can be revised if the results do not satisfy the financiers. This can, potentially at least, lead to drastic actions being taken in some programmes (as described in the case of Dutch programmes). In the case of Turkey's Industrial R&D Grant Programme (TUBITAK), which is an ongoing programme, evaluation meetings are held between the funded companies, external evaluators and the Under-Secretariat of Foreign Trade. These meetings are tasked with revising the programme implementation and improving the benefits of the programme through a procedural evaluation study carried out by an external consultant.

The interim evaluation is usually conducted internally, but in the case of the evaluation of implemented projects, external evaluators are often used. When examining the responses it is difficult to come to a conclusion as to whether the interim evaluations are part of the practical duties of the programme monitoring process, whether the assessment of the results of the individual projects is handled separately with no connection to the programme as a whole, or whether the interim evaluations extensively examine the progress of the programme considering all of the relevant aspects of the programme process including initial goal setting. The programmes in the Research Council of Norway may be subject to an external mid-term review and such evaluations will focus on the main success indicators set out in the programme plans, where the adequacy of these indicators will also be assessed. In the case of Dutch programmes (as noted previously) the interim evaluation is used to assess whether to continue, to revise the whole programme, or to end the programme.

### *Ex-post evaluation*

Responses regarding the evaluation of the programmes describe both the evaluation of the individual projects carried out in the framework of the programme, and also the comprehensive programme evaluation studies. The evaluation results of the individual projects illustrate the success of the programme for the financier and the stakeholders (as

in the case of the interim evaluation). In order to attain a coherent picture of the results and impacts of the programme, a more profound study should however be undertaken. The idea of a programme evaluation can be problematic for funding organisations conducting continuously ongoing R&D programmes, as the evaluation of the whole programme is not possible in the same way as in the case of programmes that have a limited implementation phase with a set endpoint.

Every programme described in the process questionnaires includes, in one way or another, an *ex-post* evaluation (except the Israel Science Foundation–programmes, or at least such an evaluation is not described in the response). Most of the responses describe the evaluation of individual projects. The *ex-post* (whole) programme evaluation study is carried out, or will be carried out in about 30% of the programme cases. In every case, the evaluation is undertaken by external consultants or experts, except in the cases of Greece and Hungary's Operational Programmes where the Commission (together with the member state) is responsible for the *ex-post* evaluations. In Framework Programmes the Commission acts as a financier, although it does not rule out the possibility that the evaluation can be outsourced. In the R&D programme data, 15 R&D programmes had already been evaluated by the time the survey was undertaken. In most cases however the evaluation report was not publicly available, or there was no information given in that respect.

Indicators and focus areas which respondents identified as important in the context of the *ex-post* evaluation of programmes included:

- Economic success of the projects (additional turnover, revenues from licences, turnover maintenance)
- Multiplier effects
- Labour market effects (created, safeguarded and eliminated jobs)
- R&D effects (patents, prototypes, cooperation)
- Additionality (role of the public funding/programme)
- Socio-economic impacts
- Customer satisfaction
- International cooperation
- Educational aspects
- Level of research and technology
- Industrial relevance
- Management of the programme (implementation, coordination, auditing, project selection)
- Programme activities
- Scientific results
- Contribution to standards
- Level of industry/academic collaboration
- Accuracy for respective programme (in the case of project evaluations)
- Absorption of resources available
- Mobilisation of resources from industry
- Human resource development

The indicators listed above are used both for the programme and the project *ex-post* evaluations. As in the case of the *ex-ante* evaluation indicators, *ex-post* indicators seem to cover a wide-ranging area of evaluation information.

There is however an evident difference here relating in particular to whether the evaluation is an integral or merely an incidental part of the programme process. In the former case, the evaluation of the programme and respective projects is already decided in the

programme planning phase and the funding of the evaluation may be financed from the programme budget. In the latter, it is up to the financier whether it wants to conduct an evaluation after the programme ends and there are no general rules for the evaluation of the whole programme. The *ex-post* evaluation was identified as an integral part of the programme processes in Denmark (Ministry of Science, Technology and Innovation), and for the Academy of Finland, the Hungarian Information Society Strategy and the Research Council of Norway.

In almost all cases, the *ex-post* evaluation is done immediately after the programme or respective project finishes. In order to assess the impacts of the programmes in the longer-term, evaluation of the results and impacts should however be monitored again at a later date. In the case of the Austrian Research Promotion Agency, the *ex-post* evaluations of individual projects are made four years after the end of the projects.

The *ex-post* evaluation theme was further elaborated in one of the CISTRANA workshops, *Programme Impact Assessment in National IST Initiatives* (PIANIST), organised on December 13-14 2005 in Paris by ANRT, the French partner in the CISTRANA project. The workshop report and all of the presentations are available on the CISTRANA website[14]. The workshop enabled us to reach concrete conclusions that were translated into a set of commonly agreed recommendations for programme evaluation:

**Recommendation 1:**
Develop a pertinent methodology for the evaluation before the programme starts

**Recommendation 2:**
Evaluation and monitoring must be considered as a management tool and a learning process for structuring information

**Recommendation 3:**
Early design of the evaluation process on clearly pre-defined targets

**Recommendation 4:**
The construction of an “intervention logic model” is recommended at an early stage to design the research investment

**Recommendation 5:**
Select suitable indicators

**Recommendation 6:**
Take into account the nature of the programme finalities (basic research or innovation technologies) in the evaluation design

***Conclusions***

The policy process of setting up R&D programmes is rarely a rational one. The initiation and planning of programmes varies both between and within countries, depending on the funding organisation involved. On the one hand, this can improve the flexibility of the

[14] http://www.cistrana.org/

policy process, on the other however the efficiency and rationality of funding organisations can often be weakened if there are no established rules in programme management.

Table 7 presents the most common type of R&D programme process with alternative procedures identified from the survey responses.

**Table 7: R&D programme processes**

| | Programme Initiation | Programme Implementation | Programme Evaluation |
|---|---|---|---|
| **Typical process** | -National research community and industrial actors are involved during the idea generation and preparation phase<br><br>-Decision to launch the programme is made in the funding agency by the Board of the agency or Board of directors. | -Steering and coordination of programmes are managed by different committees. Committee members are usually representatives of the national scientific community, industry and governmental bodies.<br><br>-Some of the tasks can be outsourced, e.g. project selection or evaluation of project proposals. | -*Ex-ante* and *ex-post* evaluations are undertaken by external experts or consultants appointed by the funding organisation or the superior governmental body.<br><br>-Interim evaluations are conducted internally for monitoring purposes<br><br>-*Ex-post* evaluations are made immediately after the end of the programme or respective projects. |
| **Alternative process (es)** | -Horizontal governmental organisations are involved in idea generation and programme formulation<br><br>-A special representative Committee makes the final decision.<br><br>-Decisions on extensive national programmes are taken at a higher political level (e.g. the Council of Ministers) | -Programme management can be outsourced to a private company, subordinate agency or consortium.<br><br>-All programme management operations can be done in-house by internal experts.<br><br>-Governmentally pervasive programmes can be managed jointly between horizontal organisations. | -Project proposal evaluations can be entrusted to several organisations<br><br>-Interim evaluation can be used for deciding whether to continue or revise the whole programme and also for assessing the adequacy of performance indicators.<br><br>-*Ex-post* evaluation of the programme or respective projects can be made retrospectively in order to assess the impacts of the programme better. |

No indication was given in the responses as to how the cooperation and interaction between other national R&D programmes is arranged within each country. The acquiring of information on this issue in the future is thus desirable, as the information would be useful in analysing the national programme processes of each country. Coordination between different programmes is an important factor here when evaluating the effectiveness of national R&D activity.

The national research communities have a major influence on the content and framework of R&D programmes and they typically also have a major role in the practical planning process of the programmes. Programmes are rarely designed on a purely ‘top-down’ basis. Research communities and industrial actors are often consulted when deciding the allocation of funds for important research topics.

The decision to launch a programme is usually made by the funding organisation itself and specifically by the board or board of directors. In some cases the decision is made outside of the funding organisation with the assistance of peer-organisations. Decisions on extensive national programmes are taken at a higher political level e.g. at the Council of Ministers.

No systematic efforts were made in respect of national and international cooperation in relation to the (co)financing of programmes. This provides a major challenge in terms of the coordination of national ICT programmes.

The programme implementation procedures are in most cases managed by different committees and boards of external experts and stakeholders. In some cases programme management is outsourced or jointly managed. In few cases the whole management process is done ‘in-house’.

Evaluation is an important and recurrent operation in the programme processes, although the *ex-post* evaluation of a programme as a whole is not a generalised rule in the funding organisations. Due to the fact that many of the programmes identified in the responses have no pre-defined endpoint however, the evaluation phase of a programme is not applicable in the same way as in fixed-term programmes.

# 8. National R&D programmes in the field of ICT

Realizing that various definitions for the word 'programme' exist among the users of international English, a consensus was agreed defining it as "national public funding given to companies, public research institutes or universities etc. through calls or similar procedures to be used for research and technological development (R&D) in the field of information and communications technology (ICT)". The focus of the survey was on national-scale programmes, but information on significant regional programmes was also allowed. To some extent, the responses to the questionnaire on R&D programmes reflect the various interpretations given to the term 'programme'. To clarify this variation, the programmes were divided into three categories according to the nature of each programme. The categories were, (1) 'programmes' which aim to cover all ICT related R&D topics, normally within a pre-defined timeframe (i.e. have a fairly 'bottom-up' approach), (2) 'programmes' with defined ICT sub-area(s) for which R&D funding is offered, typically within a pre-defined timeframe, and, (3)'programmes' outside the scope of these two (covering descriptions of councils, institutes, foundations, centres of excellence and 'programmes' in which the main focus seems to be on building infrastructure rather than on R&D). The total number of questionnaires received on national R&D programmes in the field of ICT was 134. Table 8 below summarises the programme data.

Information was collected on programmes which had ended in 2004, were on-going, or for which the decision to launch had been made at the time of the survey (10/2004-3/2005). In addition, information updates received by the end of 2005 have also been catered for in this final report.

In this chapter, the 20 largest individual programmes, by volume, are initially presented, in section 8.1, by means of a clustering approach. The R&D programme analysis continues by looking at the programme data from selected technology and application-oriented perspectives in sections 8.2 and 8.3, respectively. Finally, section 8.4 presents an overview of already existing programme-based international cooperation.

**Table 8: Number of programmes in the survey data by country and by programme type**

| Country | Number of programmes by programme type | | | Total number of programmes in the survey data |
|---|---|---|---|---|
| | all ict | defined | other | |
| Austria | | 1 | | 1 |
| Belgium | - | - | - | - |
| Bulgaria | - | 1 | - | 1 |
| Cyprus | - | 2 | - | 2 |
| Czech Republic | - | 1 | - | 1 |
| Denmark | | - | 5 | 5 |
| Estonia | - | - | - | - |
| Finland | - | 14 | - | 14 |
| France | - | 9 | - | 9 |
| Germany | - | 9 | 2 | 11 |
| Greece | - | 8 | 1 | 9 |
| Hungary | 5 | - | 2 | 7 |
| Iceland | - | 1 | - | 1 |
| Ireland | - | - | 2 | 2 |
| Israel | - | - | 4 | 4 |

| | | | | |
|---|---|---|---|---|
| Italy | - | 1 | 4 | 5 |
| Latvia | - | 1 | - | 1 |
| Lithuania | - | - | - | - |
| Luxembourg | - | - | - | - |
| Malta | 1 | - | - | 1 |
| Netherlands | - | 17 | 3 | 20 |
| Norway | 1 | 3 | - | 4 |
| Poland | - | 1 | 2 | 3 |
| Portugal | - | - | - | - |
| Romania | - | 1 | - | 1 |
| Slovakia | - | 1 | - | 1 |
| Slovenia | - | - | 17 | 17 |
| Spain | - | 5 | - | 5 |
| Sweden | - | 2 | - | 2 |
| Switzerland | 1 | - | 3 | 4 |
| Turkey | - | - | 1 | 1 |
| United Kingdom | 1 | - | 1 | 2 |
| Total | 8 | 78 | 47 | 134 |

## 8.1. Top 20 programmes by volume

Table 9 below presents a listing of the twenty largest programmes in the data in terms of the amount of public funding. This information is based on the data of programmes classified as “defined” programmes (see previous chapter for definition). Some programmes from the “other” category are also considered later, but excluded from this Top 20 listing.

Evidently, Germany (8 programmes on the list), Finland (7), France (3) and Spain (2) are countries that are channelling major flows of public R&D funding through programmes with a defined scope. In fact, all of the programmes on this list are located in one of these four countries. As a whole, the Framework programme IT Research 2006 in Germany represents the biggest effort among the programmes. In this study however, this large programme is considered as four separate sub-programmes.

The major European effort is concentrated on a few strong areas. Actually, three or four clusters can be identified. Firstly, there is a micro-nano cluster including, on the one hand, two programmes that clearly focus on nanotechnologies: The Nanoelectronics and Nanosystems sub-programme of IT Research 2006 in Germany and the FinnNano programme in Finland, and, on the other hand, four programmes that have a somewhat broader focus, including the Framework programme Microsystems and Förderprogramm Optische Technologien in Germany, Micro-nanotechnologies network (RMNT) in France, and ELMO in Finland. The leader country of this cluster is Germany, with investments of almost one billion euros in the area through its ongoing five-year programmes.

Secondly, there is a communications cluster comprising the Basic technologies for communications engineering sub-programme, and partly also the Internet Basics and Services subprogramme, of IT Research 2006 in Germany, Telecommunications network (RNRT) in France, Converging Networks and NETS programmes in Finland, and the National Programme on Electronics and Communication Technologies – Subprogramme on Communication Technologies in Spain. In terms of programme budgets, Germany and

France are the major investors in this area, although two consecutive programmes in Finland also constitute a significant effort in this field.

The third cluster focuses on software engineering. The Software Technology Network (RNTL) in France and Forschungsoffensive Software Engineering 2006 in Germany both aim to strengthen the software engineering competence of companies through co-operation between public research and industry. Support for small or new businesses is also a central goal of both programmes. Forschungsoffensive Software Engineering 2006 belongs to the Software systems sub-programme of IT Research 2006, which also includes more research oriented themes.

The fourth cluster is perhaps not so well-defined. These programmes do however display some common topics related to modelling or information management in particular.

Large programmes in the "other" category include the LOFAR and GigaPort Next Generation in the Netherlands, as well as PIONIER in Poland. Such programmes generally however, invest most of their budget in the building of infrastructure even though some programmes also support research projects. GigaPort and PIONIER are building research networks while LOFAR has evolved from a telescope that consists of an array of simple antennas to a wide area sensor network.

**Table 9: Top 20 national programmes by volume of public funding**

| Country | Programme name | Volume | Start | End | Cluster |
|---|---|---|---|---|---|
| Germany | Framework programme IT Research 2006 Programme Area 1: Nanoelectronics and Nanosystems | 395,5 M€ | 2002 | 2006 | micro-nano |
| Germany | Rahmenprogramm zur Förderung Mikrosysteme (Framework programme Microsystems) | 300 M€*) | 2004 | 2009 | micro-nano |
| Germany | Framework programme IT-Research 2006 Programme Area 3: Basic technologies for communications engineering | 282,5 M€ | 2002 | 2006 | com |
| Germany | Förderprogramm Optische Technologien | 280 M€ | 2002 | 2007 | micro-nano |
| Germany | Framework programme IT Research 2006 Programme Area 2: Software Systems | 272,8 M€**) | 2002 | 2006 | software |
| France | Telecommunication Research Network (RNRT) | 208 M€ | 1998 | 2003 | com |
| Germany | Framework programme IT Research 2006 Programme Area 4: Internet Basics and Services | 150,5 M€ | 2002 | 2006 | com/info |
| France | Software Technology Network (RNTL) | 110 M€ | 2000 | 2004 | software |
| Finland | GIGA - Converging Networks | 100 M€ | 2005 | 2010 | com |
| Finland | NETS - Networks of the Future | 97 M€ | 2001 | 2005 | com |
| Germany | Forschungsoffensive Software Engineering 2006 | 93,5 M€ | 2003 | 2008 | software |
| Finland | FinnWell - Healthcare technology programme | 75 M€ | 2004 | 2009 | info |
| Spain | National Programme on Electronics and Communication Technologies-Subprogramme on Communication Technologies | 66,9 M€ | 2004 | 2007 | com |
| Spain | National Programme on Service Technologies for the Information Society. | 64,3 M€ | 2004 | 2007 | info |

| | | | | | |
|---|---|---|---|---|---|
| Finland | ELMO - Miniaturising Electronics 2002-2005 | 62 M€ | 2002 | 2005 | micro-nano |
| Germany | Ausbildungs- und Technologieinitiative Bioinformatik | 51,2 M€ | 2001 | 2006 | info |
| France | Micro-Nanotechnologies Network (RMNT) | 50 M€ | 1999 | 2004 | micro-nano |
| Finland | MASI - Modeling and Simulation | 46 M€ | 2005 | 2009 | info |
| Finland | FinnNano - Nanotechnology Programme | 45 M€ | 2005 | 2009 | micro-nano |
| Finland | FENIX - Interactive Computing | 39 M€ | 2003 | 2007 | info |

(*) 50 M€ per year 04-09
(**) Also includes the 93,5 M€ budget of Forschungsoffensive Software Engineering 2006

## 8.2. Technology orientation in national ICT R&D programmes

Looking further at the ICT programme data from selected technology-based angles, the following sections illustrate the national programmes dealing with communications technology, embedded systems, micro- and nanotechnology, and optoelectonics. These angles were selected based on the results of national policy priority analysis that identified most of these themes to be suitable for cooperation (see Sec. 6.2). As software technologies is a generic theme, appearing in most of the programmes, it has not been covered as an individual perspective as such, instead, the embedded systems theme is included due to its strategic importance for Europe.

### 8.2.1. Communications Technology

Communications technology is recognised as a European strength and as a key area for the future in the CISTRANA survey on national ICT R&D policies. Furthermore, high priority is also given to this area at the EU level. The 7th Framework programme recognises mobile and wireless communications as new technologies with high entry barriers, uncertain profitability, but high economic and social potential. Moreover, the overall policy objective of the mobile and wireless communications technology platform[15] is to reinforce Europe's leadership in mobile and wireless communications and services and to master the future development of the technology so that it best serves Europe's citizens and the European economy. In addition, foresight on information society technologies (FISTERA)[16] recognises that networks and communications were a prominent topic in most of the national foresight studies.

The importance of communications technology can also be seen in the national ICT R&D programmes. About 40% of the programmes and activities in the CISTRANA survey deal with communications technology at least to some extent. In the Top 20 programmes the communications cluster is strongly represented with 5-6 programmes in the area of communications technologies.

[15] http://www.emobility.eu.org/
[16] http://fistera.jrc.es/

It is clear that communications technology is viewed as an important investment area and future competitiveness factor in almost every European country. Presumably then this implies that there are many co-operation possibilities between the countries involved.

Finland and Germany invest substantial amounts of public funding in communications R&D programmes. Germany has a small number of very large programmes whereas Finland has several programmes which are more strictly focused and smaller in volume.

The programmes in this field are mostly planned and implemented as individual, national programmes. In most of the programmes there is no international co-operation, although it is considered possible. There are few programmes which have true international co-operation.

The programmes *EXSITE Explorative System-Integrated Technologies* and its successor *NORDITE* are truly collaborative (EXSITE was completed in 2003). Each programme was planned and implemented in co-operation, EXSITE between Finland and Sweden and NORDITE between Finland, Sweden and Norway. Co-operation occurs on the funding level, on the management level and between and within the projects. In addition, the programme *PROACT Research Programme on Proactive Computing* between Finland and France is similar style.

The Polish programme *PIONIER: Polish Optical Internet – Advanced Applications, Services and Technologies for Information Society* has co-operated with the DANTE consortium and the GEANT consortium in Great Britain. PIONIER also plans to broaden its co-operation to the USA and Canada by building new internet connections between Poland, the USA and Canada.

Some programmes have project level co-operation with different EU activities (e.g. EUREKA-projects and Framework Programme projects).

Below, all of the programmes and activities in the “defined”, “other”, and “all ICT” categories dealing with communications technology are listed in tables 10, 11, and 12, respectively. In addition, specified information about the 10 largest communications technology programmes is then also presented.

**Table 10: Programmes that are classified as “defined” programmes and which contain development and research in communications technology**

| Country | Organisation | Programme name | Volume | Start | End |
|---|---|---|---|---|---|
| Bulgaria | Ministry of Education and Science | Information Society - National Scientific Programme | 0,05 M€ per call | 2003 | 2005 |
| Cyprus | Research Promotion Foundation of Cyprus (RPF) | Research for enterprises | 2,55 M€ | 2003 | 2005 |
| Cyprus | Research Promotion Foundation of Cyprus (RPF) | Action "INFORMATION SOCIETY" | 7,65 M€ | 2003 | 2005 |
| Czech Republic | Academy of Sciences of the CR (AV CR) | Thematic National Research Programme Information Society | 6,6 M€ (2005) | 2004 | 2009 |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | Converging Networks | 100 M€ | 2005 | 2010 |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | Nordite | 14 M€ | 2005 | 2010 |
| Finland | Tekes, the Finnish Funding Agency for Technology and | Explorative System-Integrated | 4,2 M€ | 2001 | 2003 |

| | | | | | |
|---|---|---|---|---|---|
| | Innovation | Technologies | | | |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | NETS – Networks of the Future | 102 M€ | 2001 | 2005 |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | Vamos - Value Added Mobile Solutions | 30 M€ | 2005 | 2010 |
| Finland | Academy of Finland | Research Programme on Proactive Computing | 7,5 M€ | 2002 | 2005 |
| Finland | Academy of Finland | Future Electronics Research Programme | 7,5 M€ | 2003 | 2006 |
| France | Ministry of Research, Ministry of Industry | French Telecommunication Research Network | 208 M€ | 1998 | 2003 |
| Germany | Federal Ministry of Education and Research | Framework programme IT Research 2006 – Programme Area 4: Internet Basics and Services | 150,5 M€ | 2002 | 2006 |
| Germany | Federal Ministry of Education and Research | Framework programme IT-Research 2006 - Programme Area 3: Basic technologies for communications engineering | 282,5 M€ | 2002 | 2006 |
| Greece | General Secretariat of Research and Technology/Ministry of Development | INFORMATION SOCIETY PROGRAMME/MEASURE 3.3: Research and Technological development in the IT domain/E-business | 8,8 M€ | 2002 | 2005 |
| Netherlands | Telematica Instituut | Freeband Communication | 30 M€ | 2004 | 2009 |
| Netherlands | Thales Research & Technology Netherlands | Interactive Collaborative Information Systems | 13,7 M€ | 2004 | 2009 |
| Netherlands | Stichting MultimediaN | Multimedia Netherlands | 16 M€ | 2004 | 2008 |
| Netherlands | Netherlands Organisation for Scientific Research (NWO) | Netwerk van Netwerken | 4 M€ | 2002 | 2006/ 2007 |
| Netherlands | Stichting Bevordering Onderzoek Ambient Systems | Smart Surroundings | 6,5 M€ | 2004 | 2008 |
| Netherlands | Wetenschap en Technologie Centrum Watersgraafmeer | Virtual Lab E-Science | 27,6 M€ | 2004 | 2009 |
| Norway | Research Council of Norway | Basic ICT Research | 20 M€ | 2000 | 2007 |
| Norway | Research Council of Norway | ICT Trust and Security | 7 M€ | 2003 | 2007 |
| Slovakia | Ministry of Education | Building the Information Society | 15 M€ | 2002 | 2005 |
| Spain | Ministry of Education and Science | National Programme on Electronics and Communication Technologies- Subprogramme on Communication Technologies | 66,9 M€ | 2004 | 2007 |
| Sweden | VINNOVA | Future Communication Networks | 10 M€ | 2001 | 2006 |
| Sweden | VINNOVA | Network Based Software Technology | 10 M€ | 2001 | 2006 |

**Table 11: Programmes that are classified as "other" programmes and which contain development and research in communications technology**

| Country | Organisation | Programme name | Volume | Start | End |
|---|---|---|---|---|---|
| Germany | BMBF | IT2006 subtopic "magnetoelectronics" | 1453 M€ | 2002 | 2006 |
| Greece | General Secretariat of Research and Technology/Ministry of Development | INFORMATION SOCIETY PROGRAMME/MEASURE 3.3:Research and Technological development in the IT domain/ Upgrading of the Greek Research and Technology Network | 19 M€ | 2001 | 2006 |
| Hungary | Hungarian Scientific Research Fund Programmes (OTKA) | Hungarian Scientific Research Fund Programmes (OTKA) | 95 M€ in 2001-2004 | 1997 | |
| Hungary | National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI) | Mobil 2004 | 2005: 180 M€ (Fund, all fields altogether) | 2004 | |
| Ireland | Enterprise Ireland | Commercialisation Fund | 45 M€ | 2003 | 2006 |
| Israel | Office of the Chief Scientist (OCS), Ministry of Industry Trade & Labour | R&D fund | 95 M€/year for communications | 1974 | |
| Italy | Ministry of Education, University and Research | Fondo Agevolazioni Ricerca | 81 M€ in 2004-2005 | | |
| Netherlands | Embedded Systems Institute | Embedded Systems Institute | 25 M€ | 2004 | 2008 |
| Poland | State Committee for Scientific Research (at present the Ministry of Science and Higher Education) | PIONIER: Polish Optical Internet - Advanced Applications, Services and Technologies for Information Society | 70 M€ | 2001 | 2005 |
| Slovenia | Institute of Mathematics, Physics and Mechanics | Selected Topics in Theoretical Computer Science and Combinatorial Optimization | 0,561 M€ | 2004 | 2008 |
| Slovenia | University of Maribor, Faculty of Electrical Engineering and Computer Science | Advanced methods of interaction in telecommunication | 0,729 M€ | 2004 | 2008 |
| Slovenia | INSTITUTE JOZEF STEFAN | Parallel and distributed systems | 1,1 M€ | 2004 | 2008 |
| Slovenia | INSTITUTE JOZEF STEFAN | Telecommunication systems | 1,487 M€ | 2004 | 2008 |
| Slovenia | INSTITUTE JOZEF STEFAN | Technologies, services and business in the next generation networks | 0,758 M€ | 2004 | 2008 |
| Slovenia | University of Maribor, Faculty of Electrical Engineering and Computer Science | Telematics | 0,337 M€ | 2004 | 2008 |
| Slovenia | University of Ljubljana, Faculty of Electrical Engineering | Algorithms and optimization methods in telecommunications 1,010 Me, 2004-2008 | 1,010 M€ | 2004 | 2008 |
| Switzerland | Swiss National Science Foundation | National Center of Competence in | 21 M€ | 2001 | 2013 |

| | | | | | |
|---|---|---|---|---|---|
| | | Research in Mobile Communication and Information Systems | | | |
| Turkey | TUBITAK-TIDEB (Technology Monitoring and Evaluation Board) | Industrial R&D Grant Programme | 30 M€/year | 1995 | |

**Table 12: Programmes or activities that are classified as "all ICT" programmes prioritizing communications technology in some way**

| Country | Organisation | Programme name | Volume | Start | End |
|---|---|---|---|---|---|
| Hungary | National Office for Research and Technology (NKTH) / Agency for Research Fund, Management and Research Exploitation (KPI) | Economic Competitiveness Operational Program: Measure 3.1 – Support to application-oriented co-operative R&D activities | 61,2 M€ | 2004 | 2006 |
| Hungary | Ministry of Informatics and Communications / Ministry of Education | ITEM (Innovative Technological Solutions to Promote the Information Society) | 5,1 M€ | 2002 | 2003 |
| Hungary | National Office for Research and Technology (NKTH) / Agency for Research Fund, Management and Research Exploitation (KPI) (and their legal predecessors) | Infocommunications Technologies and Applications | 26 M€ | 1996 | 2004 |
| Hungary | National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI) (and their legal predecessors | National Research and Development Programmes | 175 M€ in 2001-2004 | 2000 | |
| Norway | Research Council of Norway | ICT Innovation programme | 60 M€ | 2001 | 2006 |

## Specified information about the 10 largest "Defined" programmes:

### Framework programme IT-Research 2006 - Programme Area 3: Basic technologies for communications engineering, *Germany*

This German programme is administered by the Federal Ministry of Education and Research. Its duration is 2002-2006 and the budget is 282.5 M€. This programme concentrates on four areas:

**Photonic Communication Networks**
The objective is to adapt the core network, based on optical transmission technology to the increased demands of the Internet over the next few years. The research aims to increase capacity from a transmission rate of up to 50 Terabit per second per optical fibre by 2005. Furthermore, it is important that an intelligent network management is developed for the optical message network which can

ensure application services with guaranteed transmission qualities between core, distribution and access networks.

**Mobile Broadband Communication Systems**

The development of the mobile Internet and its universal availability (any time, any place) plays a key role. The challenges of future mobile communication are the universal supply of bandwidths and the efficient use of all resources. New concepts and architectures are necessary to meet the demands of a volume of traffic that is changing dynamically.

**Innovative Display Technology**

The objective is to develop innovative display solutions for communication, mobility and production. Tailor-made component solutions for vehicles and communications technologies using innovative production processes, with high output, seem to be promising for the future.

**New Components and Materials**

The objective is to push basic research ahead in the field of new communication technologies so that new materials and new physical effects, such as in quantum physics, can be used to develop innovative components. Furthermore, it is necessary to develop optical memory technologies for the multi-gigabyte area. On the one hand, the objective is being pursued comprehensively in order to increase the competitiveness of German manufacturers and service providers. On the other hand, basic research is being carried out in selected fields to enable new products and services in the longer term.

http://www.it2006.de/

**French Telecommunication Research Network, *France***

RNRT (the National Telecommunication Research Network) is the French National Research and Innovation Programme for Telecommunication. It is supported by key telecommunication stakeholders and funded by the Ministry of Industry and the Ministry of Research. During the years 1998-2003 the budget was 208 M€. The scope of RNRT covers:

radio and optical technologies in networks
signal processing and associated integrated circuits
network architecture and telecommunications systems
software engineering for telecommunications
human-machine interactions, human factors and service acceptability

http://www.telecom.gouv.fr/rnrt

**Framework programme IT-Research 2006 - Programme Area 4: Internet Basics and Services, *Germany***

This German programme is administered by the Federal Ministry of Education and Research. Its duration is 2002-2006 and its budget is 150.5 M€. This programme concentrates on two research topics:

**Middleware and Protocols for the Internet**

Research must work on solutions that meet increased demands on bandwidth, quality of service (QoS), availability, reliability, security and mobility. The emphasis of the research must lie with the control and operation mechanisms of the network, which must be kept as simple as possible. Initial and subsequent costs that are too high can

delay or even prevent industrial use of these concepts and technologies. The provision of a network platform with these properties will enable the realization of new, innovative business ideas in the services and application area and therefore considerable economic potential.

**Mobile Internet**

Further development of the Internet is marked by the integration of mobile access possibilities and new standards for organization and communication, as well as by increases in bandwidth and speed. Since European companies have a strong position in digital mobile communication, merging the Internet with digital mobile communication ("mobile Internet") can increase the prospects of European Internet technologies. This could benefit both the market opportunities for European industry in the field of internet equipment as well as in particular the development of innovative Internet applications.

http://www.it2006.de/

**Networks of the Future (NETS), *Finland***

This Finnish programme is administered by Tekes. Its duration is 2001-2005 and its budget is 102 M€.

The objectives of the NETS Programme are:

- to promote the leading position of the Finnish telecommunications industry in technologies of wireless systems and broadband packet switched networks, and also in the technology sectors critical for the current and future business
- to generate new business opportunities for the markets of wireless and broadband networks, terminals, and software for achieving an internationally leading position
- to promote the leading positions of Finnish enterprises as innovators and developers of applications, services, and content based on the mobile and broadband technologies
- to expand and diversify the business and service activities utilising telecommunications technologies

The key technology areas are:

- architectures and implementation technologies of future wireless systems and networks
- technologies of broadband packet switched networks
- new service concepts and applications utilising the networks

http://www.tekes.fi/ohjelmat/nets

**Converging Networks (GIGA), *Finland***

This Finnish programme is administered by Tekes. Its duration is 2005-2010 and its budget is 100 M€.

The main objectives are:

- to intensify and enhance the national strengths of the broadband communication
- to strengthen the strategic basic research and applied research know-how in the field of broadband communication
- to create new strategic know-how in the key broadband technologies

- to increase international cooperation especially in the research field between universities and research institutes
- to contribute to the international standardisation

The key technology areas are:

1. Wireless access
    - Wide area broadband networks
    - Short range broadband communication
    - Terminals and base stations
    - Access networks
2. Seamless networking
3. Network support

http://www.tekes.fi/ohjelmat/giga

**National Programme on Electronics and Communication Technologies-Subprogramme on Communication Technologies, *Spain***

This Spanish programme is administered by the Ministry of Education and Science. Its duration is 2004-2007 and its budget is 66.9 M€.

The main objectives are:

- maximal mobility on communications
- higher broadband with improved management
- strategic actions for Digital TV

Technology areas are extremely split between technologies. It may be that highlighted areas are antenna development and 3rd/4th generation mobile technologies for professional equipment (stations).

http://www.mec.es

**Freeband Communication, *the Netherlands***

This Dutch programme is administered by the Telematica Institut. Its duration is 2004-2009 and its budget is 30 M€. This programme also funds defined technology areas other than those relating to communications technology.

The vision for Freeband for 2010 is to consider communication and information transfer from the perspective of the user, not the provider. The communication infrastructure will become transparent and abundant in all its layers. The focus of Freeband is to create a leading knowledge position for the Netherlands in the forthcoming ambient intelligent communication environment so that its industry and society can profit from both the construction and application of this environment. Freeband addresses the knowledge chain of the new ubiquitous communication paradigm. New knowledge is needed in the most important components of that chain.

The key technology areas are:

- Middleware and distributed systems
- Dependable systems and infrastructures
- Trust and security
- Embedded systems

- Internet technologies
- Network management
- Switching, routing and communication systems
- Computing architectures
- Micro-systems and sensors

http://www.freeband.nl

**Value Added Mobile Solutions (VAMOS), *Finland***

This Finnish programme is administered by Tekes. Its duration is 2005-2010 and its budget is 30 M€.

The main objectives are:

- increase utilizing wireless & mobile technology widely in industries like paper, traffic, constructions and services
- improve productivity by developing mobile solutions for businesses
- improve internationally successful mobile business solutions and create new business opportunities

The key technology areas are mobile and wireless technologies.

http://www.tekes.fi/ohjelmat/vamos

**Basic ICT Research, *Norway***

This Norwegian programme is administered by the Research Council of Norway. Its duration is 2000-2007 and its budget is 20 M€. This programme also funds defined technology areas other than those in communications technology.

The main objective is to generate and make available new knowledge within the areas:

- distributed systems
- communication technology
- large software systems

The key technology areas are:

- software engineering
- middleware and distributed systems
- dependable systems and infrastructures
- knowledge and information management
- agent technologies
- internet technologies
- network management
- mobile and wireless communications
- switching, routing and communication systems

**Multimedia Netherlands, *the Netherlands***

This Dutch programme is administered by Stichting MultimediaN**.** Its duration is 2004-2008 and its budget is 16 M€. This programme also funds defined technology areas other than those in communications technology.

Multimedia Netherlands involves the knowledge creation and transfer on handling of video, pictures, audio and language in ICT. Knowledge creation is focused on four themes:

- processing multimedia data streams: combined video, audio and speech gaining, extracting and analysis
- connecting and interacting to different modularities of computers around us: ambient databases and emotional interfaces
- providing semantic access to multimedia databases: internet's next generation search technology and individual adapted interfaces
- enriching content and discover knowledge by intelligent and adaptive pattern recognition, adding structure and annotations to multimedia data

The key technology areas are:

- software engineering
- middleware and distributed systems
- agent technologies
- trust and security
- mobile and wireless communications

http://www.multimedian.nl

### 8.2.2. Embedded Systems

Embedded systems refer to electronic devices, or groups of them, containing a significant amount of application-specific computational power or embedded software. Such systems include, for example, mobile phones, cars, aircraft, smart sensor networks etc. Compared to the number of PC's and the like, the amount of embedded computers is overwhelming.

The significance of embedded systems can hardly be overestimated – a fact reflected e.g. in the EU policy where dominant players launched the ARTEMIS Technology Platform[17], a key initiative in the building of the European Research Area. The scope of embedded systems is very wide, encompassing concepts such as "ubiquitous networks" or "ambient intelligence". It can be justly claimed that nearly all European electronics programmes contain elements related to embedded systems, which in turn makes it cumbersome to differentiate between those where the focal point is mainly on embedded systems and those where it is not.

Our study indicates that most of the programmes in this field indeed serve a somewhat larger scope than just embedded systems, with the exception of the PROGram for Research on Embedded Systems and Software in the Netherlands which focuses directly on them. From the information provided it is impossible to say just exactly how much is dedicated to embedded systems, likewise it is also clear, due to the omission of key words, that they are represented in many programmes not listed here. For example, large and important embedded system providers such as France or Italy do not show up here. The Netherlands has the clearest focus, which is hardly surprising due to the very strong Dutch industry in this field.

[17] http://www.artemis-office.org/

Typically, programmes in this field are national, though the option to include international co-operation is available. For example, EUREKA umbrella ITEA 2 contains projects which may be parts of national programmes. It is also anticipated that the aforementioned ARTEMIS Technology Platform will lead to a significant Joint Technology Initiative by the end of 2007.

Next, the defined type of programmes containing R&D in embedded systems are listed first in table 13 below, followed by some more specific information on these programmes.

**Table 13: Programmes dedicated to or containing a significant contribution to development and research in embedded systems**

| Country | Organisation | Programme name | Volume | Start | End |
|---|---|---|---|---|---|
| Austria | BMVIT, Austrian Federal Ministry for Transport Innovation and Technology | FIT-IT (Forschung, Innovation, Technologie – Informationstechnologie) | 29,9 M€ | 2002 | 2007 |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | ELMO – Miniaturising Electronics | 62 M€ | 2002 | 2005 |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | Healthcare Technology Programme | 75 M€ | 2004 | 2009 |
| Finland | Academy of Finland | The Application of Information Technology in Mechanical, Civil and Automation Engineering | 6 M€ | 2005 | 2009 |
| Finland | Academy of Finland | Research Programme on Proactive Computing | 7,5 M€ | 2002 | 2005 |
| Finland | Academy of Finland | Future Electronics Research Programme | 7,5 M€ | 2003 | 2006 |
| Germany | BMBF (Bundesministeriums für Bildung und Forschung) | Framework programme IT Research 2006 Programme Area 1: Nanoelectronics and Nanosystems | 395,5 M€ | 2002 | 2006 |
| Germany | BMBF (Bundesministeriums für Bildung und Forschung) | Framework programme IT Research 2006 Programme Area 2: Software Systems*) | 272,8 M€ | 2002 | 2006 |
| Germany | Project Management Organization Software Systems | Forschungsoffensive Software Engineering 2006 | 93,5 M€ | 2003 | 2008 |
| Hungary | National Office for Research and Technology (NKTH) / Agency for Research Fund, Management and Research Exploitation (KPI) | Economic Competitiveness Operational Program: Measure 3.1 – Support to application-oriented co-operative R&D activities | 61,2 M€ | 2004 | 2006 |
| Hungary | Hungarian Scientific Research Fund Programmes (OTKA) | Hungarian Scientific Research Fund Programmes (OTKA) | 95 M€ in 2001-2004 | 1997 | |
| Hungary | National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI) (and | National Research and Development Programmes | 175 M€ in 2001-2004 | 2000 | |

| | | | | | |
|---|---|---|---|---|---|
| | their legal predecessors | | | | |
| Netherlands | Stichting Astronomisch Onderzoek in Nederland | LOFAR ICT for Wide-area Adaptive Sensor Network | 65 M€ | 2004 | 2009 |
| Netherlands | Telematica Instituut | Freeband Communication | 30 M€ | 2004 | 2009 |
| Netherlands | Netherlands Organization for Scientific Research | Netwerk van Netwerken | 4 M€ | 2002 | 2006/ 2007 |
| Netherlands | Technology Foundation STW | PROGram for Research on Embedded Systems and Software | 20 M€ | 1998 | 2010 |
| Netherlands | Embedded Systems Institute | Embedded Systems Institute | 25 M€ | 2004 | 2008 |
| Norway | Research Council of Norway | ICT Innovation Programme | 180 M€ | 2001 | 2006 |
| Slovenia | University of Maribor | Mechatronics Systems | 1,7 M€ | 2004 | 2008 |
| Slovenia | Institute Josef Stefan | Computer Structures and Systems | 1,7 M€ | 2004 | 2008 |

(*) Also includes the 93,5 M€ budget of Forschungsoffensive Software Engineering 2006

## Specified information about the programmes:

### FIT-IT(Forschung, Innovation, Technologie – Informationstechnologie), *Austria*

Programme objectives are:

- Development of radically new information technology resulting in a functional prototype in Austria
- Improving the competitiveness of Austrian research and economy
- Training of highly qualified researchers
- Improving the European and international visibility and networking of Austrian research

Main ICT technology areas in the programme are embedded systems, semantic systems and systems on chip.

http://www.fit-it.at

### ELMO - Miniaturising Electronics 2002-2005, *Finland*

The aim of the ELMO Programme launched at the beginning of 2002 is to build a widely applicable know-how base for the coming years, with the focus on the core competence of the electronics sector. The major themes of the programme are miniaturising, integration, and cost-efficiency.

The total ELMO budget was estimated at approx. 100 M€. The target was reached in May 2005, and the cumulated program volume is finally 128 M€, out of which Tekes has funded 62 million.

The objectives of ELMO are:

- to promote the technological leadership of Finland in the sub-areas that are critical from the point of view of the electronics sector
- to createpreconditions for new business opportunities
- to increase mental human resources by encouraging research institutes and enterprises to participate in long-term research
- to develop the innovation environment by enhancing interaction between various parties
- to develop co-operation networks and the control of the value-chain
- to spur small and medium-sized enterprises to renew their operations

This programme is nationally based. International co-operation is however possible though potential foreign partner(s) must provide their own funding. Examples of possible co-operation forms includes: organised information exchange, student exchange, EUREKA projects, additional funding for EU-projects.

http://www.tekes.fi/ohjelmat/elmo

**Healthcare Technology Programme (FinnWell), *Finland***

The objective of the programme is to improve the quality and profitability of healthcare, and to promote business activities and export in the field.

The underlying idea of the programme is that technology only improves the quality and profitability of healthcare services if new procedures are simultaneously developed in as innovative a manner as the products themselves.

Areas of focus
• Processes of healthcare
• Technologies for diagnostics and care
• Healthcare IT related products and services

The programme is not dedicated to embedded systems but some of the projects do contain significantly embedded software.

http://www.tekes.fi/ohjelmat/finnwell

**The Application of Information Technology in Mechanical, Civil and Automation Engineering, *Finland***

The aim of the research programme is to create and establish a culture of basic research in the fields of mechanical, civil and automation engineering, to support postgraduate training in these fields and to liven up their rather traditionalist image and give them greater appeal.

ESF's Smart Structural Systems Technology -programme has some common themes and one common PI with this programme.

http://www.aka.fi

**Research Programme on Proactive Computing, *Finland***

The Research Programme on Proactive Computing (PROACT) funds fourteen projects in the field of proactive computing for a three-year period during 2002-2005. A proactive system adapts and adjusts to the user and his or her environment without requiring any conscious control. The programme integrates technological innovations in hardware and software with psychological, social science and medical research. The programme is organised in cooperation with the Academy of Finland, Tekes (the Finnish Funding Agency for Technology and Innovation), and the French Ministry of Research and New Technologies through their National Research Network for Software Technology, RNTL.

The objectives of the programme are (1) To support high quality research on proactive computing by funding several interrelated projects within the target area. (2) To develop IT solutions that will help people, especially the elderly and disabled, in everyday life. (3) To strengthen bilateral research cooperation between Finland and France. (4) To strengthen multidisciplinary research cooperation. (5) To intensify researcher training. (6) To strengthen funding cooperation between European funding organisations.

http://www.aka.fi

**Future Electronics Research Programme, *Finland***

The objective of the Future Electronics Research Programme (TULE, 2003-2006) is to promote long-term and high-level basic research leading to new innovative applications and to support the ongoing research and development efforts in Finland. A goal is to strengthen the scientific know-how in the fields that are important to the present and future development of the Finnish electronics industry, and to educate skilled workforce required to growth. At the international level a programme-based co-operation is targeted both in the European and wider field.

The TULE programme is composed of 18 research projects (of those 13 consortia) that include altogether 61 research group participations. The programme has three subject areas: circuits and systems; materials, optics and optoelectronics; and nanoelectronics. The total funding volume of the research programme of Future Electronics is 7.51 M€.

At the moment this programme is national. International co-operation is possible on project level but the foreign partner(s) must find their funding in their own country. Examples of possible co-operation forms: bilateral cooperation: workshops, forward looks, researcher mobility, (joint funding).

http://www.aka.fi

**Framework programme IT Research 2006 – Programme Area 1: Nanoelectronics and Nanosystems, *Germany***

The main technology areas of this programme are: nanoelectronics and systems, technologies and devices for electronics production, lithography processes for feature size area up to 70nm, lithography processes for feature size area up to 50nm and below (NGL), lithography processes for the mask process, innovative process technologies, material and layer systems for sub-100nm technologies, merging front and backends, third dimension of integration, new types of circuits and components, silicon nanoelectronics,

nanoelectronic components for lowest energy requirements, magnetoelectronics, spintronics, three-dimensional circuits configurations and basic structures, components and structures with "Embedded non-electronic Systems" and "Non-electronic Interfaces", innovative set-up and connection technologies, innovative silicon semiconductor power electronics, microelectronic components based on new basic materials, chip systems and design methods, chip architecture and circuit technology, new chip design, creation and handling chip complexity in design, development of new technologies and coordinated company-wide and international cooperation.

International co-operation will be performed in MEDEA+. MEDEA+ is the new industry-initiated pan-European programme for advanced co-operative Research and Development in Microelectronics. It has been set up and labeled within the framework of EUREKA (E! 2365) to ensure Europe's continued technological and industrial competitiveness in this sector. The central objective of the industry-driven multi-project MEDEA+ programme is to stimulate innovation and provide the technology platform which will allow the European microelectronics industry to stay in the group of worldwide leaders. This transborder cooperation will move our economies into the Information Age, contributing to the creation of higher added value and increased employment.

http://www.it2006.de/

**Framework programme IT Research 2006 - Programme Area 2: Software Systems, *Germany***

Software systems to improve product properties, to support services, modelling and simulation and to optimize production processes.

Software Systems promotes research in the areas
• Software Engineering
• Supercomputers and Grid Computing
• Human/Technology Interaction
• Intelligent Systems / Knowledge Processing
• Bio-analogous Information Processing

This programme is part of the framework programme IT Research 2006, which promotes research and innovation in 4 programme areas:
1. Nanoelectronics and Nanosystems
2. Software systems
3. Basic technologies for communications engineering
4. Internet – basics and services

Hungary and Germany are to create a joint research institute for information and communication technology. The initiative forms a part of a declaration signed by the countries' Ministries for Education and Research, which signifies their intention to develop and intensify cooperation in the fields of scientific research and technological development, the former German minister Edelgard Bulmahn described the declaration as "a new dimension in our cooperation" and said that Hungary and Germany were making a significant contribution towards turning Europe into one of the most innovative regions in the world. The cooperation will involve the University of Budapest and the Bay-Zoltan Research Centre in Hungary, and the Kaiserslautern Technical University and the Fraunhofer Institute for Software Engineering IESE in Germany.

http://www.it2006.de/

**Forschungsoffensive Software Engineering 2006, *Germany***

The German Federal Ministry of Education and Research (BMBF) supports with this programme the research cooperation between small and medium-sized enterprises (SMEs) on the one side and research institutes or universities on the other side in the field of software engineering. The goal is to strengthen the software engineering competence in Germany especially of SMEs. The fundings support projects which are not carried out without them.

German partners of ITEA projects are encouraged to participate. (ITEA is an E! cluster.)

http://www.softwarefoerderung.de

**Economic Competitiveness Operational Program: Measure 3.1 – Support to application-oriented co-operative R&D activities, *Hungary***

The programme provides financing for the support of research and development via several measures. Information and communication technology is specified as an area to address within measure 3.1, for application-oriented co-operative R&D activities.

http://www.nkth.gov.hu

**Hungarian Scientific Research Fund Programmes, *Hungary***

The objective of this programme is to provide independent and extensive support to scientific research and to the research infrastructure, to provide assistance for young researchers and to promote the achievement of scientific achievements of international standards. This programme follows a horizontal approach to financing basic research.

The projects financed have included (but are not limited to) the following technological areas:

Software engineering
Dependable systems and infrastructures
Agent technologies
Optimisation tools and decision support systems
Trust and security
Embedded systems
Internet technologies
Mobile and wireless communications
Micro- and opto-electronics
Micro-systems and sensors
Language and speech technologies
Visualisation, virtual environments and image processing

http://www.otka.hu

**National Research and Development Programmes, *Hungary***

The NKFP Programme is part of the Széchenyi Plan setting forth comprehensive economic objectives. It consists of 5 specific programmes:
- improving the quality of life,

- information and communication technologies,
- research on environmental and materials science,
- research on agribusiness and biotechnology,
- research on the national heritage and contemporary social challenges.

Its aim is to support the implementation of comprehensive research, development and innovation projects leading to scientific and technological breakthroughs in the fields specified above, the achievements of which contribute to the improved competitiveness of Hungary, to the improvement of the quality of life, to the establishment of quality jobs and to the foundation of a knowledge-based economy and society. The Programmes are furthermore intended to concentrate financial and intellectual resources, to synchronise basic and applied research with technological development, to strengthen and ensure the efficient utilisation of national research and development capacities, to improve our international scientific competitiveness and within that our success in winning international applications. In the area of Programmes 1 through 4, a key objective is to strengthen the collaboration between domestic research and development institutions and the economy, whereas in the area of Programme 5, the preservation and enrichment of our national heritage, and the exploration and answering of contemporary social challenges. In addition to the strengthening of the domestic scientific capacities, a major objective of these Programmes is to improve the contacts between research and the competitive sector.

http://www.nkth.gov.hu

**LOFAR ICT for Wide-area Adaptive Sensor Network, *the Netherlands***

LOFAR started as a new and innovative effort to force a breakthrough in sensitivity for astronomical observations at radio-frequencies below 250 MHz. The basic technology of radio telescopes had not changed since the 1960s: large mechanical dish antennas collect signals before a receiver detects and analyses them. Half the cost of these telescopes lies in the steel and moving structure. A telescope 100x larger than existing instruments would therefore be unaffordable. New technology was required to make the next step in sensitivity needed to unravel the secrets of the early universe and the physical processes in the centers of active galactic nuclei.

LOFAR is the first telescope of this new sort, using an array of simple omni-directional antennas instead of mechanical signal processing with a dish antenna. The electronic signals from the antennas are digitised, transported to a central digital processor, and combined in software to emulate a conventional antenna. The cost is dominated by the cost of electronics and will follow Moore's law, becoming cheaper with time and allowing increasingly large telescopes to be built. So LOFAR is an IT-telescope. The antennas are simple enough but there are a lot of them - 25000 in the full LOFAR design. To make radio pictures of the sky with adequate sharpness, these antennas are to be arranged in clusters that are spread out over an area of ultimately 350 km in diameter. (In phase 1 that is currently funded 15000 antennas and maximum baselines of 100 km will be built). Data transport requirements are in the range of many Tera-bits/sec and the processing power needed is tens of Tera-flops.

Itwas soon realised that LOFAR could be turned into a more generic Wide Area Sensor Network. Sensors for geophysical research and studies in precision agriculture have been incorporated in LOFAR already. Several more applications are being considered, given the increasing interest in sensor networks that “bring the environment on-line”.

http://www.lofar.org

**Freeband Communication, *the Netherlands***

People today are surrounded by communication means. The last few decades have led to an explosion of different means of communication. We are on the edge of a new 'paradigm change' which will move the centre of information control to the individual. He will become surrounded by “intelligent” electronic equipment that can provide almost all of their information and communication needs on demand: an ambient intelligent environment.

The vision for Freeband for 2010 is to consider communication and information transfer from the perspective of the user, not the provider. The communication infrastructure will become transparent and abundant in all its layers.

The focus of Freeband is to create a leading knowledge position for the Netherlands in the forthcoming ambient intelligent communication environment so that its industry and society can profit from both the construction and application of this environment.

Freeband comprises more than 40 organisations, including all important technology providers and many representative end-user organisations.

Freeband addresses the knowledge chain of the new ubiquitous communication paradigm. New knowledge is needed in the most important components of that chain, including:

- Enabling Technologies: What are the new possibilities in different sectors for ubiquitous communication and ambient intelligence? What do they presuppose as knowledge and how can they be realised?

- Networking, Service Provisioning and Generic User Interaction: The telecommunication infrastructure viewed from the user's perspective, what are the networks of the future?

- Society, Users and Applications: No new services emerge without adequate technology; conversely, it is the technology that drives the new paradigms! We need new electronic and optical technology for broadband wireless access, house networking, optical switching, body area networks. Freeband provides an opportunity to scale-up the ideas being investigated in the Freeband Knowledge Impulse programme, and makes a solid industrial embedding of knowledge possible.

ICT / Telecommunications industry (Philips, Siemens, Lucent Technologies, Thales) is the key player in the programme.

http://www.freeband.nl

**Netwerk van Netwerken, *the Netherlands***

Netwerk van Netwerken (Network of Networks) is a research programme which focuses on the question what are the main scientific, societal and policy questions resulting from the development of electronic networks that have to be solved, more specifically the dynamics in the development of complex ICT networks: how do the market structure, users and innovation influence the development of the infrastructural and technological components of ICT networks? Expert scientists from the fields of economics, sociology, legal sciences, business administration and policy studies are needed to jointly solve the complex problems. Emphasis will be on:
- Empirical social scientific and technologically oriented research aimed at the state-of-the-art and future prospects
- Making available adequate data and indicators by composing a data set
- Knowledge transfer from the results of the studies.

The structure of the programme comprises policy-relevant short-term studies, long-term studies, congresses and seminars, network information system and development of a database.

Cooperation between universities and institutes is encouraged in this programme.

http://ict.nwo.nl

**PROGram for Research on Embedded Systems and Software, *the Netherlands***

An embedded system is an information processing system that has been embedded in an equipment or system, of which it determines completely or partially the functionality and control; the information processing system and the surrounding system are completely mutually dependent.

Embedded systems industry in The Netherlands is rather well developed. The development of embedded systems is done particularly in the metal and electrotechnical industry and in the services industry. The technology is particularly important for industrial products, in which control and signal processing play a role, like in electronic components, telecommunication equipment, professional systems and consumer electronics.

Aim of PROGRESS is to raise knowledge and technological level regarding embedded systems in The Netherlands and to enhance the competitiveness of Dutch industry.

Industrial research laboratories are responsible of carrying out the programme.

http://www.embedded-systems.nl

**Embedded Systems Institute, *the Netherlands***

The research of the Embedded Systems Institute addresses the topic of architecting complex software-controlled systems for heterogeneous environments. This topic is subdivided further into a number of research themes.

The first subdivision is into design aspects and qualities. The design aspects have to do with the process of decomposition and integration. The systems architect applies a reduction strategy by means of repeated decomposition. Whenever something is decomposed, the resulting components will be decoupled by interfaces. The architect will invest time in interfaces, since these provide a convenient method to determine system structure and behavior, while decoupling the inside of these components from their external behavior. The true challenge for the architect is to design decompositions that in the end will support an integration of components into a system. Most effort of the architect is concerned with the integrating concepts: how do multiple components work together?

The qualities have to do with concerns and constraints about the possible external behaviors of the system. This includes the question of how to cope with uncertainties. The architect often must make decisions at moments when most substantiating data are still missing. On top of that, someof the available data will be false, inconsistent or interpreted wrong. Different qualities that we want the system to satisfy are often in tension with each other. The quality of high speed, for example, is in conflict with the quality of low power. Such tensions among the qualities playimportant roles in the design decisions of the architect.

The research program of the Embedded Systems Institute has four research themes that relate to design aspects. They are
- Systems architecture
- Specification methods
- Design modelling
- Distributed control.

Around qualities the research program has three research themes. They are:
- Verification and validation
- Reliability, predictability and robustness,
- Energy efficiency.

Because all of these themes support the central research question of architecting complex software-controlled systems for heterogeneous environments, they are strongly interrelated. Each project in the Embedded Systems Institute is aimed at one or more of these research themes, but almost all of the projects will address a number of them.

http://www.esi.nl

**ICT Innovation Programme, *Norway***

The main objective is to stimulate RTD-driven innovation in the ICT industry sector, by supporting RTD projects with a focus on core ICT domains (hardware, software and communications technologies, systems design methodologies). The programme aims at covering the whole ICT sector, i.e. without predetermined selection of RTD themes. However, embedded systems are mentioned as one of the keywords.

International collaboration is a plus in the selection process The programme funds Eureka projects and supports efforts to get involved in the EU IST programme.

http://www.program.forskningsradet.no/ikt

**Mechatronics Systems, *Slovenia***

Development of mechatronics systems presents a guarantee for development, technological progress and thus also of the overall society progress in both, developed and underdeveloped countries. All over the world enormous effort is made in the fields of controlled drives, electronic voltage inverters, embedded systems, and telerobotic applications connected with virtual environments for the technological solutions' demands from macro- to nano- world. Likewise the advance in the field of the optical MEMS sensors and measurement instrumentation interferes with most topical and promising fields of science, like nano-, optical and sensor technologies and their combinations and takes care for the transfer of those technologies into the practical use.

http://www.uni-mb.si/podrocje.aspx?id=2

**Computer Structures and Systems, *Slovenia***

New silicon technologies allow implementation of complex devices composed of heterogeneous cores, massive memory, communication networks, electro-mechanical sub-assemblies and intelligent sensors, which requires new multidisciplinary design approaches and introduces numerous problems in design and test. The proposed

research programme addresses these problems and is primarily focused on the subjects in which we have gained experience in our earlier research work.

A processor core is one of the basic blocks of a modern system-on-chip (SoC), therefore the basic knowledge of processor architectures is imperative for the proposed research programme. Following the progress in this field for a number of years, we concentrate on the problem of task scheduling and resource allocation in multithreaded systems. In the area of embedded systems we address problems of dynamic reconfiguration in real-time. We aim to explore the potential for rapid embedded reconfiguration in terms of predictability, reliability and power consumption searching for adequate technologies, such as real-time operating systems, programming languages, hardware platforms for experimental work and prototyping.

High-level systhesis faces complex combinatorial problems including parameters that are mutually dependent. Consequently, optimization of the design is often subject to analysis of extensive space of possible solutions. A typical example is concurrent resource allocation of the computing structure synthesized for a given target algorithm. Conventional approaches are often non-adequate, therefore we investigate alternative approaches based on metaheuristic algorithms.

System-on-Chip (SoC) design integrates large reusable blocks (i.e. cores) that have been designed and verified in earlier applications in practice. The cores put together in a SoC provide a wide range of functions, like CPUs, DSPs, interfaces, controllers, memories, etc. and normally originate from different core providers which makes the problem of testing rather challenging to the SoC designer. Technical problems (i.e., testability problems due to the limited access of internal points, built-in self-test design, high frequency signal integrity, etc.) as well as problems related to intellectual property issues initiated development of IEEE P1500 (Standard for Embedded Core Test). In collaboration with Laboratoire d'informatique, de robotique et de microelectronique de Montpellier (LIRMM) we explore possibilities of its extension to mixed-signal devices.

We also develop new approaches to functional test and built-in self-test for digital systems as well as mixed-signal test approaches based on oscillation test technique optionally supported by IEEE 1149.4 test infrastructure.

http://csd.ijs.si

### 8.2.3. Micro- and nanotechnologies

Microelectronics has become a foremost driver of social and economic progress worldwide. With an average annual growth of 15% a year for the past three decades, its industry has made massive investments and is heavily rooted in Europe, creating thousands of jobs[18]. Continuous miniaturisation has enabled the move from microelectronics to nanoelectronics – electronics with circuit dimensions of less than 100 nanometres – and the field is becoming even more essential to Europe.

[18] Vision 2020, Nanoelectronics at the Centre of Change, A Far-Sighted Strategy for Europe, European Commission, Report of the High Level Group - June 2004.

Table 14 lists the national programmes investing in micro- and nanoelectronics according to our data, though it is clear that some of the programmes again have a broader coverage. Some more specific information on the programmes is also given below. Our data includes only seven national programmes investing in nanoelectronics/nanotechnology, the biggest investors being Germany, France, and Finland. This table provides only a limited overview of the situation. This is so because some of the countries involved do not define nanotechnology under ICT at all, and thus information on those programmes was not provided. This is the case for the Netherlands[19], for example.

Typically the programmes are national, though the option to engage in international co-operation does exist. In this field, MEDEA+ EUREKA Cluster is the main platform for European cooperation. In addition, there is MNT ERA-NET[20], a successful ERA initiative involving 17 countries with 21 programmes, which launched a coordinated call for transnational research projects in January 2006.

**Table 14: Programmes dedicated to or containing significant development and research in micro- and nanotechnologies**

| Country | Organisation | Programme name | Volume | Start | End | micro | nano |
|---|---|---|---|---|---|---|---|
| Austria | BMVIT, Austrian Federal Ministry for Transport Innovation and Technology | FIT-IT ((Forschung, Innovation, Technologie – Informationstechnologie) | 29,9 M€ | 2002 | 2007 | X | |
| France | CEA(Comissariat a' l'Energie Atomique) | RMNT(Réseau français des micro et nanotechnologies) | 200 M€ | 1999 | 2004 | X | X |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | NORDITE | 6 M€ | 2006 | 2010 | X | |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | ELMO – Miniaturising Electronics | 62 M€ | 2002 | 2005 | X | X |
| Finland | Academy of Finland | Future Electronics Research Programme | 7,5 M€ | 2003 | 2006 | X | X |
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | FinNano | 45 M€ | 2005 | 2009 | X | X |
| Germany | Federal Ministry of Education and Research | Framework programme IT Research 2006 – Programme Area 1: Nanoelectronics and Nanosystems | 395 M€ | 2002 | 2006 | X | X |
| Germany | VDI/VDE Innovation + Technik GmbH | Rahmenprogramm zur Förderung Mikrosysteme (Framework programme Microsystems) | 300 M€*) | 2004 | 2009 | X | |
| Netherlands | Stichting Astronomisch | LOFAR ICT for Wide-area Adaptive Sensor Networks | 65 M€ | 2004 | 2009 | X | |

[19] Report from the first CISTRANA workshop on 8 November 2005, National policy priorities and RTD programmes in the field of ICT, available on CISTRANA web-site www.cistrana.org.
[20] http://www.mnt-era.net/

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Onderzoek Ambient Systems | | | | | | |
| Slovenia | University of Maribor, Faculty of Electrical Engineering and Computer Science | Mechatronics systems | 1,68 M€ | 2004 | 2008 | X | |
| Slovenia | INSTITUTE JOZEF STEFAN | Systems and control | 2,2 M€ | 2004 | 2008 | X | |
| Slovenia | University of Ljubljana, Faculty of Electrical Engineering | Algorithms and optimization methods in telecommunications | 1 M€ | 2004 | 2008 | X | |
| Spain | Ministry of Education and Science Ministry of Industry, Tourism and Trade | National Programme on Informatics | 29,7 M€ | 2004 | 2007 | X | |
| Switzerland | Swiss National Science Foundation | Quantum Photonics National Center of Competence in Research | 26 M€ | 2001 | 2005 | X | X |

*) 50 M€ per year 2004-09

## Specific information about the programmes:

### FIT-IT (Forschung, Innovation, Technologie – Informationstechnologie), *Austria*

Programme objectives are:

- Development of radically new information technology resulting in a functional prototype in Austria
- Improving the competitiveness of Austrian research and economy
- Training of highly qualified researchers
- Improving the European and international visibility and networking of Austrian research

Main ICT technology areas in the programme are embedded systems, semantic systems and systems on chip.

http://www.fit-it.at

### RMNT (Réseau français des micro et nanotechnologies), *France*

The main ICT technology area in this programme is micro and nano technologies. Specified technology areas include the following: micro and nanoelectronic's, optronic's

microsystems for all business sectors automotive, medical, peripheral, process control, telecommunication.
At the moment this programme is national. However, international co-operation on project level is possible but the foreign partner(s) must find their funding in their own country.

http://www.cea.fr/fr/actualites/articles.asp?orig=actu&id=641

**NORDITE 2005-2010, *Finland***

VINNOVA, the Research Council of Norway (RCN) and Tekes, the Finnish Funding Agency for Technology and Innovation have in 2005 launched a new technology programme, NORDITE. The new programme is only open to research organisations in the above-mentioned countries, and it will focus on research projects that will bring about positive results for the Scandinavian ICT industry. Tekes and VINNOVA have co-operated earlier in two technology programmes: INWITE in 1996-1999 and EXSITE in 2000-2003.

On April 25th 2005 a call for proposals was opened in the fields of technology development for SW radio, wireless sensors, short-range wireless networks and RFID or MEMS utilizing RF technology. The purpose with the call is to assist Swedish, Norwegian and Finnish research institutes and companies to further develop and demonstrate their technical expertise in that area.

Projects in this programme start 1.1.2006 and the first twoyears period will end by the end of 2007. In the beginning of 2007 there will be a second call of projects for the funding.

http://www.tekes.fi/ohjelmat/nordite

**ELMO - Miniaturising Electronics 2002-2005, *Finland***

The aim of the ELMO Programme launched at the beginning of 2002 is to build a widely applicable know-how base for the coming years, with the focus on the core competence of the electronics sector. The major themes of the programme are miniaturising, integration, and cost-efficiency.

The total ELMO budget was estimated at approx. 100 M€. The target was reached in May 2005, and the cumulated program volume is finally 128 M€, out of which Tekes has funded 62 million.

The objectives of ELMO are:

- to promote the technological leadership of Finland in the sub-areas that are critical from the point of view of the electronics sector
- to create preconditions for new business opportunities
- to increase mental human resources by encouraging research institutes and enterprises to participate in long-term research
- to develop the innovation environment by enchancing interaction between various parties
- to develop co-operation networks and the control of the value chain
- to spur small and medium-sized enterprises to renew their operations

This programme is nationally based. International co-operation is however possible though potential foreign partner(s) must provide their own funding. Examples of possible co-operation forms includes: organised information exchange, student exchange, EUREKA projects, additional funding for EU-projects.

http://www.tekes.fi/ohjelmat/elmo

**Future Electronics Research Programme, *Finland***

The objective of the Future Electronics Research Programme (TULE, 2003-2006) is to promote long-term and high-level basic research leading to new innovative applications and to support the ongoing research and development efforts in Finland. A goal is to strengthen the scientific know-how in the fields that are important to the present and future development of the Finnish electronics industry, and to educate skilled workforce required to growth. At the international level a programme-based co-operation is targeted both in the European and wider field.

The TULE programme is composed of 18 research projects (of those 13 consortia) that include altogether 61 research group participations. The programme has three subject areas: circuits and systems; materials, optics and optoelectronics; and nanoelectronics. The total funding volume of the research programme of Future Electronics is 7.51 M€.

At the moment this programme is national. International co-operation is possible on project level but the foreign partner(s) must find their funding in their own country. Examples of possible co-operation forms: bilateral cooperation: workshops, forward looks, researcher mobility, (joint funding).

http://www.aka.fi

**FinNano, *Finland***

Nanotechnology refers to science and technology operating at atomic, molecular and macromolecular levels and where the distances stretch from one nanometre to a hundred nanometres. Nanotechnology is an enabling technology and is connected to several different sectors. The point of departure is genuinely multidisciplinary, i.e., a combination of physics, chemistry and biology and engineering sciences. The objective of the programme is to study, exploit and commercialise nanoscale systems and phenomena occurring on a nanoscale.

**The vision of the FinNano programme**

The nanotechnology programme will strengthen Finland's position as an innovative high-tech country, in which enterprises, service providers and research institutions by exploiting nanoscale structures and phenomena are able to create unique products, services and innovations, the commercialisation of which increases the welfare of our society.

**Duration and costs of the programme**

The total duration of the programme is five (5) years, 2005 – 2009. The programme will be launched on 1st January 2005 and end on 31st December 2009.

The total volume of the programme including corporate financing is approx. 70 million euros. Tekes' costs of the programme are 45 million €, comprising 25 million € in research financing and 20 million € in corporate financing.

**The focuses of programme**

1. Innovative nanostructure materials
2. Nanosensors and nanoactuators
3. New nanoelectronics solutions

**The objectives**

The objective of the nanotechnology programme is to:

1. strengthen existing research, research prerequisites and to construct new expertise in multidisciplinary research groups and development centres
2. render the economic exploitation of research data more effective by converting research results into technology and products and to strengthen and accelerate the commercial development of nanotechnology
3. support national and international networking and researcher mobility
4. foster participation by Finnish researchers, research institutions and enterprises in the European Union's nanotechnology research and development programmes
5. strengthen regional expertise concentrations and to link these to international networks
6. promote effective and synergetic use of resources and infrastructures
7. encourage enterprises to see the potential of nanotechnology, and ensure that there emerge good prerequisites for utilizing nanotechnology applications

**Background**

The need for and time of the nanotechnology programme are explained by a number of current change factors: networked activity, efficacy requirements, environmental problems and sustainable development.

Nanotechnology products and services are growing at an annual rate of 30 - 40%. Factors accelerating the development of nanotechnology include the rise of the knowledge society, changes in research inputs, investments in advanced technology, the stimulating effect of unique products on industrial development, the need for miniaturisation of production and for cleaner production processes and the requirements of the information and communication sectors.

Programme activity suits new, emerging, rapid-cycle industrial or technology sectors, where the prerequisites for success are based on a capacity for quick innovation and the commercialisation of innovations.

FinNano is an international technology programme and the form of it is MNT ERA NET. Planned activities are: MNT ERA NET, Bi- or multilateral activities to generate EoI's forming a base for a Common Call. The number of participating countries (programmes) can vary.

http://www.tekes.fi/ohjelmat/finnano

**Framework programme IT Research 2006 – Programme Area 1: Nanoelectronics and Nanosystems, *Germany***

The main technology areas of this programme are: nanoelectronics and systems, technologies and devices for electronics production, lithography processes for feature size area up to 70nm, lithography processes for feature size area up to 50nm and below (NGL), lithography processes for the mask process, innovative process technologies, material and layer systems for sub-100nm technologies, merging front and backends, third dimension of integration, new types of circuits and components, silicon nanoelectronics, nanoelectronic components for lowest energy requirements, magnetoelectronics, spinotronics, three-dimensional circuits configurations and basic structures, components and structures with "Embedded non-electronic Systems" and "Non-electronic Interfaces", innovative set-up and connection technologies, innovative silicon semiconductor power electronics, microelectronic components based on new basic materials, chip systems and design methods, chip architecture and circuit technology, new chip design, creation and handling chip complexity in design, development of new technologies and coordinated company-wide and international cooperation.

International co-operation will be performed in MEDEA+. MEDEA+ is the new industry-initiated pan-European programme for advanced co-operative Research and Development in Microelectronics. It has been set up and labeled within the framework of EUREKA (E! 2365) to ensure Europe's continued technological and industrial competitiveness in this sector. The central objective of the industry-driven multi-project MEDEA+ programme is to stimulate innovation and provide the technology platform which will allow the European microelectronics industry to stay in the group of worldwide leaders. This transborder cooperation will move our economies into the Information Age, contributing to the creation of higher added value and increased employment.

http://www.it2006.de/

**Rahmenprogramm zur Förderung Mikrosysteme (Framework programme Microsystems), *Germany***

- to support collaborative projects between industry and research
- to improve networking of R&D facilities, MST manufacturers and users, with special regard to the requirements and interests of medium sized enterprises
- to enhance the technological and structural base for development and production services to manufacture MST products and components efficiently and cost-effectively
- to support the development of modular MST to become practical and tested interfaces and standards
- to secure future technological options of system integration through the timely development of new technologies
- to sustain the development of education and training possibilities in MST
- to facilitate innovation financing in the MST area and their applications.

http://www.mstonline.de

**LOFAR ICT for Wide-area Adaptive Sensor Networks, *the Netherlands***

LOFAR started as a new and innovative effort to force a breakthrough in sensitivity for astronomical observations at radio-frequencies below 250 MHz. The basic technology of radio telescopes had not changed since the 1960s: large mechanical dish antennas collect signals before a receiver detects and analyses them. Half the cost of these telescopes lies

in the steel and moving structure. A telescope 100x larger than existing instruments would therefore be unaffordable. New technology was required to make the next step in sensitivity needed to unravel the secrets of the early universe and the physical processes in the centers of active galactic nuclei. LOFAR is the first telescope of this new sort, using an array of simple omni-directional antennas instead of mechanical signal processing with a dish antenna. The electronic signals from the antennas are digitised, transported to a central digital processor, and combined in software to emulate a conventional antenna. The cost is dominated by the cost of electronics and will follow Moore's law, becoming cheaper with time and allowing increasingly large telescopes to be built. So LOFAR is an IT-telescope. The antennas are simple enough but there are a lot of them - 25000 in the full LOFAR design. To make radio pictures of the sky with adequate sharpness, these antennas are to be arranged in clusters that are spread out over an area of ultimately 350 km in diameter. (In phase 1 that is currently funded 15000 antennas and maximum baselines of 100 km will be built). Data transport requirements are in the range of many Tera-bits/sec and the processing power needed is tens of Tera-flops. It was soon realised that LOFAR could be turned into a more generic Wide Area Sensor Network. Sensors for geophysical research and studies in precision agriculture have been incorporated in LOFAR already. Several more applications are being considered, given the increasing interest in sensor networks that “bring the environment on-line”.
Information on international collaboration is not available on the programme level.

http://www.astron.nl/

**Mechatronics Systems, *Slovenia***

Development of mechatronics systems presents a guarantee for development, technological progress and thus also of the overall society progress in both, developed and underdeveloped countries. All over the word enormous effort is made in the fields of controlled drives, electronic voltage inverters, embedded systems, and telerobotic applications connected with virtual environments for the technological solutions' demands from macro- to nano- world. Likewise the advance in the field of the optical MEMS sensors and measurement instrumentation interferes with most topical and promising fields of science, like nano-, optical and sensor technologies and their combinations and takes care for the transfer of those technologies into the practical use.

Information on international collaboration is not available on the programme level.

http://www.uni-mb.si/podrocje.aspx?id=2

**Systems and control, *Slovenia***

The operation of modern systems and processes is largely based on embedded control technology, which integrates knowledge from control and systems theory, electronics, computer and information sciences, systems engineering and also knowledge from target application domains. The key objective of the underlying research programme is to contribute new methods and technical solutions for applications, which are expected to bring benefits in terms of better quality, efficiency and reliability as well as improved design, commissioning and use of control systems. The programme is composed of four major subprojects:

A.COMPLEX SYSTEMS CONTROL
Most processes can be controlled by relatively simple and standard control methods. Unfortunately there are also processes, which are rather complex regarding their

dynamics and uncertain behaviour. The focus within this subproject will be on research and application of nonlinear, predictive, self-tuning and adaptive control, able to cope with these problems. The applications on chemical processes, power systems and - in particular - wastewater treatment plants are foreseen.

B.FAULT DETECTION AND ISOLATION
On-line condition monitoring of products and processes is getting essential in modern production systems. Research in this field will concentrate on design of diagnostic systems robust to modelling errors. Particular endeavour will be paid to the application of advanced nonlinear signal processing techniques for extraction of features that proved useful in a range of industrial problems. The algorithms will be evaluated on laboratory test rigs and in the frame of demonstration applications in industry.

C. COMPUTER INTEGRATED PRODUCTION
One of the main issues in industry today is appropriate integration of the control processes on the physical (equipment) level, production level and business level. This is a hot topic, which is receiving a great deal of attention right now. Our work will concentrate on problems related to mastering the life-cycle of (integrated) control systems, to production decision support systems, to production scheduling algorithms, and to non-technical aspects of control and IT systems introduction. Research will be carried out in the close co-operation with several industrial partners in Slovenia.

D.DEVELOPMENT OF ADVANCED IMPLEMENTATION TECHNOLOGY
Control systems implementation is heavily based on mastering the appropriate implementation technology. Our focus will be on development of special-purpose modules for industrial programmable logic controllers (PLC's), on tools for more efficient implementation of advanced control algorithms, tools for better production control and on automatic code generation for PLC's.

Information on international collaboration is not available on the programme level.

http://www.ijs.si/ijs.html

**Algorithms and optimization methods in telecommunications, *Slovenia***

In the scope of the research program the following research activities are conducted: Retrieval, processing, characterization, analysis and modelling of real and synthetic telecommunication traffic. Switching and routing optimization of for next generation networks. Analysis and study of different network parameters impact on quality of services (QoS). Analysis of theoretical bounds of modulation methods and optimization of antennas of wireless local area networks. Optimization of optical fibers measuring methods and development of extremely fast electronics. Development of analog circuit optimization computer software for massive parallel computing. Application of algorithms developed for signal processing in communications to other areas of research (digital filtering in MRI, formation of an acoustic space image, ...). Development of new services in cooperation with service providers.

Information on international collaboration is not available on the programme level.

http://www.ijs.si/slo/ljubljana/univlj.html

**National Programme on Informatics, *Spain***

The aims of this programme are: Higher functionality on electronic subsets and systems. Higher integration and miniaturization with lower cost.

International co-operation is possible under Eureka or other recognized international programmes. Projects receive a higher priority.

http://www.mec.es/

**Quantum Photonics National Center of Competence in Research, *Switzerland***

This programme contains research in advanced areas of photonics with a view towards applications. The main fields of research addressed are quantum communications, nanophotonics and optical processes in nanoscale objects), advanced light sources from the near infrared to X-rays (light emitting diodes and diode lasers, quantum cascade lasers, high power fiber lasers, femtosecond and attosecond pulse generation), photonic systems and photonic integration (lasers, detectors, all optical switching, 2-dimensional photonic crystals).
The main technology areas of this programme are: active electro-optical components, based on semiconductor materials and glass fibers. (This includes growth and processing of semiconductor optical devices (diode lasers, light emitting diodes, optical waveguides, filters, switches, etc.)), fabrication of novel optical fibers (active fibers, hollow fibers, multicore fibers), secure transmission systems: quantum cryptography, far infrared sources for atmospheric monitoring and gas sensing, switching technologies and architectures, optical networks, micro- and optoelectronics, microelectronics and optoelectronics design, microelectronics and optoelectronics manufacturing processes, nano-devices, intellectual property blocks- Systems-on-a-Chip (SOC), authentication, cryptography, microsystems materials, packaging and interconnect and sensors.

The participating research groups have many EU collaborations, mainly via their participation in EU research programs and EU Networks. No formal links on the program level. International co-operation is possible. It should be based on concrete collaborations between research groups sharing common interests, rather than being an administrative exercise.

http://www.snf.ch/default_en.asp
http://www.esf.org/esf_domain_activity.php?language=0&domain=1&activity=1

### 8.2.4. Optoelectronics

Optoelectronics (photonics may also be used) refers to devices or systems utilizing photons, i.e. visible, infrared or ultraviolet light as well as X-rays. In principle, radio waves also belong to this category; they are however excluded from this study for practical reasons. On the other hand, pure optics is included (e.g. diffractive optics) though it does not necessarily require conversion from electronics to optics or *vice versa.*

Even though optoelectronics is a well established field of science and technology, significant potential remains for much wider use while rapid development is taking place in research, especially when it comes to semiconductor LED and laser technology.

It is perhaps surprising to see how few national programmes actually relate directly to optoelectronics, particularly given the fact that there remains significant potential both in research and in terms of commercial applications. This would lead us to speculate that the optoelectronic community was somewhat frustrated due to the failure of the previously anticipated growth in optical communications to materialise. However, the potential is still there and the only question is when the growth will actually occur. Likewise, there are other major areas where optoelectronics may offer competitive advantages as compared to other technologies.

Poland had a very specific focus in the programme already terminated, Switzerland and Germany also focused very specifically on optoelectronics, while the Finnish and Israeli programmes included optoelectronics as one part of their R&D programmes. Germany's expenditure is by far the largest of the selected programmes.

Typically programmes are national, but the option for international co-operation does exist. For example, Germany has been very active in promoting ERA-SPOT activity within the European framework programme.

**Table 15: Programmes dedicated to, or containing, significant development and research in optoelectronics**

| Country | Organisation | Programme name | Volume | Start | End |
|---|---|---|---|---|---|
| Finland | Tekes, the Finnish Funding Agency for Technology and Innovation | ELMO – Miniaturising Electronics | 62 M€ | 2002 | 2005 |
| Germany | Ministry for Education and Research (BMBF) | Förderprogramm Optische Technologien | 280 M€ | 2002 | 2007 |
| Israel | Office of the Chief Scientist (OCS), Ministry of Industry Trade & Labour | R&D Fund | 250 M€ | 1974 | |
| Poland | Ministry of Science and Information Technologies (at present: Ministry of Science and Higher Education) | Development of Blue Optoelectronics | 31 M€ | 2000 | 2004 |
| Switzerland | Swiss National Science Foundation | Quantum Photonics National Center of Competence in Research | 26 M€ | 2001 | 2005 |

## Specified information about the programmes:

### ELMO - Miniaturising Electronics 2002-2005, *Finland*

The aim of the ELMO Programme launched at the beginning of 2002 is to build a widely applicable know-how base for the coming years, with the focus on the core competence of

the electronics sector. The major themes of the programme are miniaturising, integration, and cost-efficiency.

The total ELMO budget was estimated at approx. 100 M€. The target was reached in May 2005, and the cumulated program volume is finally 128 M€, out of which Tekes has funded 62 million.

The objectives of ELMO are:

- to promote the technological leadership of Finland in the sub-areas that are critical from the point of view of the electronics sector
- to create preconditions for new business opportunities
- to increase mental human resources by encouraging research institutes and enterprises to participate in long-term research
- to develop the innovation environment by enchancing interaction between various parties
- to develop co-operation networks and the control of the value chain
- to spur small and medium-sized enterprises to renew their operations

At present this programme is national. International co-operation is possible though foreign partner(s) must provide their own funding. Examples of possible co-operation forms include, organised information exchange, student exchange, EUREKA projects, and additional funding for EU-projects.

One of the themes is Optics and Optoelectronis, whose share of the programme volume totalled 18 million euros.

http://www.tekes.fi/ohjelmat/elmo

**Förderprogramm Optische Technologien, *Germany***

The main programme objectives are:
1) next generation optical systems,
2) innovative applications of light for humans, production and enviroment,
3) creation of favourable start and general conditions

Throughout the funding program, optical technologies will proceed to change the challenges made of them and their environment. Rapid, ongoing adjustment of the program to technical and scientific developments, always geared to the markets of the future, will take account of this dynamic process. The program is designed as an open, learning framework.

One of the main technology areas is the displays technology: Organic LEDs (OLEDs) offer the option of flexibility. They can be used to realise flat screens on curved surfaces, just to give one example.
Other main technology fields are new photon sources, optical components, sensors, nano-optics, light and optic measurement and system integration. There is a need for research into optical elements for phase transformation, wave guidance, modulation and switching in order to obtain new functions and qualities. Miniaturisation requires new photon sources with shorter wavelengths (UV/EUV). Basic procedures are among others for measuring

techniques for micro-materials and nano-processing and process and quality control for EUV lithography.

Programme duration is 2002 – 2007.

http://www.optischetechnologien.de/

**R&D Fund, *Israel***

Funding is open to all Israeli registered firms wishing to engage in technological research and development that involves technological novelty and economic justification resulting in the development of a new product or process, or a significant improvement to an existing product or process. There is no limitation as to the scientific field of the R&D.

There is no pre-allocation of budget to a technology field, the priority for funding is worked out through a "Bottom-up" approach. In 2004 the overall OCS budget for ICT was 67.6% of the overall budget, out of which the distribution is:
Communication – 56%,
Software – 17.5%,
Electronics – 16.5% and
Electro-optics – 10%.
This reflects in general the distribution within the R&D Fund program.

Annual budget is 250 million euros.

**Development of Blue Optoelectronics, *Poland***

Blue optoelectronics is a new rapidly developing branch of electronics. The main applications include: dense storage of information, generation of high quality full color pictures, new generation of energy-saving light sources. The aim of the programme was to develop and produce in Poland the blue optoelectronic devices such as blue lasers and UV detectors. The developed cascade lasers can be used in telecommunication, and the polariton lasers - in optical processing of information and optical computing. The program was based on the Polish scientific and technological potential in the field of physics and semiconductor materials technologies for blue optoelectronics. It will result in creation of fundamentals of the new industry branch - blue optoelectronics.

The programme lasted from 2000 to 2004.

http://www.polishmarket.com.pl/index.php?p=/current_issue/&a=8647

**Quantum Photonics National Center of Competence in Research, *Switzerland***

This programme contains research in advanced areas of photonics with a view towards applications. The main fields of research addressed are quantum communications, nanophotonics and optical processes in nanoscale objects), advanced light sources from the near infrared to X-rays (light emitting diodes and diode lasers, quantum cascade lasers, high power fiber lasers, femtosecond and attosecond pulse generation), photonic systems and photonic integration (lasers, detectors, all optical switching, 2-dimensional photonic crystals).

The main technology areas of this programme are: active electro-optical components, based on semiconductor materials and glass fibers. (This includes growth and processing of semiconductor optical devices (diode lasers, light emitting diodes, optical waveguides, filters, switches, etc.)), fabrication of novel optical fibers (active fibers, hollow fibers, multicore fibers), secure transmission systems: quantum cryptography, far infrared sources for atmospheric monitoring and gas sensing, switching technologies and architectures, optical networks, micro- and optoelectronics, microelectronics and optoelectronics design, microelectronics and optoelectronics manufacturing processes, nano-devices, intellectual property blocks- Systems-on-a-Chip (SOC), authentication, cryptography, microsystems materials, packaging and interconnect and sensors.

The participating research groups have many EU collaborations, mainly via their participation in EU research programs and EU Networks. No formal links on the program level. International co-operation is possible. It should be based on concrete collaborations between research groups sharing common interests, rather than being an administrative exercise.

http://www.snf.ch/default_en.asp
http://www.esf.org/esf_domain_activity.php?language=0&domain=1&activity=1

## 8.3. Application orientation in national R&D programmes

As identified in the policy analysis, the following application areas are those with most prominent positions in national policies for ICT R&D:

- eGovernment (15 countries)
- eHealth (13 countries)
- eBusiness and eCommerce (13 countries)
- e-Education and eLearning (9 countries)
- Security and Safety (8 countries

The programme data will now be interrogated, with ICT in healthcare taken as an example of the application orientation in national R&D programmes. The programme specific data collected in the CISTRANA survey focuses on the support for R&D in the field of ICT. Thus, national 'programmes' with a primary focus on applications rather than on technology development may exist under other national initiatives besides ICT R&D programmes. As for eHealth, or ICT in healthcare, the first CISTRANA workshop[21] demonstrated that, in the Netherlands for example, this area is considered to be so close to the market that there is no ICT R&D programme, although funding is available through other types of channels. Furthermore, in Germany most application-oriented programmes are not run by the Ministry of Research, but by other sectoral ministries (e.g. Ministry of Transport), which may not entail purely research.

[21] The workshop report and presentations are available on CISTRANA web-site: http://www.cistrana.org/.

## 8.3.1. ICT in healthcare

In the near future, the growth of the ageing population will undermine European welfare systems as a result of e.g. increased spending on healthcare[22]. At the Community level, increasing productivity in the healthcare sector by utilizing ICT technologies has been an important topic in the EU IST and eTEN programmes for many years. At the national level, however, there seems to be surprisingly few R&D programmes focusing on this subject even though ICT R&D policies in many countries define eHealth as a priority area (see chapter 6.2). eHealth can be defined as healthcare practice supported by electronic processes and communications. In many countries eHealth has been included as an application area in programmes which aim to promote the utilization of ICT in society. In this study, we have distinguished between internal healthcare processes and the eHealth services theme that normally emphasizes the interface between the healthcare system and the citizen. The tables below present all those R&D programmes which have chosen healthcare, medical equipment, assistive devices and/or eHealth services as an application sector for their programme.

**Table 16: National R&D programmes with healthcare, medical equipment, assistive devices or eHealth services as a relevant application sector**

| Country | Programme name | Start | End | healthcare | medical equipment | assistive devices | eHealth services |
|---|---|---|---|---|---|---|---|
| Bulgaria | Information Society - National Scientific Programme | 2003 | 2005 | | | | X |
| Cyprus | RESEARCH FOR ENTERPRISES | 2003 | 2005 | | | | X |
| Cyprus | Thematic Actions - Action "INFORMATION SOCIETY" | 2003 | 2005 | | | | X |
| Finland | Healthcare technology programme | 2004 | 2009 | X | X | X | X |
| Finland | Nordite | 2005 | 2010 | | X | | |
| Finland | The Application of Information Technology in Mechanical, Civil and Automation Engineering | 2005 | 2009 | | X | | |
| Finland | Research Programme on Proactive Computing | 2002 | 2005 | | | X | |
| Finland | Future Electronics Research Programme | 2003 | 2006 | | X | | |
| France | RMNT | 1999 | 2004 | | | | |
| France | Action Concertée Incitative GRID'5000 | 2003 | 2004 | | | | |
| France | Action Concertée Incitative Masses de Données | 2003 | 2006 | | | | |
| France | Action Concertée Incitative Sécurité Informatique | 2003 | 2007 | | | | |
| France | Techno-Vision | 2004 | 2008 | | X | | X |
| Germany | Ausbildungs- und Technologieinitiative Bioinformatik | 2001 | 2006 | | | | X |
| Germany | Förderprogramm Optische Technologien | 2002 | 2007 | | X | | X |

[22] Facing the challenge, The Lisbon strategy for growth and employment, Report from the High Level Group chaired by Wim Kok, November 2004.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Germany | Framework Action Programme "Information Society Germany 2006" (expression of political will, not implemented by a real "programme"). See document DE_Multimedia part II_20050228 | ongoing | | | | | X |
| Germany | Rahmenprogramm zur Förderung 2004 - 2009 Mikrosysteme (Framework programme Microsystems) | 2004 | 2009 | | X | | X |
| Greece | COMPETITIVENESS PROGRAMME/MEASURE 4.5: COOPERATIVES FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT IN SECTORS OF NATIONAL PRIORITY/4.5.4 ATHLETICS | 2004 | 2005 | | | | X |
| Iceland | IS_U&U (RTD programme on the Environment- and Information Society Technologies) | 1999 | 2004 | | X | X | X |
| Netherlands | Freeband Communication | 2004 | 2009 | | | | X |
| Netherlands | Interactive Multimodal Information Extraction | 2002 | 2008 | | | | X |
| Netherlands | Netwerk van Netwerken | 2002 | 2006/2007 | | | X | X |
| Netherlands | Sentinels | 2004 | 2011 | | | | X |
| Netherlands | Spraak- en Taaltechnologische Essentiële Voorzieningen In het Nederlands | 2004 | 2009 | | | X | X |
| Netherlands | Access To Knowledge and its enhancement Netherlands | 2000 | 2008 | | | | X |
| Netherlands | Virtual Lab E-Science | 2004 | 2009 | | | | X |
| Norway | ICT for Medical and Health Care (IKT i medisin og helsetjeneste) | 2001 | 2005 | X | X | | X |
| Slovakia | Building the Information Society | 2002 | 2005 | | X | X | X |
| Spain | National Programme on Informatics | 2004 | 2007 | | | | X |
| Spain | National Programme on Service Technologies for the Information Society. | 2004 | 2007 | | | | X |
| Switzerland | Interactive Multimodal Information Management | 2002 | 2014 | | | X | |

**Table 17: All ICT –type programmes including healthcare, medical equipment, assistive devices or eHealth services as an application area**

| Country | Programme name | Start | End | healthcare | medical equipment | assistive devices | eHealth services |
|---|---|---|---|---|---|---|---|
| Hungary | Economic Competitiveness Operational Program: Measure 3.1 – Support to application-oriented co-operative R&D activities | 2004 | 2006 | | X | | X |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hungary | ITEM (Innovative Technological Solutions to Promote the Information Society) | 2002 | 2003 | | | | X |
| Hungary | Infocommunications Technologies and Applications | 1996 | 2004 | | | | X |

**Table 18: Other activities or initiatives including healthcare, medical equipment, assistive devices or eHealth services as an application area**

| Country | Programme name | Start | End | healthcare | medical equipment | assistive devices | eHealth services |
|---|---|---|---|---|---|---|---|
| Netherlands | GigaPort Next Generation | 2004 | 2009 | | | | X |
| Slovenia | Computer Systems, Methodologies, and Intelligent Services | 2004 | 2008 | | X | | X |
| Slovenia | PARALLEL AND DISTRIBUTED SYSTEMS | 2004 | 2008 | | X | | X |
| Slovenia | Decision Support Systems in Global Electronic Commerce | 2004 | 2008 | | | | X |
| Slovenia | Telecommunication systems | 2004 | 2008 | | | | X |
| Slovenia | Technologies, services and business in the next generation networks | 2004 | 2008 | | | | X |
| Slovenia | Information systems | 2004 | 2008 | | | | X |
| Slovenia | Telematics | 2004 | 2008 | | | | X |
| Slovenia | Computer Structures and Systems | 2004 | 2008 | | | | X |
| Slovenia | Knowledge Technologies | 2004 | 2008 | | | | X |
| Slovenia | Algorithms and optimization methods in telecommunications | 2004 | 2008 | | | X | |
| Switzerland | Interactive Multimodal Information Management | 2002 | 2014 | | | X | |

Taking a closer look at the data, there are only two R&D programmes where the *main* focus area is healthcare, namely, the Finnish Healthcare technology programme FinnWell (volume of public funding 75 M€) and the Norwegian ICT for Medical and Healthcare (volume 7 M€). These two are described below in greater detail.

### Healthcare technology programme FinnWell, *Finland*

The programme aims to improve the quality and profitability of healthcare through technology, as well as to promote business activities and export in the field.

The underlying idea of the programme is that technology only improves the quality and profitability of healthcare services if new procedures are developed simultaneously in as innovative a manner as the products themselves.

Main themes of the programme:

- Development of technologies for diagnostics and care
- Development of IT products and systems that support care, follow-up or prevention of illnesses
- Development of the operational processes of healthcare

Utilisation of ICT is promoted in all thematic areas of the FinnWell programme.

http://www.tekes.fi/ohjelmat/finnwell

**ICT for Medical and Healthcare, *Norway***

The main objective of the programme is to improve health services and medical care by developing and piloting new ICT-based solutions.

Main themes of the programme:

- Treatment-oriented information systems which focus on electronic medical records and collateral images
- ICT facilitated networking and co-operation (telemedicine) to improve utilisation of the resources in the health and social services
- Planning and control systems, focusing on the development of various types of indicators and systems for managing shared health data.

http://www.program.forskningsradet.no/ikthelse

Several programmes with a wider scope also include eHealth as one of their themes. For example, The Hungarian *Infocommunications Technologies and Applications* programme has defined healthcare applications as a priority area in some of its calls. Often, these programmes also aim to create an information society by utilization of ICT in different areas. It is, however, impossible to evaluate the share of the total budget ultimately directed to eHealth.

Medical equipment is defined as one of the main ICT application sectors relevant to the programme in 12 programmes. Most of these programmes concentrate on some specific technology areas, for example in computer vision, wireless communication, embedded systems, microelectronics and optoelectronics. Assistive devices are included in 9 programmes.

Thus, our data on the programmes indicates that the 'ICT in healthcare' theme is often included in the national programmes, but rarely as a main focus area.

**Actors in healthcare technology**

Most of the programmes dealing with ICT in healthcare promote cooperation among research institutes and enterprises to improve the utilization of research results. Funding is provided for research institutes and in many programmes also for private enterprises.

In Norway, public sector organisations may participate as project partners, though they cannot receive funding. In Finland the aim of the FinnWell-programme is to promote synergies between new technologies and new procedures by financing joint projects between private enterprises and healthcare service providers. Funding is provided for research institutes, private enterprises, healthcare providers (both public and private) and also for non profit organisations (the third sector). It is understood that technology alone cannot provoke change unless procedures are developed simultaneously with technology. The service sector has a significant role in the Cypriot “Thematic Actions – Action INFORMATION SOCIETY”, “Research for Enterprises” and the Spanish “National Programme on Service Technologies for the Information Society” where service development is one of the main focus areas.

**International collaboration**

There are very few programmes which undertake international collaboration with national R&D programmes in other countries, though in many programmes international cooperation is now being planned, for example, through ERA-NET -projects. However, cooperation at the project level is encouraged and is often even an evaluation criterion of research projects for example in Slovenian programmes “Information systems”, and “Telecommunication systems”, in the Finnish FinnWell-programme and also in the Norwegian “ICT for Medical and Health Care” programme.

## 8.4. Already existing programme-based international cooperation

Of the 134 programmes comprising the sample in this survey, almost 30% stated that they have bi- or multilateral collaboration with national R&D programmes in other countries. This programme level cooperation has however rarely taken on a concrete form through joint calls. Our data includes only a few examples of this kind of collaboration.

Firstly, there is a joint programme that has been established between France and Finland called PROACT (Research Programme on Proactive Computing), the French counterpart being RNTL (Réseau National de Recherche et d’Innovation en Technologies Logicielles), with the Finnish ones being the Academy of Finland and Tekes. This programme involves a strong basic research orientation. Secondly, a Nordic dimension is manifested by the successive EXSITE and Nordite programmes, the first being a joint programme between Finnish Tekes and Swedish VINNOVA, and the latter being – also temporally – between Tekes, VINNOVA and the Research Council of Norway. Thirdly, focusing on language technologies, STEVIN is a joint programme between several Dutch and Belgian organisations: Nederlandse Taalunie (Dutch, Belgian Flanders and Surinamese joint organisation) with the Netherlands Organisation for Scientific Research (NWO) and SenterNovem in the Netherlands, and Administratie Wetenschap en Innovatie (AWI), IWT-Vlaanderen and Fonds voor Wetenschappelijk Onderzoek (FWO) in Belgium.

Linkages to EUREKA clusters are another concrete form of international collaboration that appears in our data. EUREKA collaboration is particularly highlighted in the context of German programmes. For instance, the Framework Programme IT Research 2006 – Programme Area 2: Software Systems is linked to ITEA, Programme Area 1: Nanoelectronics and Nanosystems to MEDEA+, and the German Framework Programme Microsystems to Eurimus and Pidea. It is probable that similar linkages to these clusters exist in many of the countries that are actively participating in EUREKA.

Some lessons learned when building and managing these multilateral or EUREKA collaborations were presented at the CISTRANA workshop entitled, "Best Practice in Multinational Programme Collaboration" organised in Cologne, on 18 January 2006 by DLR, the German partner in the CISTRANA project. The workshop emphasized, for example, the need to avoid putting participants in a situation of 'double jeopardy' in which they have to satisfy both the multinational and national requirements giving them a much lower chance of succeeding in both competitions. As indicated in the presentations held during the workshop, this problem is also evident in the EUREKA context (see Figure 10). The workshop report[23] also includes a number of other key messages on multinational collaboration for policy-makers and programme managers, as well as for companies and research organisations.

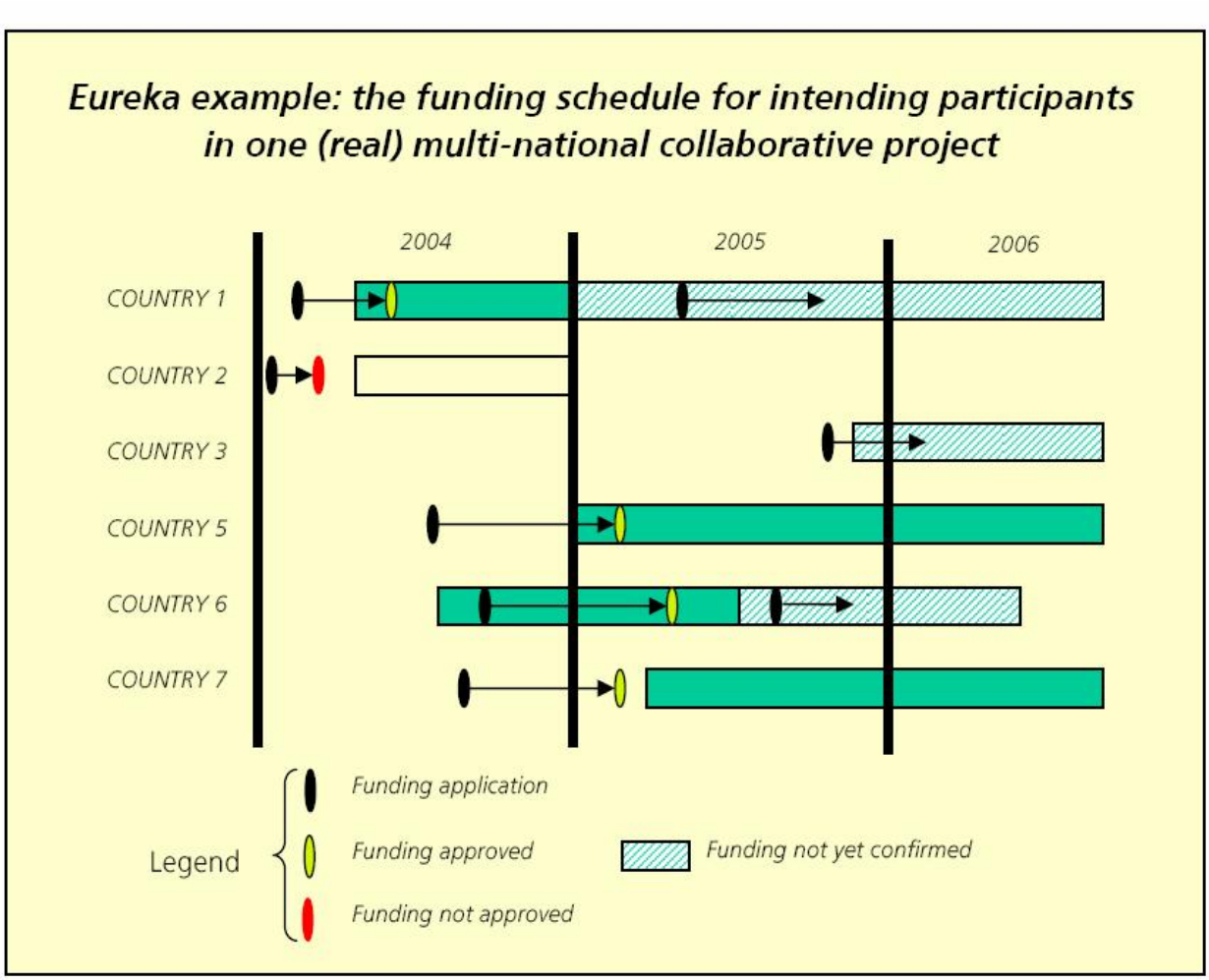


**Figure 10: Eureka funding schedule. Source: Eureka-Cluster CELTIC, Heinz Brüggemann**

Further to these concrete forms of cooperation, our data on programmes also includes less structured international linkages. In Israel, for example, the OCS R&D Fund, supporting Israeli companies, involves Parallel Funding Agreements, which provide guidelines for granting support to joint R&D projects. Currently there are 14 bi-national

[23] The workshop report and presentations are available on CISTRANA web-site: http://www.cistrana.org/

agreements with the following countries: Belgium, Finland, France, Germany, the Netherlands, Ireland, Italy, Portugal, Spain, Sweden, China, Hong-Kong, India and Taiwan. In addition there is also the Israel Science Foundation, which has links to the German DFG.

The Hungarian OTKA initiative has also identified collaborative links with the European Young Investigator Awards programme organized by the European Heads of Research Councils / European Science Foundation (ESF), as well as with the Netherlands Organization for Scientific Research. In addition, the Academy of Finland's KITARA programme has common themes with ESF's Smart Structural Systems Technology programme.

The international collaboration of the Cyprus programmes entails the project-based participation of foreign organizations, and no actual collaboration is established with any particular programme. The Danish councils collaborate with research councils in other countries, while the Polish PIONIER programme has contacts with the European Research Network GÉANT.

Some programmes also mention international cooperation activities with non-European countries. In addition to project-based cooperation on the European level, Swiss CTI Enabling Sciences entails cooperation with China which responds to a demonstrated need from CTI's clients. In addition, there is a Healthcare technology programme (Finnwell) in Finland with researcher exchange and joint seminars and workshops with the University of Berkeley's Citris programme. Finnwell is the only programme in this survey with programme-based collaboration across the Atlantic.

# 9. Overview of other than programme-based support in the field of ICT

In addition to the primary focus of this report, information was collected on other than programme-based support. As a hypothesis, multiple interpretations of the term 'programme' may consequently bring a variety of funding schemes into the programme data, but may also leave others aside. The questionnaire was designed in order to cater for this risk. Respondents were asked to clarify whether there is public funding (*not programme-based*) available for separate R&D projects, who are the main actors, what are the main research areas and the total funding volumes, and whether there are other forms of support for R&D in the field of ICT.

In addition to this data on other than programme-based support, the variety of funding schemes in programme data is also utilised in this chapter. In the previous chapter the national R&D programmes were classified into three groups: "all ICT", "defined" and "other". A re-examination of ICT support schemes in the "other" group was undertaken and schemes which were not regarded as "R&D programmes" in the field of ICT (as defined in chapter 8), or as individual R&D projects were also included in this analysis. All of the considered support schemes, type of support, objectives, main actors, research areas and funding bases are presented in the annex.

It was possible to identify and separate different types of support mechanisms from the data. These support types include: enabling networking, equipment and the establishment of new infrastructures, general research and development funding, incubation services, venture capital and other schemes.

- ***Enabling networking.*** These support schemes aim to build networks between researchers, academic institutions, research institutions and industry as well as with the international research community.
- ***Equipment and the establishment of new infrastructures.*** This category includes different kinds of support mechanisms which aim to establish permanent or temporary infrastructures and facilities for the research community and industry. This category includes also centres of excellence, competence centres and fixed-period research labs.
- ***General research and development funding.*** The data included many general (not programme-based) research funding schemes for academic institutions, research institutions and industry.
- ***Incubation services.*** These are support mechanisms aiming at the promotion and commercialisation of new innovative ideas and incubating new businesses. Incubation services can include funding for R&D, financial services and the creation of favourable environments for start-up companies.
- ***Other schemes.*** Other support types included venture capital funds, support for project initiation, promoting the use of ICT in companies, tax deductions and a larger IST framework programme.

Table 19 below displays these support types, corresponding schemes and the total budget of the scheme (if the information was available).

**Table 19: Other than programme-based support schemes**

| Type | Scheme | Total Budget |
|---|---|---|
| **Enabling networking** | I-NET Project – Bulgaria | 1, 5 M€ |
| | NINET – Czech Republic | Information not available |
| | High Tech Network – Denmark | Information not available |
| | Innovation Consortiums – Denmark | Information not available |
| | IT Corridor – Denmark | 24 M€ |
| | Upgrading the Greek Research and Technology Network – Greece | 19 M€ |
| | GIGAPORT Next Generation – Netherlands | 61,4 M€ |
| | The Polish Platform for Mobile and Wireless Communications Technologies - Poland | Information not available |
| | The Polish Platform for Optoelectronics Technology – Poland | Information not available |
| **Equipment and the establishment of new infrastructures** | Christian Doppler research labs – Austria | For ICT labs: 0,7 M€ |
| | Research Studios – Austria | Information not available |
| | I-NET Project – Bulgaria | 1, 5 M€ |
| | IT Corridor – Denmark | 24 M€ |
| | Upgrading the Greek Research and Technology Network GRNET2 – Greece | 19 M€ |
| | KFIIF (part of RTIF) – Research Information Infrastructure – Hungary | Information not available |
| | Pazmany Peter Programme (part of RTIF) – Creation of Regional University Knowledge Centers – Hungary | Information not available |
| | Economic Competitiveness Operational Program: Measure 3.2 – Improvement of the conditions of research, technology transfer and co-operation at publicly financed and non-profit research facilities – Hungary | 46,1 M€ |
| | Economic Competitiveness Operational Program: Measure 3.3 – Reinforcement of Corporate R&D capacities and innovations skills – Hungary | 12,4 M€ |
| | FONDO EUROPEO SVILUPPO REGIONALE – Italy | 165 M€ |
| | LOFAR – Netherlands | 65 M€ |
| | GIGAPORT Next Generation – Netherlands | 61,4 M€ |
| | Embedded Systems Institute (ESI) – Netherlands | 54,6 M€ |
| | Centres of Excellence – Norway | Information not available |
| | Simula Research Lab – Norway | 6 M€ (annual) |
| | PIONIER – Poland | 70 M€ |
| | Interactive Multimodal Information Management (NCCR) – Switzerland | 60 M€ |
| | National Center of Competence in Research in Mobile Communication and Information Systems - Switzerland | 21 M€ |
| | Quantum Photonics (NCCR) – Switzerland | 26,2 M€ |
| **General Research and Development Funding** | Austrian Science Fund (FWF) – Austria | 15 M€ (for IST relevant research) |
| | The ICT Development Agency (As of Oct 2005 the activities of ICT Development Agency are transferred to the State Agency for Information Technologies and Communications) – Bulgaria | 80 000 € (in 2004-2005) |
| | RTD funding from central and other administrative agencies – Czech Republic | Information not available |
| | RTD grants – Czech Republic | Information not available |

| | | |
|---|---|---|
| | The Danish Council for Independent Research – Denmark | 121, 6 M€ |
| | The Danish Council for Strategic Research – Denmark | 6 M€ (for IT-sector) |
| | Tekes, the Finnish Funding Agency for Technology and Innovation – Finland | R&D funding 70 M€ (annual) |
| | The Technological Development and Innovation Fund – Iceland | 4 M€ (in 2005) |
| | The Research Fund – Iceland | 6,3 M€ (in 2005) |
| | Commercialisation Fund – Ireland | 45 M€ |
| | Research Technology and Innovation – Ireland | 178 M€ |
| | Magnet – Israel | 35 M€ |
| | Israel Science Foundation – Israel | 45 M€ |
| | R&D Fund – Israel | 250 M€ |
| | Promotion and diffusion, within small and medium enterprises, of innovation based on ICT, in order to improve their competitiveness – Italy | 62,8 M€ |
| | FONDO AGEVOLAZIONI RICERCA – Italy | 81 M€ (2004-2005) |
| | FONDO PER GLI INCENTIVI NELLA RICERCA DI BASE - Italy | 134,5 M€ (2001-2003) |
| | Latvian Council of Science Grants – Latvia | 0,4 M€ (In ICT) |
| | Open Scheme for academic institutions – Norway | 1 M€ (in ICT) |
| | Support for Strategic technology research projects – Norway | 6 M€ (annually in ICT) |
| | Funding in Ministry of Science and Information Society Technologies – Poland | 1,5 M€ (annual) |
| | Grants organised by The Agency for Support of Science and Technology – Slovakia | Information not available |
| | Agency for Grants in Science (VEGA) – Slovakia | Information not available |
| | Slovenian Research Agency – Slovenia | Information not available |
| | Industrial R&D grants – Turkey | 45 M€ (annual) |
| **Incubation services** | Innovation Incubators – Denmark | 64 M€ (2005-2008) |
| | Accompanying Services – Germany | Information not available |
| | Irinyi Janos Programme (part of RTIF) – Individual innovative ideas, spin-offs, technology incubators – Hungary | Information not available |
| | Technological Incubators – Israel | 23 M€ (annual) |
| **Other schemes** | The Danish Growth Fund – Denmark | Capital base 300 M€ |
| | The High Technology Development Fund – Denmark | 400 M€ (in 2005), expected to reach 2,3 billion € in 2012 |
| | Financial support for (EU) project initiation – Austria | |
| | Strengthening the use of ICT in SMEs. – Denmark | Information not available |
| | Tax deductions for firms' R&D expenditures – Denmark | Information not available |
| | Information Society Germany 2006 – Germany | 20 M€. |

In most cases, the beneficiaries of the schemes include the national research community and private sector companies. In many cases, the funding scheme requires cooperation between research organisations and industry, although institutions and agencies providing general funding for R&D in particular can fund individual researchers, e.g. post-graduate studies. In some cases the beneficiary is also government administration (e.g. Polish PIONIER or Bulgarian ICT Development Agency), or broadly speaking, society as a whole (Information Society Germany 2006).

Some of the support schemes have multiple tasks, e.g. the Bulgarian I-NET project or the Dutch GIGAPORT, which supports both networking and the establishment of new infrastructures, and therefore they occur in both categories. It is common that funding organisations have multiple purposes; they provide funding for the development of new products, processes and services, but at the same time they seek to promote networking, international mobility or gender equality. Having multiple tasks may cause some problems: in the form of the ineffective targeting of beneficiaries or as regards the difficult evaluation of specific schemes. Although, in some cases multiple operations are required in order to accomplish certain objectives, as in the case of the Danish IT Corridor, where the objective is to "create new modes of access to new and best practice knowledge on IT, irrespective of the businesses' geographic location"– for effective networking a functional nationwide infrastructure must exist.

Many of the support schemes operate on a general level, especially R&D funding agencies, and they are not specifically targeted to the ICT sector. The largest support schemes measured by the volume of funding operating only in ICT areas include Polish PIONIER, and LOFAR and GIGAPORT from the Netherlands.

The largest effort in the support of innovation systems is undertaken in Denmark, where the Danish Growth Fund has a capital base of 300 M€ for venture financing and the High Technology Development Fund will reach over 2 000 M€ of total capital base up to 2012. Another major funding scheme is the Israeli R&D fund which provides funding for Israeli registered firms to a total of 250 M€ per year, with the budget for ICT development in 2004 being 67.6% of the overall budget.

Some of the schemes have focused or predetermined research or application areas. These schemes include:

- Research Studios (Austria) – application oriented: eBusiness, eLearning and eCommunities.
- The ICT Development Agency (Bulgaria, as of Oct 2005 the activities of ICT Development Agency are transferred to the State Agency for Information Technologies and Communications) – application oriented: eLearning, eAdministration, eSecurity and eCulture.
- Upgrading of the Greek Research and Technology Network (Greece) – WDM network
- Embedded Systems Institute (Netherlands) – systems architecture, specification methods, design modelling and distributed control
- LOFAR (Netherlands) – Wide Area Sensor Network
- Simula Research Lab (Norway) – software engineering, networks and distributed systems and scientific computing
- The Polish Platform for Optoelectronics Technology (Poland) – optoelectronics technologies
- Interactive Multimodal Information Management (Switzerland) – multimodal man-machine interaction
- Quantum Photonics NCCR (Switzerland) – quantum communications, nanophotonics, advanced light sources, photonic systems and photonic interaction

Reflecting on these support schemes within the context of the Cistrana objectives, it is also useful to examine the international cooperation aspects of different schemes. On the one hand, schemes include support for the preparation of EU project proposals. These kinds of support schemes are found in Austria and the Czech Republic (NINET). On the other hand, there are schemes that promote successful integration for international

cooperation by providing infrastructures for the scientific community and industry. These include the Bulgarian I-NET, Greek GRNET2, Dutch GIGAPORT and the Polish Platform for Optoelectronics.

In addition to the strategic aim of Cistrana (to achieve coordination between national ICT programmes), one useful aspect here is to consider what kind of opportunities these 'other than programme based' support themes are likely to bring for cooperation efforts in the future. The most obvious mechanisms may be in already established national infrastructures which provide equipment and facilities for R&D in the field of ICT. These infrastructures could however be more widely utilised throughout the European Research Area. National networks, research labs and competence centres which carry out research and development activities in specific ICT areas, and which do not have specific regional objectives, could thus more systematically exchange information and also offer services to other countries. It is important therefore to develop practices and procedures for the more effective utilisation and reallocation of already established national infrastructures on the European level.

# 10. Conclusions

The main objective of this study was to sketch the European ICT R&D landscape by identifying national R&D policies, priorities, and programmes or other support mechanisms in the field of ICT. Filling this information gap was seen as being essential in order to facilitate the implementation of transnational cooperation activities.

Our study indicates that there seems to be a strong consensus across the studied countries of the importance of ICT as a R&D policy priority. Furthermore, the analysis on national policy priorities has helped to identify the following ICT sub-themes that could provide fertile ground for cooperation: telecommunications, micro- and nanotechnology, software technologies, optoelectronics, eGovernment, eHealth, eBusiness and eCommerce, e-Education and eLearning, as well as Security and Safety.

There is, however, major variation in how the importance of ICT is operationalized in different countries. In addition, the way in which each country uses their palette of different tools to support R&D is inextricably linked with national realities and the needs identified in the countries' industrial base. There are also countries where R&D policy is more likely to raise different ambitions across the political arena. In such countries, changes in party political fortunes can thus often entail radical swings in the official focus of R&D policy. Alternatively, in those countries where a strategic view of national R&D policy is to a large extent shared, irrespective of political party, this may be seen to better facilitate the long-term development of R&D policy. A critical question however remains, namely, how to ensure a sufficient amount of stability and longer term commitment while remaining flexible enough to adapt to changing situations.

The study also indicates that the landscape is very variable in terms of national programmes. Firstly, no one universal definition exists for what is perceived as a 'programme'. Secondly, national approaches vary according to whether programme-like instruments are characteristically directed at funding basic research or applied/industry-driven research. Thirdly, ICT seems to have a multitude of definitions in national contexts, and, consequently the study could identify technology-oriented R&D programmes, but application orientation - while clearly of growing importance as ICT has become a constitutive technology[24] - was visible only to a limited extent. This heterogeneity makes it difficult to compare the different programmes, while also hindering collaboration between national ICT programmes.

The analysis of the national ICT programmes discovered a number of mega-clusters, such as micro-nano, communications, and software, to which large amounts of national funding are directed. As noted previously, these same three topics, together with optoelectronics, were those most often emphasized at the national ICT R&D policy level. As such then, national priorities seem to be in line with those of the EU level (Framework Programme, European Technology Platforms). Communications technology is generally viewed as an important priority, as almost half of the identified initiatives are related to this subject. Germany, Finland, France, Spain, and the Netherlands are the countries where major flows of R&D funding are channelled through programme-based instruments of a defined scope.

[24] ISTAG Report on Shaping Europe's Future Through ICT, Report from the Information Society Technologies Advisory Group (ISTAG), European Commission, March 2006.

Until now, the cooperation between national ICT programmes has rarely taken on a concrete form through joint calls. Actually, our data includes only three examples of this type. Most cooperation currently takes place at the project level through EUREKA, for example. The study did however also indicate some bilateral initiatives with non-European countries.

In principle, the national programmes entail a fairly similar set of general procedures. The depth of implementation however often varies to a significant degree. Typically, the initiation phases of the programmes hardly entail detailed implementation plans for international collaboration. This creates a major challenge in achieving the coordination of national programmes in terms of the setting up of priorities, call timing and project evaluation criteria. The rationalisation and harmonisation of national programme procedures can thus be seen as desirable although the level of complexity increases with the number of participating countries. Based on the existing joint programmes with 2-3 participating countries one could then speculate on the maximum number of feasible countries.

In 'Eureka-type' programme level collaboration, the number of countries involved does not seem to be critical to the success of the programme, as the level of complexity remains at the project level rather than gravitating towards the programme level. Recently, MNT ERA-NET has launched a call utilizing a EUREKA-type approach with some harmonisation in the timing of the national decision making. This approach might prove feasible for international collaboration of a group of more than 4 countries. From the applicants' point of view, it is easier for each applicant to deal with the national funding agency and existing national rules of funding. Each country can decide, on a project by project basis, if the project is eligible to receive national funding, and national funding principles do not need to be changed. On the other hand, in joint programmes, there is normally a stronger commitment from participating countries, as common rules of procedure are agreed and ear-marked budgets are defined between the funding agencies before the programme is launched.

In addition to programmes, other national support mechanisms were identified in this study. These mechanisms include: enabling networking, equipment and the establishment of new infrastructures, general research and development funding, incubation services, venture capital and other schemes. In addition to programme level cooperation, these support schemes can also provide opportunities for cooperation in the future. The most obvious mechanisms may be found in already established national infrastructures which provide equipment and facilities for R&D in the field of ICT. These infrastructures could thus be more widely utilised throughout the European Research Area.

Many open questions remain[25] on the road to a deeper IST ERA. However, based on the findings of this study it is evident that common European ICT R&D policy priorities do exist. This creates a solid basis for future cooperation activities, and current CISTRANA activities are already striding out in this direction.

[25] See also "Outstanding questions" in CISTRANA Workshop report: Design of National ICT Programmes in the context of ERA Coordination, available on CISTRANA website, http://www.cistrana.org

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# ANNEX: National R&D programmes included in the survey data

| National R&D programmes included in the survey data | | |
|---|---|---|
| **Country** | **Programme name** | **Programme acronym** |
| Austria | FIT-IT (Forschung, Innovation, Technologie – Informationstechnologie) | FIT-IT |
| Bulgaria | Information Society - National Scientific Programme | Information Society |
| Cyprus | RESEARCH FOR ENTERPRISES | |
| Cyprus | Thematic Actions - Action "INFORMATION SOCIETY" | |
| Czech Republic | Thematic National Research Programme Information Society" | NPV-TP2 |
| Denmark | The Danish Growth Fund (Vaekstfonden) | VF |
| Denmark | The High Technology Development Fund (Fonden for Højteknologisk Udvikling) | |
| Denmark | Innovation incubators (Innovationsmiljøer) | |
| Denmark | THE DANISH COUNCILS FOR INDEPENDENT RESEARCH | |
| Denmark | THE DANISH COUNCIL FOR STRATEGIC RESEARCH | |
| Finland | Miniaturising Electronics 2002-2005 | Elmo |
| Finland | Explorative System-Integrated Technologies | EXSITE |
| Finland | The Application of Information Technology in Mechanical, Civil and Automation Engineering | KITARA |
| Finland | NETS - Networks of the Future | NETS |
| Finland | Research Programme on Proactive Computing | PROACT |
| Finland | Future Electronics Research Programme | TULE |
| Finland | ÄLY - Intelligent Automation Systems | ÄLY |
| Finland | Interactive Computing | Fenix |
| Finland | GIGA - Converging Networks | GIGA |
| Finland | Healthcare technology programme | Finnwell |
| Finland | Nordite | Nordite |
| Finland | Nanotechnology Programme | FinNano |
| Finland | MASI - Modeling and simulation | MASI |
| Finland | Vamos - Value Added Mobile Solutions | VAMOS |
| France | Réseau national de Recherche et d'Innovation en Audiovisuel et Multimédia | RIAM |
| France | RMNT | |
| France | French Telecommunication Research Network | RNRT |
| France | Réseau National de Recherche et d'Innovation en Technologies Logicielles | RNTL |
| France | Action Concertée Incitative GRID'5000 | ACI GRID 5000 |
| France | Action Concertée Incitative Masses de Données | ACI MD |
| France | Action Concertée Incitative Sécurité Informatique | ACI SI |
| France | Techno-Vision | |
| France | Techno-Langue | |
| Germany | Ausbildungs- und Technologieinitiative Bioinformatik | |
| Germany | Förderprogramm Optische Technologien | |
| Germany | Information Systems in Earth Management (GEOTECHNOLOGIEN) | |
| Germany | Framework programme IT Research 2006 – Programme Area 1: Nanoelectronics and Nanosystems | |

| National R&D programmes included in the survey data | | |
|---|---|---|
| **Country** | **Programme name** | **Programme acronym** |
| Germany | Framework programme IT Research 2006 – Programme Area 2: Software Systems | |
| Germany | Framework programme IT Research 2006 – Programme Area 4: | |
| Germany | IT Forschung 2006 - magnetoelectronics | IT2006 |
| Germany | IT-Research 2006 - Programme Area 3: Basic technologies for communications engineering | |
| Germany | Framework Action Programme "Information Society Germany 2006" (expression of political will, not implemented by a real "programme"). See document DE_Multimedia part II_20050228 | |
| Germany | Forschungsoffensive Software Engineering 2006 | |
| Germany | Rahmenprogramm zur Förderung 2004 - 2009 Mikrosysteme (Framework programme Microsystems) | Mikrosysteme |
| Greece | COMPETITIVENESS PROGRAMME/MEASURE 4.5: COOPERATIVES FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT IN SECTORS OF NATIONAL PRIORITY/4.5.4 ATHLETICS | ATHLETICS |
| Greece | COMPETITIVENESS PROGRAMME/MEASURE 4.5: COOPERATIVES FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT IN SECTORS OF NATIONAL PRIORITY/4.5.3 Culture-Knowledge Intensive Tourism | Culture-Knowledge Intensive Tourism |
| Greece | INFORMATION SOCIETY PROGRAMME/MEASURE 3.3: Research and Technological development in the IT domain/E-business | E-business |
| Greece | INFORMATION SOCIETY PROGRAMME/MEASURE 3.3:Research and Technological development in the IT domain/E-Learning | e-learning |
| Greece | COMPETITIVENESS PROGRAMME/MEASURE 4.5: COOPERATIVES FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT IN SECTORS OF NATIONAL PRIORITY/4.5.1.NATURAL ENVIRONMENT AND SUSTAINABLE DEVELOPMENT | NATURAL ENVIRONMENT AND SUSTAINABLE DEVELOPMENT |
| Greece | INFORMATION SOCIETY PROGRAMME/MEASURE 3.3:Research and Technological development in the IT domain/ Upgrading of the Greek Research and Technology Network | |
| Greece | INFORMATION SOCIETY PROGRAMME/MEASURE 3.3:Research and Technological development in the IT domain/Image, Sound & Language Processing | |
| Greece | COMPETITIVENESS PROGRAMME/MEASURE 4.5: COOPERATIVES FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT IN SECTORS OF NATIONAL PRIORITY/4.5.9 NEW METHODS OF ENTERPRISES, WORK, AND TRAINING ORGANIZATION | NEW METHODS OF ENTERPRISES, WORK, AND TRAINING ORGANIZATION |
| Greece | COMPETITIVENESS PROGRAMME/MEASURE 4.5: COOPERATIVES FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT IN SECTORS OF NATIONAL PRIORITY/4.5.6 TRANSPORT & NAVIGATION TECHNOLOGY | TRANSPORT & NAVIGATION TECHNOLOGY |
| Hungary | Economic Competitiveness Operational Programme, 3rd Priority: Research, Development and Innovation | ECOP RD |
| Hungary | Information Technology Research and Development | IT RD |
| Hungary | ITEM (Innovative Technological Solutions to Promote the Information Society) | ITEM |
| Hungary | Infocommunications Technologies and Applications | IKTA (KMUFA) |
| Hungary | National Research and Development Programmes | NKFP |
| Hungary | Hungarian Scientific Research Fund Programmes (OTKA) | OTKA |
| Hungary | Programmes Financed from the Research and Technology Innovation Fund | RTIF - NKFP, Mobil 2004, RET, RIU, NAP, KFIIF |

| National R&D programmes included in the survey data | | |
|---|---|---|
| **Country** | **Programme name** | **Programme acronym** |
| Iceland | IS_U&U (RTD programme on the Environment- and Information Society Technologies) | |
| Ireland | Commercialisation Fund | |
| Ireland | Research Technology and Innovation (RTI) | |
| Israel | Magnet-Support for Generic R&D | MAGNET |
| Israel | Technological Incubators | |
| Israel | | ISF |
| Israel | R&D Fund | |
| Italy | Programmi di ricerca di Interesse nationale | PRIN |
| Italy | FONDO AGEVOLAZIONI RICERCA | FAR |
| Italy | FONDO EUROPEO SVILUPPO REGIONALE | FESR |
| Italy | FONDO PER GLI INCENTIVI NELLA RICERCA DI BASE | FIRB |
| Italy | Promotion and diffusion, within small and medium enterprises, of innovation based on ICT, in order to improve their competitiveness | Bando ICT MAP |
| Latvia | Research supporting Latvian informatics industry | No. 02-0002 |
| Malta | National RTDI Programme | |
| Netherland | Basic Research in Informatics for Creating the Knowledge Society | BRICKS |
| Netherland | Continuous Access to Cultural Heritage | CATCH |
| Netherland | Embedded Systems Institute | ESI |
| Netherland | reinFOrcing CompUter Science | FOCUS |
| Netherland | Freeband Communication | Freeband |
| Netherland | GigaPort Next Generation | GigaPort |
| Netherland | GlobAl computer scieNCE | GLANCE |
| Netherland | Interactive Collaborative Information Systems | ICIS |
| Netherland | Interactive Multimodal Information Extraction | IMIX |
| Netherland | JACQUARD | |
| Netherland | LOFAR ICT for Wide-area Adaptive Sensor Networks | LOFAR |
| Netherland | Multimedia Netherlands | MultimediaN |
| Netherland | Netwerk van Netwerken | NvN |
| Netherland | PROGram for Research on Embedded Systems & Software | PROGRESS |
| Netherland | Sentinels | |
| Netherland | Smart Surroundings | |
| Netherland | Spraak- en Taaltechnologische Essentiële Voorzieningen In het Nederlands | STEVIN |
| Netherland | Access To Knowledge and its enhancement Netherlands | ToKeN |
| Netherland | Visual Interactive Effective Worlds | VIEW |
| Netherland | Virtual Lab E-Science | VL-E |
| Norway | Basic ICT Research | ICT-2010 |
| Norway | ICT for Medical and Health Care (IKT i medisin og helsetjeneste) | |
| Norway | ICT Innovation programme | |
| Norway | ICT Trust and Security (IKT Sikkerhet og sårbarhet) | IKT-SOS |
| Poland | Development of Blue Optoelectronics | |
| Poland | PIONIER: Polish Optical Internet - Advanced Applications, Services and Technologies for Information Society | PIONIER |
| Romania | Information Society | INFOSOC |
| Slovakia | Building the Information Society | BIS |
| Slovenia | Systems and control | |
| Slovenia | Telecommunication systems | |

| National R&D programmes included in the survey data | | |
|---|---|---|
| **Country** | **Programme name** | **Programme acronym** |
| Slovenia | Technologies, services and business in the next generation networks | |
| Slovenia | Information systems | |
| Slovenia | Telematics | |
| Slovenia | Computer Structures and Systems | |
| Slovenia | Knowledge Technologies | |
| Slovenia | Artificial intelligence and intelligent systems | |
| Slovenia | Computer vision | |
| Slovenia | Algorithms and optimization methods in telecommunications | |
| Slovenia | Selected Topics in Theoretical Computer Science and Combinatorial Optimization | |
| Slovenia | Mechatronics systems | |
| Slovenia | Computer Systems, Methodologies, and Intelligent Services | |
| Slovenia | Advanced methods of interaction in telecommunication | |
| Slovenia | PARALLEL AND DISTRIBUTED SYSTEMS | |
| Slovenia | MODELLING, SIMULATION AND CONTROL OF PROCESSES | |
| Slovenia | Decision Support Systems in Global Electronic Commerce | |
| Spain | National Programme on Informatics (PNTE) | |
| Spain | National Programme on Informatics (PNTIN) | |
| Spain | National Programme on Electronics and Communication Technologies - Subprogramme on Communication Technologies | |
| Spain | National Programme on Service Technologies for the Information Society. | |
| Spain | STRATEGIC CROSS ACTION ON TRUST AND SECURITY | |
| Sweden | Future Communication Networks | |
| Sweden | Network Based Software Technology | |
| Switzerland | CTI Enabling Sciences | |
| Switzerland | Interactive Multimodal Information Management | IM2 |
| Switzerland | Quantum Photonics National Center of Competence in Research | NCCR-QP |
| Switzerland | National Center of Competence in Research in Mobile Communication and Information Systems | NCCR MICS |
| Turkey | Industrial R&D Grant Programme | |
| United Kingdom | EPSRC Information and Communications Technologies Programme | EPSRC ICT |
| United Kingdom | The Technology Programme | |

# ANNEX: Other than programme-based support for R&D in the field of ICT

| Country | Support Scheme | Type of support and objectives | Main actors, research areas and funding |
|---|---|---|---|
| Austria | **Financial support for project initiation** | Funding scheme, in order to support extra expenditures during the preparation of an EU – proposal, or to cover specific unexpected costs during the project lifetime | Decision and operations: Ministry of Transport, Innovation and Technology, Ministry of Education, Science and Arts, FFG/Department 1. Total volume of funding: in the period 2003-2005 for ICT research: 3 M€. |
| | **Christian Doppler Forschungsgesellschaft (CDG) – a non-profit research organisation** | Research labs, where scientist conduct research on issues raised by industry. | Co-financed by industry. Special focus on the steel production, but does not follow thematic restrictions. There are overall 36 labs, 3 of them in ICT:<br>1) Compilation Techniques for embedded Processors (budget 2003: 242 000€)<br>2) Design Methodology of Signal Processing Algorithms (Budget 2003: 183 000 €)<br>3) Nonlinear Signalprocessing (Budget 2003: 245 000€) |
| | **Austrian science Fund (FWF)** | Austria's central body for the promotion of basic research. Funding in centres of excellence, international mobility, promotion of gender equality, programs for outstanding researchers, cooperation with economy | Equally committed to all branches of science. Budget for IST-relevant research approx. 15 M€. |
| | **Austrian Research Promotion Agency – FFG<br>Division 1: Research and Technology Promotion for industry** | The general programme is open (no thematic restrictions) ongoing programme (no specific calls) designed to provide public funding for industrial R&D projects. | Total budget for 2004: 248 M€ of which approx. 1/3 for ICT Research |
| | **Structural programme K-ind and K-net implemented by BMWA, FFG Division 1 and CFG** | Programme has established several industrial competence centres and networks. Main idea was to complement the K-plus programme with a co-operation initiative, acting closer to industrial application and market.<br><br>Grants awarded under this programme follow two lines of action:<br>- Line of Action Centres of Excellence (k ind): Industrial competence centres serve the targeted development and strengthening of internationally competitive technology clusters.<br>- Line of Action Networks of Excellence (k net): Competence networks consist of a number of competence nodes from the fields of science and industry. | So far there are 4 Centres in the area of ICT:<br>- EC3 Electronic Commerce Competence Center<br>- HITT health information technologies tirol<br>- Evolaris Competence Centre for Interactive e-Business<br>- Industrial Competence Centre for Mechatronics and Automation |
| | **Structural Programme Kplus implemented by FFG Division 2** | Some 270 enterprises of all different sizes are working in Kplus centres, generally in the form of multi-company projects with several enterprises working together with various researchers on solving problems. So far there are approx. 800 people in 12 Kplus centres. Kplus centres are organised on a private enterprise basis. | Seven Kplus centers are working in the ICT-area:<br>-Advanced Computer Vision, 11 M€ for 4 years<br>- Sensor Technology and Intelligent Sensor-Actuator Systems, 9,6 M€<br>- Knowledge Management Center Craz, 10 M€<br>- Software Competence Center Hagenberg, 11,8 M€<br>- Telecommunications Research Center Vienna, 15,6 M€<br>-Virtual Reality and Visualisation, 9,3 M€<br>- The Virtual Vehicle, 16,3 M€<br>The proportion of public funding for Kplus Centres is a maximum of 60%. |
| | **ZIT – Zentrum fur** | ZIT Center for Innovation and | Since 2003 ZIT has conducted two calls |

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| | **Innovation und Technologie GmbH** | Technology is responsible for supporting high-tech enterprises in the City of Vienna. ZIT aims to find the best RTD projects in 3-4 calls for proposals per year since 2003. | for proposals in the field of ICT with 109 submissions and 32 projects being supported with 4.75 M€ of overall subsidies. 2003 ZIT focused on finding the best ICT projects concerning security in Vienna, 2004 the focuses were: mobile applications, simulations, open source software and again security. |
| | **Research Studios Austria** | This initiative is for executing research in the area of eTechnologies, smart contents and new media. | Set up by Federal Ministry for Economic Affairs and Labour.<br><br>Focus of research relies in application oriented development addressing mainly eBusiness, eLearning and eCommunities.<br><br>So far, 5 studios have been implemented:<br>• iSPACE (GIS-technologies)<br>• Smart Agents (for Convergent Media)<br>• AdVISION (3D Computer Graphics)<br>• MemEngineering (Digital Memory Systems)<br>• eLearn Environ (ELearning Environments) |
| Bulgaria | **The ICT Development Agency (As of Oct 2005 the activities of ICT Development Agency are transferred to the State Agency for Information Technologies and Communications)** | Funding scheme for a series of RTD projects that correspond to the objectives of the National programme for Information Society Development | Operates under the Ministry of Transport and Communications.<br>The main R&D areas are in the ICT application sector: e-Learning, e-Administration, e-Security, e-Culture.<br><br>The projects may be fully or partially funded. Total volume of allocated funding in 2004-2005 is 80 000€. |
| | **I-NET project** | The project aims to facilitate the integration of the Bulgarian scientific research and development community into the European Research Area providing a state of the art ICT infrastructure. | Beneficiary is the National Research Network. The implementing agency for the project is the ICT Development Agency.<br><br>Project duration is 3 years. Volume of funding: Project budget 776 000€, Government 735 000€, UNDP 41000€. Total: 1,5M€. |
| Czech Republic | **RTD funding from central and other administrative agencies** | Provides funding for individual RTD projects and programmes in their respective areas and also for integrated research. | Main actors include Ministry of Industry and Trade, Ministry of Education, Youth and Sports, Ministry of Health, Ministry of Agriculture and Ministry of Environment. |
| | **RTD grants** | Provides different kinds of research grants including: standard research grants, directed research grants, supplementary grants, post-graduate grants, post-doc grants, publishing grants or joint project grants. | Actors include: Academy of Sciences of the Czech Republic, The Grant Agency of the Czech Republic, The Grant Agency of the Academy of Science |
| | **NINET (National Information Network for FP)** | National information network for ensuring successful participation of Czech Rep. in research and development cooperation projects (especially for 6th Framework Programme). | Network includes the National Contact Organisation (Technological Centre AS CR) and the Regional and Professional Contact Organisations (RKO and OKO). The network is coordinated by the AS CR on behalf of Ministry of Education, Youth and Sports. |
| Denmark | **High Tech Network** | Framework for cooperation between businesses and public research institutions. Networks allow businesses and research institutions to meet, develop and share research based knowledge. | The Ministry of Science, Technology and Innovation partially finances the establishment and operation of the network. The network is relevant for both ICT and other high tech sectors. |
| | **Innovation Consortiums** | Through these consortiums, firms and public research institutes can develop technological platforms that can form a basis for Danish firms' future development of goods and services. | The programme is administered by the Ministry of Science, Technology and Innovation.<br><br>Projects should take account of the Danish business sectors' development needs, and results should be applicable to a broad range of businesses. The objective of the programme is to establish better links between public research and the business |

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| | | | sector. The programme covers a broad range of fields, including ICT. Accepted projects are awarded partial public funding. |
| | **IT Corridor** | Public funding for development projects for cooperation with the private business sector and for the establishment of 4 IT-competence centres. The objective of this programme is to create new modes of access to new and best practice knowledge on IT, irrespective of the businesses' geographic location. | The programme is administered and funded by the Ministry of Science, Technology and Innovation.<br><br>The objectives are to be accomplished through interregional projects involving businesses and public research institutions within the field of ICT.<br><br>Total public funding is 24 M€; 12 M€ for development projects and 12 M€ for the IT-competence centres. |
| | **IT Use SME** | This support scheme concerns strengthening the use of ICT in small and medium sized enterprises. | The project is initiated by the Ministry of Science, Technology and Innovations.<br><br>A pilot project has been set up to fund projects concerning the establishment of business networks and the development of new IT support services. |
| | **Tax Deductions** | Tax deductions are given in order to promote cooperation between small and medium sized businesses and public research institutions. | Businesses (with fewer than 250 employees) receive a 150% deduction on R&D expenditure for joint projects with public research institutions. |
| | **The Danish Growth Fund** | The Fund is a state backed investment company, which offers compelling value propositions for companies and investors. | The Fund provides funding to fast-growing Danish companies and act as a fund-of-funds investor in the private equity sector in the Nordic region.<br><br>Vaekstfonden invests in early stage ventures mainly focusing on Life Science/Med Tech and High Tech, and provides mezzanine financing to a broad range of industries.<br>It is part of Vaekstfondens strategic objective to work actively to facilitate access to international venture capital and drive the development of an internationally competitive private equity environment in Denmark.<br><br>With a capital base of € 300 million the fund is one of the largest Danish VC players. |
| | **The High Technology Development Fund** | A fund for high technology R&D and innovations in Denmark. | An independent board will administer the fund and allocation of resources. The size of annual expenditures on R&D and innovations will be determined by returns to total capital. The fund will focus on three areas for its funding: ICT, biotechnology and nanotechnology.<br>The funds capital is planned to be built up over eight years from 2005 to 2012, where 400 million euro will be added in 2005 and 270 million Euro each following year until total capital reaches approx. 2.3 billion Euro. |
| | **Innovation Incubators** | The purpose of the innovation incubators is to promote the commercialisation of new innovative ideas, inventions and research. The incubators are established in order to help scientists and others commercialise knowledge and to help them overcome barriers during the start-up of new innovative and knowledge intensive companies. Most of the public financial support is in the form of loans and equity capital placed at the disposal of the incubators to invest in innovative companies. Since 2001, the incubators have been required to | The incubators focus both on ICT companies and on companies in other high tech sectors.<br><br>As of 2004, seven incubators had been established in Denmark, all organised as limited companies.<br><br>Total public funding in 2005-2008 is 64 M€ and private sources of capital in 1998-2003 was 135 M€. |

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| | | finance part of the innovative companies themselves or find private funding for the companies. Investment occur at three stages.<br>1. Investigative activities. Investigative activities are activities that aim to secure the future access to and supply of innovative ideas to the incubators.<br>2. Preliminary analysis and evaluation. A preliminary analysis is a pre-investigation of an idea's scientific and commercial relevance and viability.<br>3. Pre-project funding. When the initial analysis indicates that an innovative idea is viable, the entrepreneur establishes a company to develop the project further. | |
| | **The Danish Council for Independent Research** | The Danish Councils for Independent Research provide support to Danish research based on the initiatives – both single-discipline and cross-discipline – of researchers themselves. Funding is allocated on the basis of applications for e.g. research networks, research teams, grants, international collaborative programmes, researcher training programmes, etc. The Councils also provide scientific research advice in all scientific fields for the Danish Minister of Science, Technology and Innovation, the Danish Parliament and the Danish Government. | The Councils consist of a Board of Directors and, at the most, six scientific research councils. The Board of Directors consists of a Chairperson and eight recognised researchers. Every member is appointed by the Minister of Science, Technology and Innovation after an open call for applications. The Board decides on the number of scientific research councils and must ensure that all fields of scientific research are covered. Furthermore, the Board allocates the independent research funds to the scientific research councils.<br>In each of the scientific research councils, there are 15 recognised researchers who, together, cover a council's area of responsibility. The members of the scientific research councils are appointed by the Minister after an open call for applications. The scientific research councils choose their own chairperson and decide which specific research activities are to receive funding.<br>The Danish Councils for Independent Research's advice will be based on the scientific research councils and will be channelled through the Board of Directors, which is responsible for the Councils' scientific research advice.<br><br>Total expenditures for all fields: 121,6 M€. |
| | **The Danish Council for Strategic Research** | The Danish Council for Strategic Research supports research in politically prioritised research areas and contributes to strengthening interaction between public and private research. Furthermore, the Council is to seek out new research trends and provide professional research advice to the Minister. Private and public institutions can also receive professional research advice.<br>The Board does not have the competence to allocate funding. For the implementation of programme funding, the Board either appoints programme commissions or, according to previous agreement, leaves this task to the discretion of the Danish Councils for Independent Research. | The Danish Council for Strategic Research consists of a Board of Directors and a limited number of programme committees. The Board consists of a chairperson and eight members. The Minister for Science, Technology and Innovation appoints the chairperson and one member. The other members are appointed by the Minister after an open call for applications.<br><br>The Danish Council for Strategic Research is, furthermore, responsible for approving the allocation procedures and conducting a professional assessment of the incoming applications in connection with the allocation of government research funds by the individual ministers. To underpin this work, the Council can appoint so-called programme committees.<br>The Council has received a number of proposals for strategic priority areas.<br><br>Total public funding in IT sector: 6 M€. |
| Finland | **Tekes, the Finnish Funding Agency for Technology and Innovation** | The Agency provides funds for individual R&D projects, preparation projects, seed phase loans for start-up companies and supports technology transfer. | Total volume of RD project funding is annually about 70 M€. Research areas are not specified (=ICT generally).<br><br>Small R&D preparation projects (market surveys, business plans, competitor analysis, internationalisation plans etc.) funding is 24 M€, part of this funding is |

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| | | | directed to ICT-companies.<br><br>Seed phase loans (2004 volume 2,2 M€), part of this funding is directed to ICT-companies.<br><br>- PK-ICT (=SME-ICT): to support the use of ICT in business, aim is to improve the productivity and competitiveness of Finnish SMEs by encouraging wider use of ICT in business.<br>- Mobile-TUPAS: aim is to transfer the research results in mobile business field to SMEs. Companies can apply for funding to buy services from research organisations in the mobile business field<br>- TULI activity: aim is to identify research-oriented business ideas and offer funding and help to commercialise them (2004 volume 2,5 Meuros) |
| Germany | **Accompanying Services** | Other support for RTD in the field of OT (including certain research topics closely related to ICT) consists of strategically planned and coordinated accompanying measures (InnovuM OT;) for the creation of favourable start and general conditions, i.e. networking resources, education and training, measures for small and medium-sized companies und harmonisation and standardisation. | This measure is managed by VDI TZ. |
| | **Information Society Germany 2006** | The goal is it to promote the use and spread of modern information and communications technologies in economy and society, to initiate the formation of companies in the field of Multimedia, and to develop and test new information and communication technologies. | The Federal Ministry of Economics and Labour has commissioned the Project Management Organization (PT-MM) in DLR to implement through funding activities the political will of the German Government, which is expressed in the action programme "Information Society Germany 2006". There is no "programme" in the CISTRANA sense which implements the political concepts but the organization PT-MM, which funds IT activities.<br><br>The spectrum of possible project contents ranges from technology applications in the area of Business-to-Business (B2B), Business-to-Consumer (B2C), Business-to-government (B2G), over eLearning and ePayment solutions up to mobile Multimedia services, knowledge management and virtual firm's structures. Further funding priorities are:<br>- eBusiness, - eGoverment, - eMobility, - eLearning / knowledge management, - secure transactions, - future technologies, - networked intelligent systems.<br>The chosen projects mostly have a duration of three years and receive a grant of approx. 3-4 million €. The grant is fixed for one year only, depending on the budget resources, which is given each year to the Project Management Organization (PT-MM) by the Ministry. On average PT-MM receives 20 Million € for new competitions and for funding running projects. 35 - 40 projects are supervised by PT-MM at present with an average of 7 partners. Promoted projects aim at close-to-applications developments, from which products are to be developed later on. |
| Greece | **Research and Technological development in the IT domain/ Upgrading of the Greek Research and Technology Network** | The recent upgrading of the National Network for Research and Technology to 1-5 Gbps introduces a new digital era in Greece. The GRNET upgrading to GRNET2, the new generation optical Wavelength Division | GRNET2 is implemented with co-financing from the Information Society Operational Programme (Priority 3 "Development & Employment in Digital Economy", Measure 3.3 "Research & Technological Development for the Information Society") and Community competitiveness |

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| | | Multiplexing (WDM) network, is carried out in parallel with the upgrading of the European GEANT research centre and the corresponding networks in Germany, France and Italy.<br><br>GRNET2 provides fast and secure access to the Internet, as well as advanced telematics services to the research and educational community in Greece. | programmes in the framework of the common European Policy under e-Europe2000 and e-Europe2005 on research - educational networks.<br><br>Total public funding by Ministry of Finance/Structural Funds/ERDF: 19 M€. |
| Hungary | **KFIIF (part of RTIF) – Research Information Infrastructure** | The aim is the support of the development and improvement of the research information infrastructure, improve access to information technology tools and services and encourage cooperation among researchers both at national and internation levels with various IT technologies and solutions. | This measure is managed by National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI). |
| | **Pazmany Peter Programme (part of RTIF) – Creation of Regional University Knowledge Centers** | This programme provides funds for the establishment of Knowledge Centres at Universities where significant research activities are focused on particular fields and close cooperation is established with industrial actors and innovation activities. They are to be regional clusters of activities that contribute to the economic development of the region and to the increase in Hungarian economic competitiveness. | This measure is managed by National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI). |
| | **Irinyi Janos Programme (part of RTIF) – Individual innovative ideas, spin-offs, technology incubators** | Support the realisation of individual innovative ideas and creation of technology incubators. | This measure is managed by National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI). |
| | **Economic Competitiveness Operational Program: Measure 3.2 – Improvement of the conditions of research, technology transfer and co-operation at publicly financed and non-profit research facilities** | Development of the research infrastructure of publicly financed research facilities<br><br>Support of partnerships and building of networks promoting technology transfer and co-operation between companies and publicly financed research facilities | This measure is managed by National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI). |
| | **Economic Competitiveness Operational Program: Measure 3.3 – Reinforcement of Corporate R&D capacities and innovations skills** | Support of the innovation tasks of new, technology and knowledge-intensive micro-enterprises and spin-off companies<br><br>Development of corporate research infrastructure related to the creation of new research places<br><br>Promotion of corporate innovation | This measure is managed by National Office for Research and Technology (NKTH) / Agency for Research Fund Management and Research Exploitation (KPI). |
| Iceland | **The Technological Development and Innovation Fund** | The main objective of the fund is to strengthen development work and research in the field of technological development that aims at innovation in the Icelandic economy. The Technology Development and Innovation Fund finances Innovation projects in accordance with the main emphasis of the Science and Technology Policy Council of Iceland. During the first years the main instrument of implementation is to give grants to technological development and related research supporting innovation in the | The Technological Development and Innovation Fund is under he auspices of the minister of industry and commerce.<br><br>RANNIS, The Icelandic Centre for Research is entrusted with the management of the fund on behalf of the Ministry of Industry and Commerce.<br><br>Budget for 2005 is 4 M€ and will be 6 M€ in 2007. |

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| | | Icelandic economy amongst others in co- operation with research institutes, universities and industry. | |
| | **The Research Fund** | The main objective of the Research Fund is to strengthen basic and applied research in Iceland. To that effect the fund will support well defined research projects with clear goals and deliverables. Applicants can be individuals, research groups, universities, research institutes and industry. The Research Fund gives grants in accordance with the main emphasis of the Science and Technology Policy Council and on the basis of an assessment of the quality of the projects and the capacity of the applicants to carry out the research work. | The Research Fund is under the auspices of The Ministry of Science, Culture and education.<br><br>RANNIS, The Icelandic Centre for Research is entrusted with the management of the fund. RANNIS reports to the Ministry of Education, Science and Culture<br><br>Budget for 2005 is 6,3 M€. |
| Ireland | **Commercialisation Fund** | The commercialisation Fund aims to support research in the areas of technology of medium term interest to industry in Ireland leading to technologies, products or processes that provide the basis for new businesses in Ireland or can improve the competitiveness of industry in Ireland | Within the Informatics area the sub headings are a) e-business including e-Learning and e-Health b) Digital Media and c) Mobile and Wireless Technologies<br><br>Total public funding: 45M€ |
| | **Research Technology and Innovation (RTI)** | The RTI Scheme, which is co-funded by the EU Structural Funds, is aimed at bringing about a substantial increase in the level of high quality R&D in businesses In Ireland. It supports commercially focused, industry led projects in product and process development. It concentrates on high quality, risk intensive R&D projects, which are essential for companies to establish or to maintain their overall competitiveness. Projects can relate to either product or process development. | This is a generic R&D programme open to all manufacturing and internationally traded services companies based in Ireland.<br><br>Total public funding: 178 M€ |
| Israel | **MAGNET (Support for generic R&D)** | To provide a competitive position for Israel's industry with regard to state-of-the-art technologies of global interest. The new technologies are to be developed in a cooperative venture between the industry and leading academic scientific research institutions in the field, and will provide the basis for new high-tech products and processes. | This measure is coordinated by Office of the Chief Scientist (OCS) and Ministry of Industry Trade & Labour<br><br>There is no pre-allocation of budget to a technology field; the priority for funding is worked out through a “bottom-up” approach, based on the initiative of the proposers.<br><br>Grants are provided up to 66% of the approved budget.<br><br>Total public funding (from OCS) is 35 M€. |
| | **Technological Incubators** | Supportive frameworks that enable novice entrepreneurs, with innovative concepts, to translate those ideas into commercial products and to establish their own company. The incubators support the earliest stages of technological entrepreneurship that are not yet ready for private investors, such as the VC funds, thereby preventing commercially viable technological ideas from going to waste due to lack of resources. The technological Incubator program provides entrepreneurs with the following benefits:<br>• R&D grant<br>• R&D infrastructure<br>• Business guidance | This measure is coordinated by Office of the Chief Scientist (OCS) and Ministry of Industry Trade & Labour<br><br>Conditional loans up to 85% of the approved R&D expenditures (budget of €243 000 - €405 000 for two years), subject to royalties upon sales, in case of commercial success only.<br><br>Annual budget (from OCS) is 23 M€. |

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| | | • Administrative assistance | |
| | **Israel Science Foundation (ISF)** | The ISF awards grants to researchers at Israeli universities, other centres of higher education, research centres and medical centres. All ISF support is researcher lead. | Priority for budgeting is worked out solely by a "bottom-up" system and there is no pre-allocation of budget by discipline. ISF evaluates, selects and supports Israeli basic research through competitive grants based on excellence and scientific merit within the wide range of: Exact Sciences and Technology (38%), Life Sciences and Medicine (45%) and Humanities and Social Science (17%).<br><br>Total public funding (from Planning and Budgeting Committee): 43 M€ per year and external donations 2 M€ per year. |
| | **R&D Fund** | Funding is open to all Israeli registered firms wishing to engage in technological research and development that involves technological novelty and economic justification resulting in the development of a new product or process, or a significant improvement to an existing product or process. | This measure is coordinated by the Office of the Chief Scientist (OCS) and the Ministry of Industry, Trade & Labour.<br><br>There is no pre-allocation of budget to a technology field; the priority for funding is worked out through a "bottom-up" approach. In 2004 the overall OCS budget for ICT was 67.6% of the overall budget, out of which the distribution is: Communication – 56%, Software – 17.5%, Electronics – 16.5% and Electro-optics – 10%. This reflects in general the distribution within the R&D Fund program.<br><br>Total public funding (from OCS) is 250 M€ per year. |
| Italy | **Promotion and diffusion, within small and medium enterprises. of innovation based on ICT, in order to improve their competitiveness (Bando ICT MAP)** | The content of the programme is the experimentation and the implementation, using advanced software applications, of new business processes concerning the phases of ideation, approval, production, distribution and marketing, finalised to the development of new products/services and to the reduction of business costs. | Organisation responsible for the administration: Ministry of Production Activities (MAP)<br><br>Total public funding: 62,8 M€ |
| | **FONDO AGEVOLAZIONI RICERCA (FAR)** | Call 2004 ICT<br>Call 2004 Wireless Piemonte<br>Call 2005 public private laboratories<br>Call 2005 Aero-space Lazio | Organisation responsible for the administration: Ministry of Education, University and Research (MIUR)<br><br>Total public funding: 81 M€ (2004-2005)<br><br>Main Technology Areas:<br>- Regional and sectoral pilots<br>- Multi-modal and multi-sensorial dialogue modes<br>- Mobile applications and services<br>- Infomobility and geographic information<br>- Advances signal processing<br>- Application services provision |
| | **FONDO EUROPEO SVILUPPO REGIONALE (FESR)** | Call 2002 Information Society for the Southern Scientific System Strengthening and Qualification of the Infrastructural Equipment Used for Scientific and Technological Research and for High Formation in the Regions of the Objective 1 in Italy<br>Call 2003 Local Network Infrastructures<br>Call 2004 High Performance Computing and Simulation Systems | Organisation responsible for the administration: Ministry of Education, University and Research (MIUR)<br><br>Total public funding: 165 M€ |
| | **FONDO PER GLI INCENTIVI NELLA RICERCA DI BASE (FIRB)** | Call 2001A Enabling Technologies for the ICT Knowledge Society<br>Call 2001B Safeguard of citizens' rights and security<br>Call 2001C Science and Technology in the Knowledge Society<br>Call 2003A Consitution, strengthening and deployment on the net of public-private laboratories specialised in the | Organisation responsible for the administration: Ministry of Education, University and Research (MIUR)<br><br>Total public funding: 134,5 M€ |

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| | | development and use of enabling technological platforms in the area of advanced nano and micro technologies applied to post-genomic and to advanced diagnostics systems<br>Call 2003B Strategic programs: chemistry and pharmacology – human, economic and social science - Fusion | |
| Latvia | **Latvian Council of Science Grants** | Provides grants in the field of informatics. | Currently the amount of grants in the field of IT is 0,4 M€. These grants cover a very wide spectrum of research, both theoretical and applied. |
| Netherlands | **Embedded Systems Institute (ESI)** | The research of the Embedded Systems Institute addresses the topic of architecting complex software-controlled systems for heterogeneous environments- | The research program of the Embedded Systems Institute has four research themes that relate to design aspects. They are:<br>• Systems architecture<br>• Specification methods<br>• Design modelling<br>• Distributed control.<br>Around qualities the research program has three research themes. They are:<br>• Verification and validation<br>• Reliability, predictability and robustness<br>• Energy efficiency.<br>Because all of these themes support the central research question of architecting complex software-controlled systems for heterogeneous environments, they are strongly interrelated. Each project in the Embedded Systems Institute is aimed at one or more of these research themes, but almost all of the projects will address a number of them.<br><br>Total public funding from Ministry of Economic Affairs: 25 M€. Other sources: industry 12,46 M€, research institutes 17,12 M€. |
| | **LOFAR ICT for Wide-area Adaptive Sensor Networks** | LOFAR started as a new and innovative effort to force a breakthrough in sensitivity for astronomical observations at radio-frequencies below 250 MHz. The basic technology of radio telescopes had not changed since the 1960s: large mechanical dish antennas collect signals before a receiver detects and analyses them. Half of the cost of these telescopes lies in the steel and moving structure. A telescope 100x larger than existing instruments would therefore be unaffordable. New technology was required to take the next step in sensitivity needed to unravel the secrets of the early universe and the physical processes in the centers of active galactic nuclei.<br><br>LOFAR is the first telescope of this new sort, using an array of simple omni-directional antennas instead of mechanical signal processing with a dish antenna<br><br>It was soon realised that LOFAR could be turned into a more generic Wide Area Sensor Network. Sensors for geophysical research and studies in precision agriculture have been incorporated in LOFAR already. Several more applications are being considered, given the increasing interest in sensor networks that “bring the environment on-line”. | This programme is owned by Stichting Astronomisch Onderzoek in Nederland (ASTRON).<br><br>Total public funding from Ministry of Education, Culture and Sciences: 52 M€. Other sources: industry 13 M€. |

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| | **GIGAPORT Next Generation** | GigaPort offers the Netherlands the opportunity to take a lead in the development and use of advanced and innovative Internet technology. This will strengthen the position of the Netherlands in the new ICT-driven economy. GigaPort focuses on research on next-generation networks and the implementation of a next-generation network for the research community. The GigaPort-Network can match the best research networks in the world and offers companies and institutions a state-of-the-art test environment for new (network) services. The GigaPort NG Network will accelerate the exploration and implementation of ICT innovations in the Netherlands, and will position the Netherlands as an important hub and knowledge centre for ICT infrastructure in Europe. | - Programme structure<br>The programme has been divided into the following subprojects:<br><br>• Research on Networks<br>In this subprogramme GigaPort will develop the knowledge, skills and tools to construct networks and to bring them into production. Its area of research spans 'optical networking', 'high performance routing and switching', 'management and monitoring', 'grids' and 'access and testing methodology'.<br>• Networks for Research<br>In this subprogramme GigaPort will make available advanced national and international network services to the Dutch scientific community, providing them with a competitive edge in the form of an instrument for their research. The current network, SURFnet5, is a high-grade national infrastructure to which research institutions, universities, universities of professional education and similar institutions have been connected. The external connections of SURFnet5 can be divided into connectivity with European research networks; other research networks in America and Asia; other Internet service providers through the Amsterdam Internet Exchange; and the remaining parts of the world, i.e. everything not covered by the above. Designing, constructing, bringing into production and upgrading SURFnet6, the new network, will provide valuable empirical knowledge and expertise of networks.<br>Within these activities there is close collaboration with the SURFworks Next Generation (NG) project, that develops advanced middleware and applications for the research community and higher education.<br><br>Total public funding from Ministry of Economic Affairs: 40 M€, National Organisation for Scientific Research (NWO)/National Computer Facilities and EU: 7,8 M€. Other sources: industry 13,6 M€. |
| Norway | **Open Scheme for Academic Institutions** | Open scheme for scholarships as well for project funding. | No pre-allocation of funds for ICT research (proposals compete solely on merits).<br><br>Total annual funding to ICT projects is estimated at about 1 M€ on average. |
| | **Centres of Excellence** | Scheme for Centres of Excellence for universities and public research institutions. Centres on certain topics are funded for 5+5 years (pending on a mid-term review). | No pre-allocation to ICT.<br><br>One of 13 centres launched in 2003 is in the ICT domain. |
| | **Support for "Strategic Technology Research Projects** | This scheme addresses the university and public research institution sector. | Annual budget allocated to the ICT domain is approximately 6 M€. |
| | **Simula Research Lab** | A publicicly funded research centre. | Established in 2001 for a 10 year period. (subject to a mid-term review).<br><br>The centre has three research departments:<br>-Software engineering<br>-Networks and distributed systems<br>-Scientific computing<br><br>Annual funding about 6 M€. |
| Poland | **Funding in Ministry of Science and Information Society Technologies** | The separate research projects in the field of electronics, informatics and communications are co-financed by the Ministry. The financed projects are mainly carried out by technical universities, institutes of the Polish | Approximate volume of funding is 1,5 M€ per year. |

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| | | Academy of Sciences as well as R&D institutes. | |
| | **The Polish Platform for Optoelectronics Technology** | The primary aim of the Platform is to create connections between research institutes and enterprises as main recipients of optoelectronics technologies. Establishment of this Platform was also an essential condition for professional and profitable cooperation with European technological platforms. | Established as a result of decisions adopted during the OPTOELECTRONICS 2004 Conference and the 2nd Engineering Forum of the Polish Federation of Engineering Associations (NOT). |
| | **Polish Platform for Mobile and Wireless Communications Technologies** | There was established a new technology platform to support research and technological development in the field of ICT. | The aim of the platform in to join in works of the European structure eMobility |
| | **PIONIER: Polish Optical Internet - Advanced Applications, Services and Technologies for Information Society** | The idea of the programme was to develop advanced infrastructure together with advanced tools, services and applications for scientific environment as well as for government and self-government administration and the society. The programme concept envisaged three aims: to develop information sciences infrastructure in Poland up to the level, which facilities conducting research in the area of challenges of contemporary science, technology, services and application; to produce and test pilot services and applications for information society as well as to let Poland compete in the area of software development for new applications. | Organisation responsible for this measure is State Committee for Scientific Research (at present: Ministry of Science and Higher Education).<br><br>Strategic tasks of the programme were realized in five areas: advanced network applications, advanced network services, advanced network infrastructure, advanced specialized infrastructure and international network connections. The projects concerning network applications were related to interpersonal communication based on utilization of voice and video transmission, computational sciences applications including information processing and transmitting techniques, remote teaching, communication between members of people group (also mobile users) and the like. The modern broadband network PIONIER allows to separate virtual optical networks such as optical broadband Internet network, special optical networks for research projects, optical network to connect supercomputer centres, network to connect public administration units and other specialized networks.<br><br>Total public funding from State Committee for Scientific Research (at present: Ministry of Science and Higher Education) has reached 70 M€. It is planned to continue the PIONIER programme in the future with the focus on development of advanced network services and applications. |
| Slovakia | **Grants organised by the Agency for Support of Science and Technology** | The Agency regularly arranges open calls for grants (maximum 50% financial contributions for the project should be approved). | The Agency is public administration under financial chapter of the Ministry of Education.<br><br>Grants are oriented for different areas – not only for ICT. |
| | **VEGA – Agency for Grants in Science** | Other activities funded by state budget are grants organised by the VEGA. The VEGA arranges regularly open calls for grants (maximum 50% financial contribution for the project should be approved) specifically oriented for science projects only. | VEGA is a joint activity of the Ministry of Education and the Slovak Academy of Science.<br><br>Grants are oriented for different areas – not only ICT. ICT area is managed by specific VEGA Sub-commission for Electro-technology and Informatics. |
| Slovenia | **Slovenian Research Agency** | The Agency annually publishes a call for proposals for research projects, applied research projects and post-doctoral projects, all for three year period. Any legal or private entity can apply for research projects if registered at the Slovenian Research Agency as a research organisation or individual researcher.<br><br>The Agency also finances post-graduate studies and research | |

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| | | qualification for young researchers and also subsidizes the purchase of research and information-telecommunications equipment through a public call. Maximum subsidy is 75% of the total costs. | |
| Switzerland | **Interactive Multimodal Information Management – National Centre of Competence in Research (NCCR)** | The National Centre of Competence in Research (NCCR) on Interactive Multimodal Information Management (IM2) is aimed at the advancement of research and the development of prototypes in the field of multimodal man-machine interaction. | The organisation responsible for this centre is Swiss National Science Foundation (SNSF).<br><br>The NCCR is particularly concerned with technologies coordinating natural input modes (such as speech, image, pen, touch, hand gestures, head and/or body movements, and even physiological sensors) with multimedia system outputs, such as speech, sounds and images. Smart meeting rooms equipped to record, process, index, archive, and make available through online meeting browsers are the first test-bed application used to illustrate the research results.<br><br>Total public funding from: SNSF 30 M€, institutional funding 10 M€, EC and CTI projects 15 M€. Funding from other sources: industry 5 M€. |
| | **National Center of Competence in Research in Mobile Communication and Information Systems (NCCR MICS)** | The NCCR MICS is one of the 14 National Centers of Competence in Research launched in 2001. | NCCR MICS is performing research in mobile information and communication systems, with a strong emphasis on wireless technologies and novel self-organizing networks and information systems.<br><br>Total public funding: SNF 9.9 M€, participating institutions 11.1 M€ |
| | **Quantum Photonics National Centre of Competence in Research (NCCR).** | Carries out research in advanced areas of photonics with a view towards applications. | Organisation responsible for this centre is Swiss National Science Foundation (SNSF)<br><br>Main fields of research are Quantum communications, Nanophotonics and optical processes in nanoscale objects), Advanced light sources from the near infrared to X-rays (light emitting diodes and diode lasers, quantum cascade lasers, high power fibre lasers, femtosecond and attosecond pulse generation), Photonic systems and photonic integration (lasers, detectors, all optical switching, 2-dimensional photonic crystals).<br><br>Total public funding from: SNSF 12,5 M€, Board of Federal Institutes of Technology 1,5 M€, participating universities 10 M€. Funding from other sources: industrial partners 2,2 M€. |
| Turkey | **Industrial R&D grants** | Industrial R&D Grant Programme is a general programme of which any scale of industrial companies including ICT companies can apply for granting their R&D projects. The technology objectives of the programme are listed as;<br>- *to share the risk doing the R&D project,*<br>- *to increase the in-house capability in design of new products and processes,*<br>- *to increase the percentage of industrial R&D expenditure in Turkey,*<br>- *to deepen and widen R&D culture in industry,*<br>- *to promote industry-university cooperation,*<br>- *to promote the employment of qualified people,* | Organisation responsible for this measure is TUBITEK-TIDEB (Technology Monitoring and Evaluation Board)<br><br>Total public funding is 30 M€ per year. Other sources of funding from Technology Development Foundation of Turkey(TTGV): 15 M€. |

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| | | - *to assist SMEs in managing projects effectively,*<br>- *to bring together the separate but related knowledge bases (networking) in generating technology specific competences,*<br>- *to open up new scopes to industry in becoming competitive.*<br><br>Grants provide funding up to 60% of eligible project costs. | |

For more information

CISTRANA web-site: http://www.cistrana.org/

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