EESTI ARENGUFOND

Smart Specialisation – Qualitative Analysis

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Foreword

Smart specialisation is a term that will be heard a lot in Europe in 2013. The purpose of smart specialisation is to identify areas of the economy where the potential for growth and the value added are above average, and where a competitive advantage can be achieved by investing in research and development. The European Commission has placed smart specialisation in the spotlight among research and development activities and innovation strategies, and turned it into a precondition for receipt of EU funds. The growth areas selected in the course of smart specialisation are priorities in the 2014-2020 financing period. The starting point in the selection of growth areas is the current specialisation of the Estonian economy and research whilst the process of entrepreneurial discovery and global economic trends are determining factors.

It is important to emphasise that the most sought-after areas are those with strong potential for cooperation between industry and science. This focus is extremely important, as they do not always go hand in hand in Estonia or elsewhere in Europe, which means that there is a lot of potential to improve cooperation.

It is also important to understand the background of smart specialisation. The European economy is still in crisis and the development of new innovation policies is seen as Europe's new source of innovation growth, which will improve its competitiveness. The crisis in Europe is, above all, a crisis of competitiveness. High sovereign debt is often named as the cause of the crisis, but this is actually a result caused, among other factors, by the weak competitiveness of Europe. In economic terms, Europe has two options in improving its competitiveness – cost-cutting (although people hardly ever consent to pay cuts) or increasing productivity. Becoming more efficient is certainly a long process, which smart specialisation facilitates. The potential for noticeable efficiency gains in the long run justifies the focus on smart specialisation already in the short run.

Estonia has been in better macroeconomic shape since the recent crisis began than "old" European countries, but Estonia's problem is that its productivity is lower than in the West – people in Estonia work hard but add less value per hour than people doing the same work in some other European countries. This makes sense considering our history – we have made great progress in productivity in the last twenty years, but it would have been impossible for us to become as efficient as Finland after building up our own state for just twenty years. The change of the political and economic regime at the beginning of the 1990s meant that the work done in many sectors was wiped out and people had to start building new systems from scratch. Therefore, the goal of smart specialisation in Estonia is the same as is it for the rest of Europe – to become more competitive.

Cheap labour used to be Estonia's competitive advantage in Europe, but this difference is decreasing unavoidably as the income levels in Estonia increasingly converge with those of Western Europe. There needs to be renewed focus on so-called "smart" jobs to avoid losing competitiveness even further. Estonia must move up in the production chain and concentrate more on innovation and development. Smart specialisation is therefore very important, as we need to find areas that increase our efficiency, to avoid relying mainly on low wage levels as our competitive edge.

Estonia must move up in the production chain and concentrate more on innovation and development.

The process of smart specialisation influences strategic choices in the RD&I strategy and the entrepreneurial growth strategy prepared by the Ministry of Education and Research and the Ministry of Economic Affairs and Communications.

We can definitely say that we are living in an era of major economic change. *The Economist* recently wrote in a special issue (21 April 2012) that we have been hit by the third wave of the Industrial Revolution. The first wave brought us the steam engine around 1850 and the second one allowed factories and mass production to use electricity around the 1920s. The third wave we are experiencing right now is based on an increasingly widespread use of technology in industry and in practical solutions. Automation represents a significant part of this: technology does an increasing amount of work that used to be done by people, starting from factory workers and train drivers to more complicated jobs. The crisis of 2008/2009 has accelerated this process considerably: companies had to become more efficient in hard times and technology was something that enabled them to do so. Unfortunately, this means that the number of unemployed people is increasing around the world. Competition has become a cross-border phenomenon, which means that having smart entrepreneurship is highly critical to a state. Countries that have the skills required for complicated jobs will find success, while life will be difficult for those that do not focus on smart enterprise.

Kristjan Lepik
Estonian Development Fund

Summary

The Ministry of Education and Research and the Ministry of Economic Affairs and Communications have launched the process of preparing an RD&I strategy and an entrepreneurial growth strategy. **Smart specialisation** has an important role in these new strategies. The European Commission has placed smart specialisation in the spotlight among research and development activities and innovation strategies, and turned it into a precondition for receipt of EU funds. The areas of growth selected in the course of smart specialisation will be the priorities in financing for the 2014-2020 period. This means that smart specialisation has certain funding assigned to it.

Different parties have been involved in the smart specialisation process in Estonia. A **quantitative analysis** was carried out with the support of the Ministry of Economic Affairs and Communications, Enterprise Estonia and the Estonian Research Council (under the guidance of Professor Urmas Varblane) and eight areas were identified in which Estonia currently has the highest economic potential. This **qualitative analysis** is a follow-up to the quantitative analysis and complements it. Future trends (which were given an important place in the previous work of the Estonian Development Fund) are also considered in the qualitative analysis as well as possible areas of cooperation between enterprise and research. The Estonian Development Fund analysed the sectors as a matrix, looking at the horizontal and vertical sectors and their crossing points.

The team of the Estonian Development Fund met with various entrepreneurs, researchers and professional associations in the course of the qualitative analysis. The fund also organised a conference on 1 November 2012 to hear the opinions of entrepreneurs and researchers. The list of related parties is given in Annex 2. **Involving entrepreneurs** is considered very important in smart specialisation, which is why many interviews were conducted with entrepreneurs from different sectors. The objective of the interviews was to determine the growth areas in Estonian scientific research and the private sector that had the most in common and to hear the opinions of entrepreneurs about the problems in our economic environment.

The process of entrepreneurial discovery refers to a bottom-up approach. The importance of using this approach is also emphasised in European-level source documents concerning smart specialisation. The use of the top-down approach – where the public sector determines narrow growth areas with administrative guidelines – is not recommended.

The objective of the qualitative analysis is to identify the areas with the greatest potential, which is also the basis of the strategies prepared by the Ministry of Education and Research and the Ministry of Economic Affairs and Communications. Thanks to the interviews conducted, the opinions of entrepreneurs were also taken into account in this qualitative analysis.

Involving entrepreneurs is considered very important in smart specialisation

This analysis is divided into three chapters. Chapter 1 describes the background of smart specialisation in Europe. Chapter 2 explains the methodology of quantitative and qualitative analysis and contains a structural analysis of the Estonian economy from the point of view of innovation and an overview of global trends. The selection of growth areas is given in Chapter 3.

Three important global trends (expanded on in Chapter 2.4) were selected as the growth areas as a result of the qualitative analysis, and sub-sectors are highlighted as more specific selections.

1. Information and communications technology (ICT) horizontally via other sectors. It is important to note that the development of this sector around the world has reached a stage where bigger opportunities can be found in the application of ICT technology in other sectors. The three sub-sectors of the highest priority are listed below, but in the case of ICT the sub-sectors should not be strictly limited to the list and support may also be given to other sectors that cross paths with ICT.

Sub-sectors:
a) use of ICT in industry (incl. automation and robotics);
b) cyber security; and
c) software development.

2. Healthcare technology and services. Demand for healthcare services is growing globally as the population ages.

Estonia has the greatest potential in:
a) biotechnology (a strong scientific basis); and
b) e-health (use of IT for the development of medical services and products).

3. More efficient use of resources. The increasing global population is likely to increase the need to use resources more efficiently.

Estonia's potential in this area is greatest in:
a) materials science and industry;
b) development of the 'smart house' concept (IT solutions and more efficient construction of houses (passive house)); and
c) food that supports health.

In Q1 2013 it will highlight the problems of growth areas that need to be supported by measures (the activities)

The ICT sector proved to be the strongest sector on the basis of the qualitative analysis, which was also confirmed by interviews with entrepreneurs and the questionnaire given in Chapter 2.3.

Qualitative analysis is an important facet of smart specialisation, but still just one part of the overall process. This analysis should not therefore be regarded as final, but as a work in progress. The Estonian Development Fund will continue analysing smart specialisation and in Q1 2013 it will highlight the problems of growth areas that need to be supported by measures (the activities) to ensure that cooperation between entrepreneurship and research is as efficient as possible. A detailed analysis of growth areas will also be provided.

The **implementation** of the smart specialisation policy from 2014 must be considered very important, as smart specialisation requires regular monitoring and surveillance in terms of growth areas as well as the regular assessment of projects and measures.

1 Process of smart specialisation in Europe

The long-term example of smart specialisation was obtained from the Nordic skills and competence centre programmes, and the OECD also started supporting the same trend recently with its analysis and publications. In 2012 Estonia participated in a joint project of the OECD and the European Union (EU) which included mapping the current smart specialisation practices of the participating states and preparing a report on the role of smart specialisation in guaranteeing the economic growth of regions. Although the concept of smart specialisation is new and developing, it is ranked high in the innovation policy of EU Member States. It is highlighted as a precondition for the use of the funds of the European Regional Development Fund (ERDF) in the proposal of the European Union Cohesion Policy (3) 2014-2020 for financing such investments from 2014-2020[1].

Smart specialisation means identifying the specific features and resources of every state and region, highlighting the competitive advantages of each region, and assembling the region's stakeholders and resources around a knowledge-based vision of the future. The national/regional research and innovation strategies (RIS3 strategies) of smart specialisation are integrated location-based economic changes that perform five important roles[2]:

1. they aim policy support and investments at the country's/region's most important priorities, problems and needs for the promotion of knowledge-based development;

2. they rely on each country's/region's strengths, competitive advantages and achievement potential;

3. they support innovation that is based on technology and practice, and stimulate private sector investments;

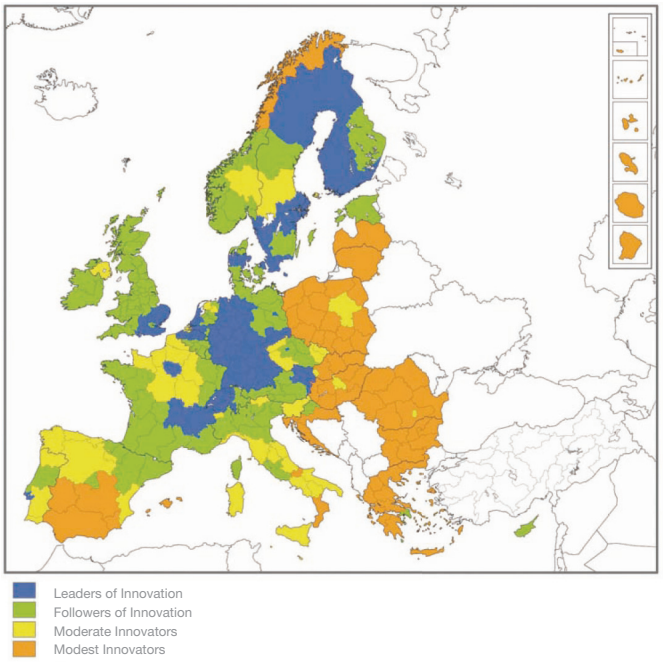
4. they include stakeholders to the full and promote innovation and experimentation; and

5. they rely on facts and contain reliable surveillance and evaluation systems.

The European Union as a whole is moving forward with this topic at present. Smart specialisation started in the EU in 2011, when the European Commission (EC) launched the smart specialisation platform to support the determination of innovation and RD&I strategies in regions and Member States (EC, 23 June 2011).

It is understood that highly different facets of reality are hidden behind macro-level indicators, which is why attention must be given to parts of the whole (GDP, unemployment, etc.), i.e. the level of sectors and regions (regional GDP, unemployment, etc.) in order to change the big picture.

Map of regional differences in level of innovation. Source: (RIS 2012)



[1] European Commission newsletter "RESEARCH AND INNOVATION STRATEGIES OF SMART SPECIALISATION"
[2] European Commission newsletter "RESEARCH AND INNOVATION STRATEGIES OF SMART SPECIALISATION"

One of the most important keywords of smart specialisation is entrepreneurial discovery[3], which points out the specialisation trend that may actually lead to results. Smart specialisation does not just attribute importance to the quality of research based on the number of times research work is quoted, but expects a clear, positive impact on the real economy. The number of times research is quoted is just one indicator used to evaluate the quality and volume of research in a region, but often-quoted research of high scientific impact may have very little influence on the region's real economy or social system.

One of the most important keywords of smart specialisation is entrepreneurial discovery[3]

Smart strategic selection and evidence-based smart specialisation presume that the private sector joins academia and that real products, services and companies are produced by academia in addition to focusing on the quality of research. A number of parties from the private and public sectors must be involved. Early involvement of the private sector reduces the risk that often threatens the spin-offs of universities: a small number of employees in a very specific area of activity and an impact on the real economy that is smaller than expected, which means that it is impossible to earn back the (public) investments made in the infrastructure, equipment and research in universities. The process of entrepreneurial discovery refers to a bottom-up approach. The opposite of this tactic would be a top-down approach, where the public sector determines narrow growth areas with orders and administrative guidelines.

A longer description of the smart specialisation process is given in Annex 1.

[3] Entrepreneurial discovery means discovering something new in entrepreneurship, be it the development of a new company, production line or innovative technology. It is accompanied by uncertainty, but discovering something new in entrepreneurship is also the path to higher profit margins.

2 Smart specialisation in Estonia

The Ministry of Education and Research and the Ministry of Economic Affairs and Communications have launched the process of preparing an RD&I strategy and an entrepreneurial growth strategy. The Knowledge-based Estonia strategies, which were prepared for the periods 2002-2006 and 2007-2013, may be considered the predecessors of smart specialisation. The difference of smart specialisation from the above is that the same strategic guidelines are given to all EU Member States and that projects also have certain funding assigned to them.

Smart specialisation has an important role in new strategies. This chapter contains an analysis of the structure of the Estonian economy from the viewpoint of innovation and gives the details of the quantitative and qualitative analysis carried out to identify growth areas within the scope of smart specialisation. The chapter also highlights the most important global trends in the coming decade that Estonia must bear in mind.

2.1. STRUCTURE OF ESTONIAN ECONOMY FROM THE VIEWPOINT OF INNOVATION

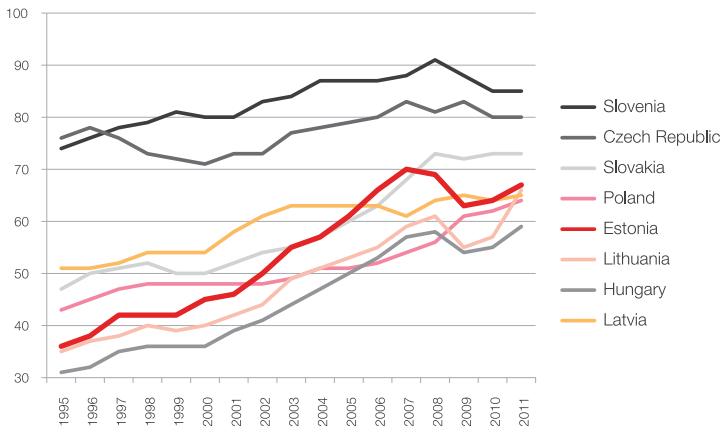
The economy of Estonia has grown strong over the last two decades and climbed from 36% of average GDP per capita in the EU in 1995 to 67% in 2011 (Figure 1).

Looking at the factors behind this rapid growth we can assume that a similar speed of growth will not be achieved again. Before the crisis the economic growth of Estonia proceeded from the inclusion of workforce and capital, while the development of technology produced around one-third of the growth. Employment in Estonia is reaching a level that corresponds to long-term potential economic growth.

It is rather unlikely that an increase in employment will be the main engine of economic growth in the coming years

There are also signs that suggest that the technical adaptation of the economy in recent times has taken place quickly, making it difficult for the labour supply to keep up. The north-easterly shift of the Beveridge curve[4] (Figure 2) may be given as an example, which can be regarded as a sign of an increase in structural unemployment as well as in the labour unit cost (which may also refer to future competitiveness problems in the Estonian economy). This means that despite the relatively high unemployment rate, it is rather unlikely that an increase in employment will be the main engine of economic growth in the coming years.

Figure 1. GDP per capita as a ratio of European Union average (source: Eurostat)



[4] The Beveridge curve represents the relationship between unemployment and the job vacancy rate, which has the unemployment rate on the horizontal axis and vacancies on the vertical axis. The shift of the curve up and to the right (north-east) should therefore refer to an increase in structural unemployment.

Although overall uncertainty remains high on domestic and export markets, Estonian companies must continue to reorganise their production activities. This means that the investment activity of companies is likely to remain high in the phase when the economy is recovering from the crisis, despite the low applicability level of production capacities.

This in turn suggests that while the economic growth of Estonia used to be based on involvement of labour and capital, in future it is more likely to occur through technological development and capital involvement.

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Estonia's research and development expenditure has been growing strong in recent times and according to Statistics Estonia amounted to as much as 2.41% of GDP in 2011. Although the result exceeded the European Union average for the first time, the massive growth this year was a **one-off** and based mainly on the construction of an oil plant, which was classified as a research and development activity and comprised one-third of the relevant expenditure[5]. Growth has still been rather broad-based, even without that one-off factor. However, the research and development expenditure of Estonia, even considering the one-off leap made in the previous year, is still considerably lower than the relevant indicator of Nordic countries and other technologically more developed countries (Figure 3).

The share of persons employed in research and development among all employed persons is relatively low in Estonia compared to the international level

Figure 2. Beveridge curve (source: Statistics Estonia)

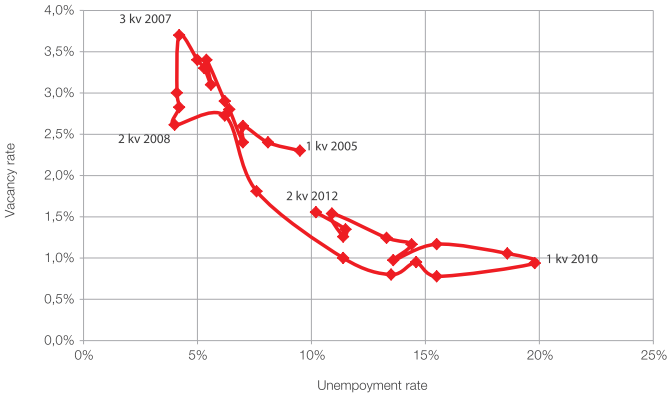


Figure 3. R&D expenditure as a ratio of GDP (source: Eurostat)

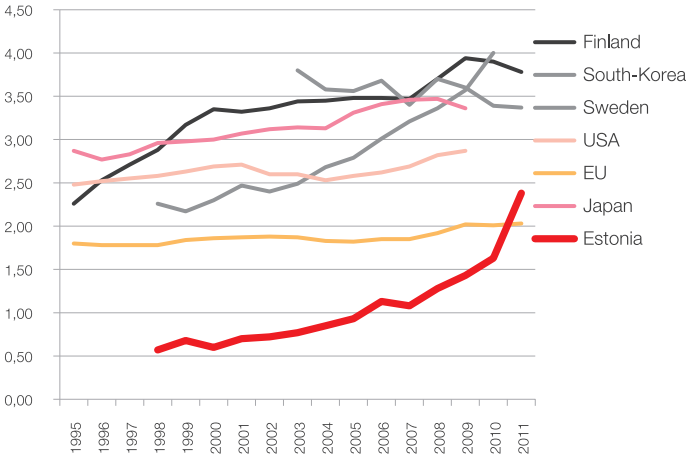
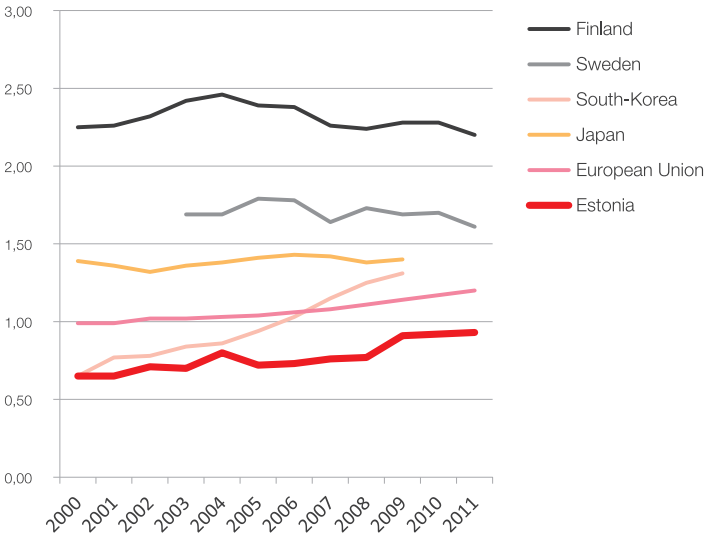


Figure 4. Share of persons employed in R&D activities among all employed persons (source: Eurostat)



The share of persons employed in research and development among all employed persons is relatively low in Estonia compared to the international level (Figure 4) and most of them are active in universities rather than in

[5] The contribution of oil industry to the R&D expenditure of Estonia comprised one-third in 2011 (http://www.stat.ee/57493).

Extra 1:
Base technology or technology applications?

States and regions face a very important question in scientific and entrepreneurial cooperation: should they focus on the development of base technology or use applications of technology developed by others? European source documents of smart specialisation (Forey et al.; 2012) use the term 'key enabling technologies' (KET). Another similar term is 'general purpose technology' (GPT). This refers to technology that has already been created and that can be applied horizontally through sectors, such as ICT, biotechnology and nanotechnology.

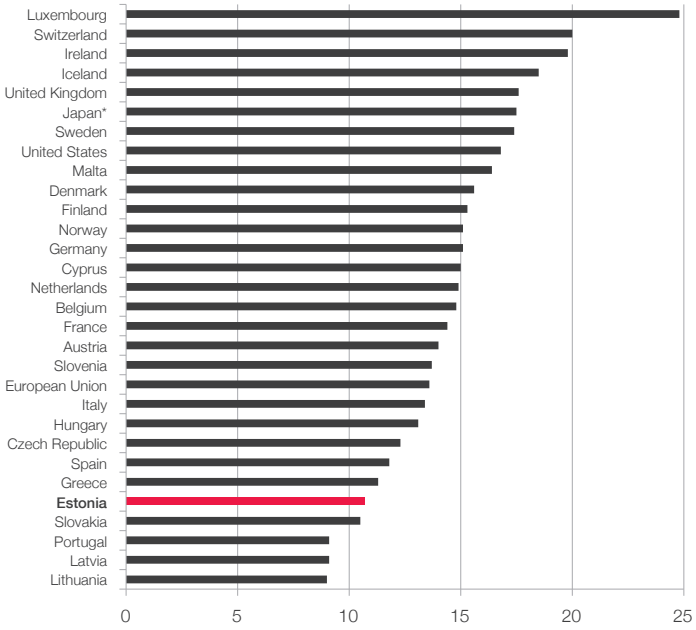
Although Europe has been successful in developing several forms of base technology, it has been less successful in their application in the creation of products and services in the private sector. Less developed European regions are advised to focus on the application rather than the development of technology.

Less developed European regions are advised to focus on the application rather than the development of technology

The opportunities to create something new in the base technology of various sectors are different, but the Estonian Development Fund is largely of the opinion that Estonia's business opportunity lies in the application of existing technology rather than the creation of new forms. Development of technology is very resource-intensive, in terms of both capital and workforce, and it is difficult for Estonia to compete with large research centres. Detailed application opportunities are highlighted in Extra 2. However, it is important to note that if Estonia does not focus on competing in the development of technology, it is very important for the country to be involved in the cooperation and networks aimed at the development of these forms of technology. The information and knowledge gained improve chances of success in the application of technology.

The EST_IT@2018 report of the Estonian Development Fund also points out that Estonia's chances of achieving success in base technology are small and adds that "the advantage of Estonia is likely to lie in its knowledge of technology and the market, the ability to combine the new areas of technology created elsewhere in suitable business models and to bring products and services meant for export to the market at the right time." (Rebane et al.; 2009)

Figure 5. Share of persons employed in knowledge-based activities among total employment in the private sector in 2011 (source: Eurostat)



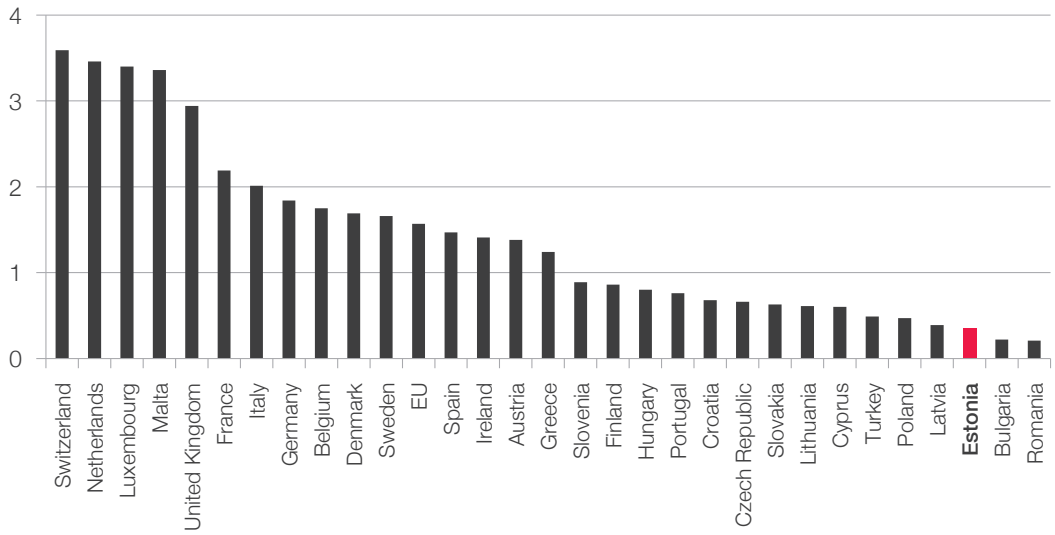
enterprises. The share of persons employed in knowledge-based areas of activities in the Estonian private sector may also be considered rather low in international comparison (Figure 5).

The International Comparative Analysis of Research Funding in Estonia (Ukrainski et al.; 2012) also stated that "the impact of the Estonian R&D system is relatively weak in the local context and it is not adequately connected to entrepreneurship, which means that the system does not generate enough economic output. This is why the policy recommendation is that Estonia must focus its RD&I activities on economic growth areas that are strong via smart specialisation, for example, in order to achieve an increase in added value."

In conclusion, the R&D data of Estonia can be considered to be in compliance with the picture that can be expected from a transition country moving from simple subcontracting towards activities that add more value in the international production chain.

Production of added value has so far been rather intensive in terms of energy and material-intensive in Estonia. According to Eurostat, the cost of the materials required to produce one unit of added value in Estonia has increased since the turn of the millennium and remained more than four times worse than the European Union average in 2009, only beating the relative indicators of Romania and Bulgaria (Figure 6). However, the energy efficiency of the Estonian economy has increased: according to the OECD, Estonia managed to create USD 2.3 worth of GDP with one ktoe of energy in 1995, but the same indicator had

Figure 6. Productivity of resources in 2009, EUR/kg (source: Eurostat)



risen to 4.1 in 2010. It remains obvious, however, that we are lagging behind the OECD average (6.9) as well as the world average (5.3). The economic model of Estonia is also very rich in greenhouse gases – in 2009 the country managed to produce USD 1.5 of GDP at 1 kg of CO^2 emissions. The relevant OECD indicator was 3.0 and the global one 2.2.

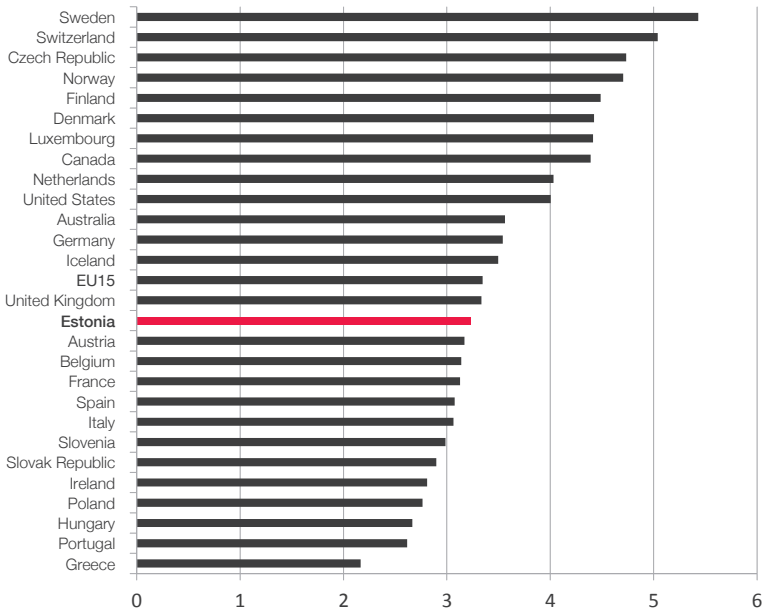
In conclusion, we can say that the Estonian model of creating added value places a relatively large burden on the environment and leaves a lot of space for development in the context of the green economy.

According to Statistics Estonia the share of the Estonian ICT sector in the added value produced has been quietly growing since 2006 and comprised 5.2% in Q3 2012. This indicator is not as good as that of the Nordic countries, but comparable to the EU average (Figure 9). 21.8 thousand people worked in the Estonian ICT sector in Q3 2012, which comprised 3.4% of total employment.

Our share of ICT specialists in total employment is well below the level of technologically developed countries and places us below the EU average

Our share of ICT specialists in total employment is well below the level of technologically developed countries and places us below the EU average (Figure 7). The relatively

Figure 7. Share of ICT specialists in total employment (source: OECD)



modest impact of the ICT sector is also indicated by the OECD survey of how much the sector contributed to the increase in labour productivity from 1995-2008, where Estonia had the highest increase in labour productivity among the surveyed states, but ICT contribution to this growth was among the lowest (Figure 8).

The impact of the ICT sector as a whole on other economic sectors has not been greatly researched. There are some examples of such research, though. For example, Oulton (2012) found that the main impact of the ICT sector proceeds primarily from use of the services created by the sector and not so much from its production side. However, it was found that in the long term the ICT sector will provide 0.54% of GDP growth per year in the case of the

European Union, and even up to 0.74% if the use of ICT services is equalised with the relevant indicator of Sweden. Sabbagh et al. (2012) listed 150 countries according to their so-called 'digitalisation' by giving points from 0 to 100 on the basis of selected indicators. Estonia placed among transition countries that scored 30-40 points and where a 10-point increase in digitalisation would increase GDP per capita by 0.59%. Similar to earlier surveys it was again found that the impact of an increase in digitalisation is larger the more developed the country is in any given area. A background indicator that can be highlighted here is the OECD (2012) survey of the impact of the Internet on the added value created in the economy, which found that the share of GDP created in the US in 2010 ranged between 4.7-7.2%, depending on the methodology used. An even narrower survey of the impact of a broadband connection on GDP growth has also been carried out, which indicated that a 10% increase in capacity varies from 0.25% (Koutroumpis, 2009) to 1.38% (Qiang et al., 2009).

However, it was found that in the long term the ICT sector will provide 0.54% of GDP growth per year in the case of the European Union

Overall, the ICT sector of Estonia rates as rather average in international comparison despite the recent growth. International experience suggests that further development via a transition to other sectors will have a positive impact on the economy as a whole, and the higher the level of development achieved by the ICT sector itself, the bigger this impact will be.

Figure 8. ICT contribution to labour productivity growth from 1995-2008 (source: OECD)

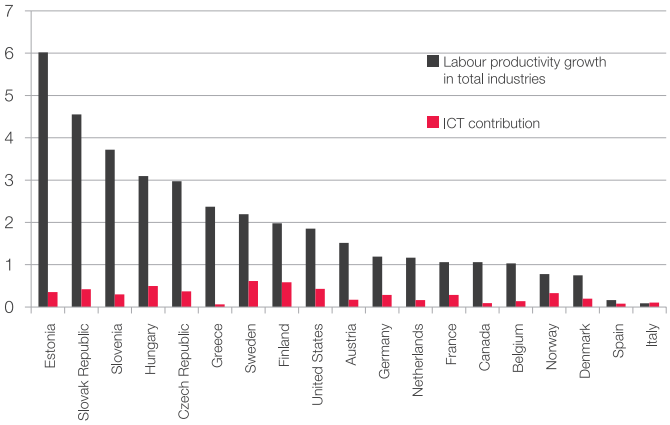
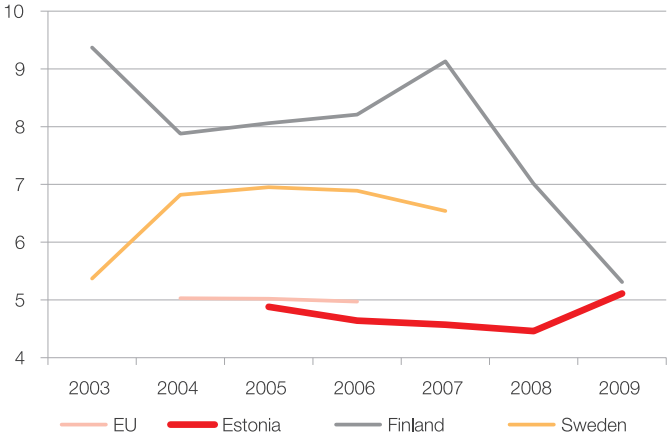


Figure 6. ICT contribution to GDP (source: Eurostat)



2.2 QUANTITATIVE ANALYSIS

The workgroup managed by Urmas Varblane carried out a quantitative analysis to ascertain Estonia's key areas with the highest potential growth. The analysis reflects the dynamics of the recent past and the current economic status of Estonia. To assess the future potential, qualitative assessment methods must also be used, but the premise of mapping the current status and the standpoint of smart specialisation is that developing one's strengths in the course of the entrepreneurial discovery process creates the preconditions for making the right choices and achieving a unique competitive advantage. An analysis of the current situation therefore indicates where the process of entrepreneurial discovery has already taken place. The quantitative analysis ascertained the areas of activity which in Estonia:

- produce higher added value;
- are export-intensive and characterised by large volumes of foreign trade; and
- have a high rate of employment.

The workgroup managed by Urmas Varblane identified eight potential growth areas. This chapter contains a brief summary of the quantitative analysis.

Table 1. Quantitative analysis of Estonian economy by sector

	Growth area	Number of companies	Employ-ment	Sales revenue (€ thousand)	Sales revenue from exports (€ thousand)	Added value (€ thousand)	Added value per worker
1	ICT	2 266	17 591	2 292 407	1 210 462	621 989	35,4
2	Health technology and health services	241	3 530	428 593	327 719	107 137	30,35
3	Mechanical engineering	257	6 720	520 121	442 156	157 915	23,5
4	Logistics	992	10 738	2 275 490	1 489 123	534 520	49,8
5	Chemical products	367	2 285	364 033	456 556	77 052	49,8
6	Innovative house-building (wooden houses)	563			255 003		
7	Timber enhancement (doors, windows, furniture, design, cellulose, paper and cardboard)	967	13 043	1 165 053	724 809	286 574	22
8	Functional food						

2.3 QUALITATIVE ANALYSIS

The team from the Estonian Development Fund met with various entrepreneurs, researchers and professional associations in the course of qualitative analysis. The fund also organised a conference on 1 November 2012 to hear the opinions of entrepreneurs and researchers. The list of parties related to the process is given in Annex 2. Involving entrepreneurs is considered very important in smart specialisation, which is why many interviews were conducted with entrepreneurs from different sectors. The objective of the interviews was to determine the areas of Estonian science and the private sector that had the most potential for cooperation and to hear the opinions of entrepreneurs about the problems in our economic environment. The interviewees were selected from different economic sectors and from the largest companies possible. Interviews were also conducted with researchers from several foreign universities, as looking at something from a distance makes it possible to see additional opportunities and problems.

Involving entrepreneurs is considered very important in smart specialisation, which is why many interviews were conducted with entrepreneurs from different sectors

The semi-structured method was used to conduct the interviews: some questions were always the same; others varied depending on the sector the interviewee represented. The questions used in the interviews were guiding and their purpose was to obtain a good overview of the interviewee's knowledge of their area of activity and their opinion of the areas of cooperation between research and entrepreneurship that have the greatest potential. The interviewees were also asked to highlight the problems in the economic environment that obstruct such cooperation as well as hindering innovation in the broader sense.

Qualitative analysis focuses on further developments and future trends in the economic environment, which are difficult to prove in quantitative terms. The fund therefore developed a model in which the eight sectors identified with quantitative analysis are assessed via qualitative analysis in the following areas:

- potential of entrepreneurship in Estonia;
- potential of research in Estonia; and
- extent of economic impact and probability of its realisation.

Experts from various sectors were sent tables with instructions and asked to assess them[6]. Altogether 22 experts responded to the survey.

Assessing the potential impact is important for the consideration of **scalability** – do the company's products have the potential for a large increase in sales volumes? How great is the capacity to offer products or services outside Estonia? The extent of impact was assessed in two parts – the potential volume of the impact and the probability of achieving the impact.

The evaluations prepared on the basis of the interviews carried out by the fund are given in Table 2. The fund did not ask the interviewees to fill in the table, but prepared the table on the basis of its own insight after the interviews had been conducted. The choices made by the respondents in the survey are also given in Table 2. Many public sector specialists, heads of research institutions and researchers, heads of clusters and associations or unions of companies and managers representing single companies gave their answers. The combined result of both approaches is given in the table, although the methodology used for the approaches is different. Its purpose is to give an overview of how much the results of the two analyses overlap.

The difference between the opinions of the respondents and the Estonian Development Fund proved to be small and the two strongest areas are the same in both cases

The difference between the opinions of the respondents and the Estonian Development Fund proved to be small and the two strongest areas are the same in both cases (incl. their order): ICT, and healthcare technology and services. The fund also asked the research committee of Tallinn University of Technology to evaluate the potential on the basis of the same model, and they likewise found that ICT and healthcare technology and services are the two areas with the greatest potential.

[6] The survey was explained as follows: "Please rate the potential of Estonian entrepreneurship and research by sector on a scale of 0-3. The response should include future potential from 2014-2020. Please also rate the size of potential economic impact – how big the given sector's economic impact is and the probability that this impact will be realised (from 0-100%). For example, if the economic potential of the sector is large but the probability of its achievement is small, the score for the extent of impact may be 3 and its probability 20%."

Table 2. Results of survey and opinion based on Development Fund's interviews by sector

	Enterprise		Research		Volume of impact		Probability of impact		Total impact		Total score	
	K	AF	K	AF	K	AF	K	AF	K	AF	K	AF
ICT	2,4	3,0	2,1	2,0	2,5	3,0	0,8	0,8	2,0	2,4	6,5	7,4
Health technology and health services	1,8	1,5	2,6	3,0	2,0	3,0	0,6	0,6	1,3	1,8	5,7	6,3
Mechanical engineering	2,1	2,0	1,4	1,5	2,0	1,5	0,6	0,6	1,2	0,9	4,7	4,4
Logistics	2,4	2,0	1,1	1,0	2,1	1,5	0,7	0,7	1,3	1,1	4,8	4,1
Chemical products	2,1	2,0	2,0	2,0	1,7	1,5	0,6	0,8	1,0	1,2	5,1	5,2
Innovative house-building (wooden houses)	2,3	2,0	1,6	2,0	1,6	2,0	0,7	0,6	1,1	1,2	5,0	5,2
Timber enhancement	2,3	2,0	1,4	1,0	1,9	2,0	0,6	0,8	1,2	1,6	4,9	4,6
Functional food	2,0	1,5	2,4	2,5	1,9	2,0	0,6	0,7	1,2	0,7	5,7	4,7

*Total impact = volume of impact * probability of impact; total score = enterprise + research + impact; DF – evaluation based on interviews carried out by Development Fund; A – average estimate obtained in survey. The volume of enterprise, research and impact is evaluated on a scale of 0-3 and the probability of impact on a scale of 0-100%. The total score is the sum of the three areas.*

The analysis of these areas is also the basis for the more detailed selection of growth areas. The Estonian Development Fund also assessed sub-sectors and crossover points between sectors on the basis of the above model (research, enterprise and impact).

The following can be highlighted when we look at the sectors in greater detail:

- Enterprise in Estonia is rather strong when it comes to mechanical engineering, logistics and timber enhancement, but the capacity of companies to use research is weak. For example, a large share of companies in forestry belongs to foreign owners and conversations with entrepreneurs confirm that in most such cases, there is no desire to bring development activities from the company's home market to Estonia.
- When it comes to functional food, however, we see that the research side is considered stronger than the entrepreneurship associated with it, and the limiting factor that often affects the food industry is that sales of their products are frequently subject to geographic restrictions. This is why extending economic impact is difficult for this industry.
- Chemical products have potential in enterprise and research, but it is not as high as in ICT and healthcare services and technology.

The ICT sector was considered the one with the greatest potential

Opinions shared by the entrepreneurs interviewed:

- The ICT sector was considered the one with the greatest potential – this opinion was also shared by many entrepreneurs active in other sectors (the food industry, mechanical engineering, etc.). Lack of quality labour was mentioned as the biggest problem for the ICT sector.
- It is important to expand cooperation with foreign countries, both by bringing foreign specialists here and sending Estonian people abroad.

- Representatives of different sectors said that bringing strong specialists to Estonia is very difficult due to the strict immigration policy.
- Estonian companies often face a growth cap – they cannot develop past a certain level with their available skills, leading to a situation where the owners either have to sell the company or bring in foreign specialists. Emphasising the latter would help keep companies in Estonia and in the hands of Estonian capital for longer. The state's support could create an amplified impact.
- Cooperating with researchers is difficult. One of the problems is that the role of research articles in the evaluation of financing is very high and the current model does not motivate researchers to carry out applied research.
- The role of Competence Centres (CC) is seen as positive and they have intensified communication between researchers and entrepreneurs. The laboratories of CCs offer entrepreneurs a great opportunity to carry out tests, as it is often impractical for single companies to have their own labs.
- Fragmentation of the current support measures is a problem. It is difficult to obtain an overview of measures and many of them are very small in volume – we need more concentrated measures and support.
- The number of engineers and other scientists trained in Estonia is too small.
- Entrepreneurs felt positive about emphasising growth areas: "a small state cannot afford to be mediocre in everything and must select sectors to focus on".

2.4. GLOBAL TRENDS

The global economic environment has been characterised by high uncertainty since the crisis of 2008/2009. On one hand, this is psychological – many people still remember the crisis and it makes them cautious. On the other hand, the changes in many places have been structural and there have been massive fundamental shifts. This has made entrepreneurs (and others) all over the world more cautious, which means that they often save money in their accounts as a security buffer instead of investing in innovation.

Europe's focus on smart specialisation is very important in such an environment, as the state's support also encourages companies to contribute more to innovation

Europe's focus on smart specialisation is very important in such an environment, as the state's support also encourages companies to contribute more to innovation. It is also important to note that countries which are not at the forefront of technology development, including Estonia, have more to gain from smart specialisation.

However, there is no doubt that establishing a long-term strategy in enterprise is difficult in such an environment and flexibility may be considered important. How do you establish a national strategy with smart specialisation in the midst of all this uncertainty? It is certainly difficult to forecast what the situation in the world economy will be like in 2020. However, there are some trends that continue even in such a complicated environment. The Estonian Development Fund has always considered analysing future trends an important activity (Matsulevitš et al.; 2012) and used this competency to highlight trends.

Three such large trends are highlighted below.

1. **Development of technology.** The development of technology has been fast in the last decade and it is very likely to continue in the next decade. Looking at the ICT sector, it is important to note that the development of technology has reached a point where many forms of technology have progressed from the development phase to a phase where they can be applied in broader use (see Extra 2). For example, when 3D printing becomes widely used, it will lead to structural changes in many sectors. Another important question for states is whether their potential is bigger in the development of technology or its application in practice. The Estonian Development Fund is of the opinion that in many sectors Estonia has a better chance of being competitive in application.

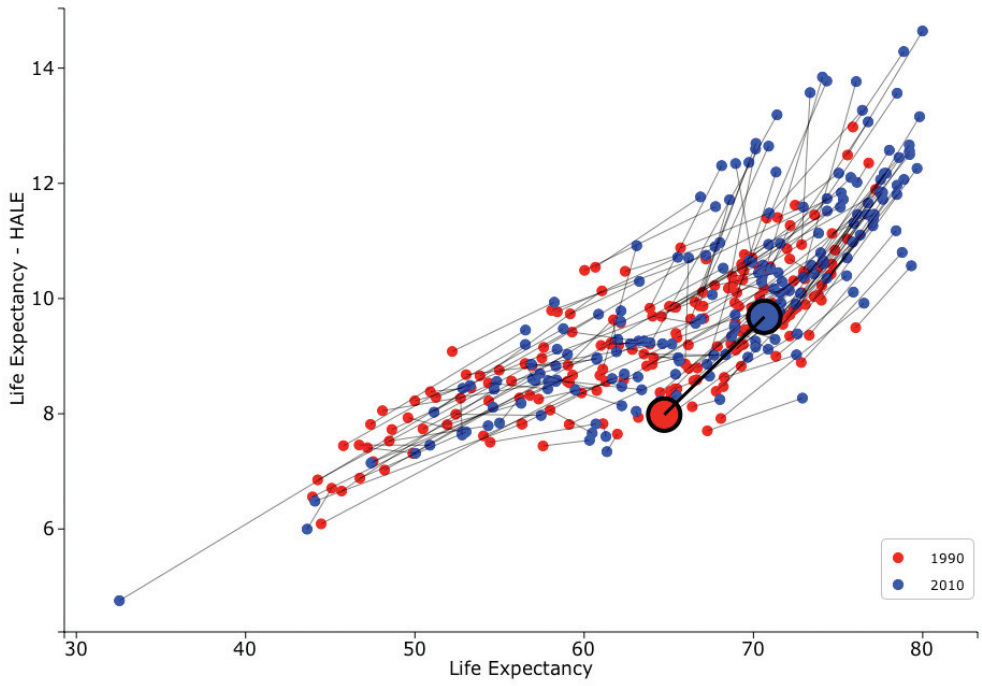


Figure 10. Average life expectancy in countries and number of healthy years lost. Source: Institute for Health Metrics and Evaluation [7]

The Estonian Development Fund is of the opinion that in many sectors Estonia has a better chance of being competitive in application

2. **Healthcare.** The development of healthcare as well as the increase in the level of welfare around the world means that people are living longer. This trend is likely to continue and although it may be regarded as socially positive, it is causing a number of economic problems. The biggest of these is related to pension expenditure – many Western countries are already struggling with social expenditure and the structural trend is that the situation will deteriorate further. States therefore have to choose whether to reduce pension expenditure or become more efficient in cost management. The first of these does not seem to be socially acceptable in almost any country, which is why the emphasis will be on reducing medical expenditure and making the service more efficient. This problem presents another opportunity for those who manage to come up with more efficient solutions. IT and biotechnology have great opportunities here. The increase in the average age of the population per country is given in Figure 10. The vertical axis shows the number of healthy years lost. Both are going up and the latter especially has an important role – the development of medicine allows chronically ill people to live longer, but it makes medical expenditure go up. The movement of Estonia is highlighted in the figure.

States therefore have to choose whether to reduce pension expenditure or become more efficient in cost management

3. **Resources.** The world's population is growing fast and increasing levels of development in emerging countries is bringing about an even faster increase in the number of people demanding welfare. This means that the use of resources, and sometimes a lack of them, is becoming more critical. It is therefore understandable that large countries are increasing their focus on procuring resources and related innovation, i.e. more efficient use. The broad term 'green economy' is likely to receive even more attention by the world in the next decade. It is necessary to use existing resources more efficiently and to develop new forms of technology that lead to greater efficiency.

It is necessary to use existing resources more efficiently and to develop new forms of technology that lead to greater efficiency

[7] http://www.healthmetricsandevaluation.org/gbd/visualizations/gbd-2010-healthy-years-lost-vs-life-expectancy

3 Result of growth area selection

Classic comparison of sectors is called vertical analysis: they are side by side and analysed separately. However, interdisciplinarity – sub-sectors at the crossover points of various sectors – is becoming increasingly important as a result of globalisation and technological development. There are also sectors that move horizontally. For example, the ICT sector could be regarded as vertical at the end of the last century, but possibilities to use the ICT sector horizontally are greater now. Horizontally, the ICT sector offers opportunities to support other sectors.

This is why the Estonian Development Fund also analysed the sectors as a matrix in the case of qualitative analysis, looking at the horizontal and vertical sectors and their crossover points

This is why the Estonian Development Fund also analysed the sectors as a matrix in the case of qualitative analysis, looking at the horizontal and vertical sectors and their crossover points. The smart specialisation documents of the European Union also encourage people to look for crossover points and activities.

3.1. SELECTED GROWTH AREAS

Three important global trends (given in Chapter 2.4) were selected as growth areas as a result of the qualitative analysis, and sub-sectors are highlighted as more specific selections. A more detailed analysis of the growth areas is given below. During the selection of growth areas the Estonian Development Fund looked for ones in which Estonia's potential for cooperation between enterprise and research was strongest and also analysed future trends.

1. **Information and communications technology (ICT) horizontally via other sectors.** It is important to note that the development of this sector around the world has reached a stage where bigger opportunities await in the application of the technology in other sectors. The three sub-sectors of the highest priority are listed below, but in the case of ICT these sub-sectors should not be strictly limited to the list: support may also be given to other sectors that cross paths with ICT.

Sub-sectors:

a) use of ICT in industry (incl. automation and robotics);
b) cyber security; and
c) software development.

2. **Health technology and services.** Demand for health services is growing globally as the population is aging.

Estonia has the greatest potential in:

a) biotechnology (a strong scientific basis); and
b) e-medicine (use of IT for the development of medical services and products).

3. **More efficient use of resources.** The increasing population of the world increases the need to use resources more efficiently.

Estonia's potential in this direction is greatest in:

a) materials science and industry;
b) development of the 'smart house' concept (both IT solutions and more efficient construction of houses (passive house)); and
c) food that supports health.

The ICT sector proved to be the strongest sector on the basis of the qualitative analysis, which was also confirmed by interviews with entrepreneurs and the questionnaire given in Chapter 2.3. This is why the volume of the support given to this sector should be at least twice as much as in health and resources (which could be supported with equal volumes). The Estonian Development Fund will complete a more detailed analysis of the measures in Q1 2013.

It is important to point out that a more detailed analysis of the given sub-sectors will continue so that narrower niches with more potential for success can be found in cooperation with entrepreneurs. Still, these narrower decisions cannot be the result of the given analysis, as decisions on smart specialisations may not be top-down ones. Details will be added to the analysis of growth areas in Q1 2013 when the Estonian Development Fund will complete the next stage of the analysis.

Details will be added to the analysis of growth areas in Q1 2013 when the Estonian Development Fund will complete the next stage of the analysis

3.2. DETAILED ANALYSIS OF GROWTH AREAS

3.2.1. Information and communications technology (ICT) horizontally via other sectors

There have been several success stories in the Estonian ICT sector in the last decade (the most notable of them being Skype), but as the statistics given in Chapter 2.1 indicate, Estonia still has a lot of space for development in the area of ICT. For example, the sector's share in total employment is well below the level of Scandinavia.

The sector has a strong and well-organised professional association (Association of Information Technology) and many companies that have successfully entered foreign markets in recent years (Grabcad, Transferwise, ZeroTurnacount, Modesat, etc.). ICT entrepreneurs often look for scalable business opportunities where the target markets are global, and they are also prepared to invest in development activities. The present development stage of ICT makes it possible to find many small niches for Estonia that are globally scalable.

The role of Skype must also be considered – the people who work and have worked in the development centre in Tallinn have gained experience as part of a global company, and they have often also obtained the capital they need to put their ideas into action. Microsoft as its owner and the size of the company are likely to slow down the speed of further development, but the future projects of the people who worked at Skype may even present bigger opportunities for Estonia. This means that the country must be ready to use this brain potential and offer fertile ground for carrying out these projects in Estonia.

As indicated above, ICT may be considered the sector with the highest potential for Estonia

As indicated above, ICT may be considered the sector with the highest potential for Estonia. ICT enterprise is strong, and the research side has the skills and readiness to cooperate with it (especially the University of Tartu). We must point out that the emphasis in the acronym 'ICT' is on 'IT', because 'C' (i.e. communications technology) is more of a vertical sector.

However, it is important to note that the ICT sector has reached a stage in its development where many forms of technology are reaching the phase of mainstream application (as shown in Extra 2). Use of ICT solutions horizontally or via other sectors is a much bigger opportunity than ten years ago. ICT can help other sectors become more efficient.

Extra 1 points out that Estonia's opportunities lie in the application rather than the development of technology, and this applies to the ICT sector. We have to look at global scales rationally and understand that it is difficult for us to complete with the development capacities of Western countries and Asia. However, it is very important that the ICT sector in Estonia moves from the provision of subcontracting (mainly as a service) **towards products.** This means that we must invest in development activities, because it is the only way to make solutions scalable.

It is therefore important to keep an eye on the development of technology by others and be prepared to apply it. Being small is a downside for Estonia in some respects, but it can also be seen as an opportunity – being a small country allows Estonia to be a great testing environment to see how technology can be applied. For example, e-voting

can already be considered Estonia's success story on the international stage and in 2013 Estonia will probably become the first country in the world to apply near field communications (NFC) nationwide.

Being a small country allows Estonia to be a great testing environment to see how technology can be applied

We have highlighted three sub-sectors of ICT, but unlike health and resources these must be regarded as recommended trends, not fixed choices. It is difficult to forecast a sector whose crossing point is seen as the source of the best opportunities by entrepreneurs in 2014, as it is changing fast. We should therefore trust the entrepreneurial discovery process and let entrepreneurs evaluate the greatest opportunities as they come along. This is why it is very important to include a strong committee of entrepreneurs and researchers in the assessment of projects from 2014.

ICT sub-sectors:

1. **Use of ICT in industry** (incl. automation and robotics) – use of automation and robotics in industry has grown considerably since the crisis of 2008/2009. Companies are trying to be more efficient and the need for people who do physical work is decreasing. This is why automation and the use of ICT solutions continue to have great potential, as most Estonian industrial companies have not used this potential in full. There is a good opportunity here for inclusion of ICT specialists in making industrial processes more efficient;

There is a good opportunity here for inclusion of ICT specialists in making industrial processes more efficient

2. **Cyber security** – Estonia became known as a country with high cyber defence awareness in the foreign media after the cyber-attacks of 2007 and we should continue taking advantage of this. Creation of the NATO Cooperative Cyber Defence Centre of Excellence in Estonia is a positive sign. It is true that not many entrepreneurial opportunities have been used in this sector in Estonia so far, but as a whole the sector is facing extensive development this decade. Global volumes of enterprise are also smaller today than they are likely to be in 2020. Virtual identity is playing an increasingly important role in people's lives, but the risks associated with this are not adequately understood – the role of cyber security must definitely increase in this area;

3. **Software development/programming** – these are necessary for the creation of all kinds of solutions (both software development centres and IT product-based companies). The process is closely related to programming and software engineering, and with the entire software layer on a broader scale – IT system design, development, installation and administration on servers and clouds, up to client administration and data analysis. Zero Turnaround is a very successful example of the cooperation between Estonian research and enterprise in this sector. Another major advantage of the software sector is its flexibility – someone who produces software in one sector can be quickly retrained if necessary to offer solutions in other sectors if demand changes.

Extra 2: Developments in the ICT sector

ICT has undergone massive developments in recent years, but the change in the sector's position has been the biggest. It could be regarded as a separate sector just 15 years ago, but it has now reached a new phase. We can say that the sector has changed from vertical to horizontal – its development has an impact on almost all other sectors and the biggest impact lies in supporting other sectors rather than relying on developments within the sector itself.

Technology research company Gartner uses the 'hype-cycle' model[8] when mapping technology and divides its lifecycle into five phases:

1. **Technology trigger** – researchers discover a form of technology, but there is no practical application.
2. **Peak of inflated expectations** – the first applications lead to unrealistic expectations about the speed of the technology's practical application.
3. **Trough of disillusionment** – arrives when applications do not emerge quickly enough. Investments decrease.

[8] http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp

4. **Slope of enlightenment** – practical application of the technology increases, second and third generation solutions. Practical application increases.
5. **Plateau of productivity** – broad application in practice, the technology has matured, but competition for use of the technology grows with it.

In which phase are Estonia's opportunities greatest? This depends on the sector, but when it comes to ICT, competing in the first phase where forms of technology are discovered is very difficult (see Extra 1). Estonia has better chances in the application of technologies discovered in phases 3-5.

Let us look at the Gartner hype cycle in the figure below. The version completed in July 2012 is given in Figure 12. It shows that a large number of forms of technology are still in the first two phases, which means that mainstream application clearly lies ahead of them.

We also added a similar figure from 2000 for comparison (Figure 13). When these two graphs are compared, we see a massive difference in the quantities of technology as well as in the opportunities for their mainstream use. This means that a massive change has occurred in the ICT sector and that contributing to the horizontal use of ICT via other sectors would have been pointless in 2000, as the economic scale was considerably smaller and the sector was not ready for this.

Contributing to the horizontal use of ICT via other sectors would have been pointless in 2000, as the economic scale was considerably smaller and the sector was not ready for this

When we look at the figure for 2012, we see that a large quantity of various forms of technology will reach the mainstream application stage from 2014-2020, and creating applications in them is also an important opportunity for Estonia.

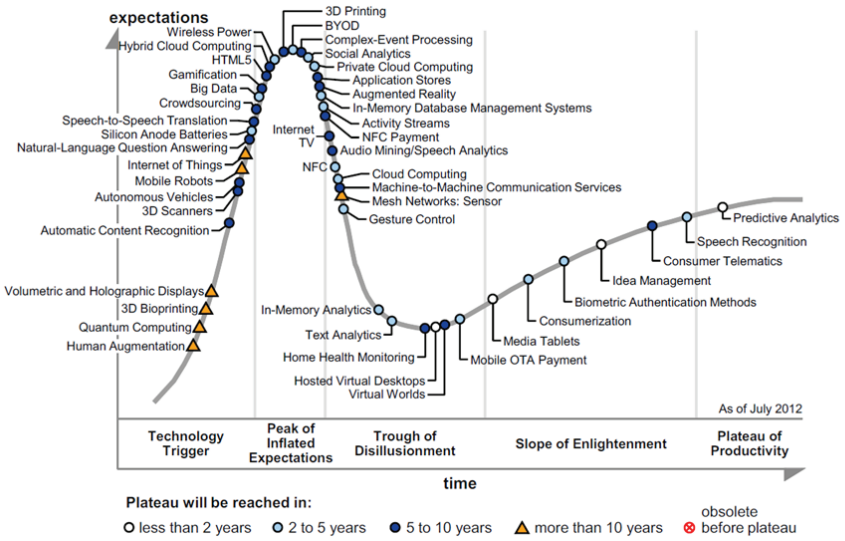


Figure 12. Gartner hype cycle (2012)

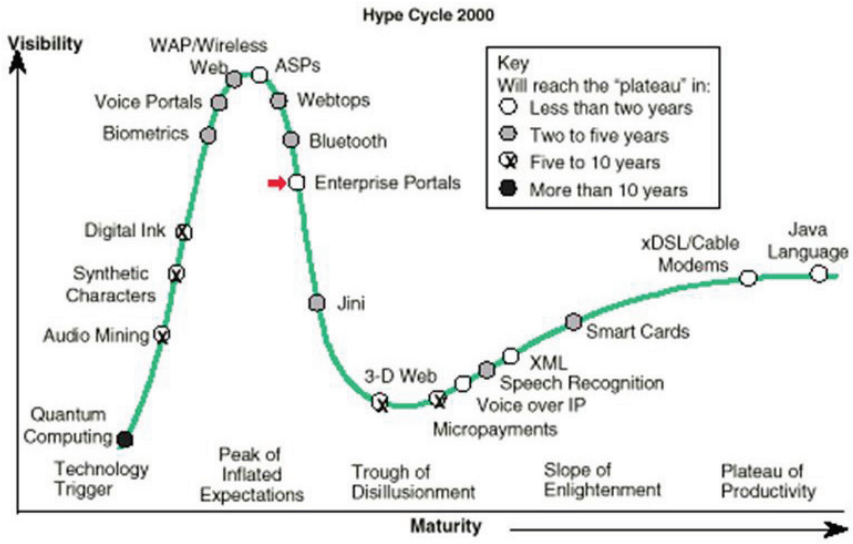


Figure 13. Gartner hype cycle (2000)

3.2.2. Healthcare technology and services

The area of healthcare services and technology is very wide, but the majority of services are local in their essence and there is little scalability potential. However, this is the sector where research is very strong in Estonia as the analysis of Baltic research sectors (Muižnieks et al.; 2013) and the survey in Chapter 2.3 confirm. Enterprise is also represented, but there are few examples in the sector that prove Estonia's export capacity. Cooperation between research and enterprise has plenty of room for improvement and this is why we believe that increasing the economic impact of the sector has potential.

Below we highlight two sub-sectors where the opportunities to achieve an economic impact are greatest in our opinion.

1) **Biotechnology** – Estonia has many strong researchers in this area, but few success stories in enterprise. However, it must be understood that business activities in this sector take a long time. Also, the big difference with other sectors in the evaluation of economic impact becomes evident in this sector (see Chapter 2.3) – the probability that projects in the sector achieve success is often very small, but the impact is massive if success is achieved. Although most projects in this sector fail, the economic benefits of successful solutions are massive. This makes it a high-risk sector for investors and increases the importance of the state's support. Estimates made in drug development indicate that the development of a drug costs approximately one billion US dollars, which makes it very difficult for Estonia to succeed in such competition. This means that Estonian biotechnology companies should be looking for smaller niches where being successful is easier and start from subcontracting if necessary.

2) **E-health** – ICT has the potential to have a very strong impact on the medical sector when moving horizontally. The founder and technology investor of Sun Microsystems, Vinod Khosla, believes that in the future more 80% of the current work of doctors will be done by technology[9]. This vision may come true in a rather distant future, but an increase in medical e-solutions seems unavoidable in the next decade, be it digital medical records or health monitoring with mobile devices. Implementation of digital prescriptions and the launch of the project of electronic medical records (the latter still has a lot of room for improvement) can be highlighted as Estonia's success stories in this sector.

An increase in medical e-solutions seems unavoidable in the next decade

3.2.3. More efficient use of resources

The topic of efficient use of resources is a broad one and contains a lot of 'green economy'. Similar to ICT, it passes horizontally through other sectors, but as it is considerably less homogeneous it is important to select the right sub-sectors. The Estonian Development Fund is considering adding the chemical industry to the three sub-sectors listed below.

Estonia's potential is greatest in the following sub-sectors:

1) **Materials science and industry.** Materials science and industry are likely to be facing massive changes in the next decade, as technological development keeps yielding new materials and applications. Estonia is strong in materials science and two of the five best areas in Estonia were related to this in the list of narrower fields in the assessment of Baltic research (Muižnieks et al., 2012). Solutions of materials science have also been used in enterprise and there is potential for much broader cooperation. There are many other opportunities in this sector, such as energy materials (fuel elements and supercapacitors), magnetic materials (in both production and application) and functionalised wood materials.

2) **Development of the 'smart house' concept.** When we say 'smart house', we mean IT solutions (controlling the house electronically, incl. with mobile devices), using more efficient materials and use of more efficient energy solutions. Estonia has potential in all three areas and we should focus more on the development of complete solutions in this area. This trend is also gaining more attention in Europe, i.e. the Smart City initiative of the European Commission is likely to push this area further into the spotlight. The Nordic countries are also working hard on the development of smart houses, which means there is an opportunity to cooperate with nearby regions.

3) **Health-promoting food.** There are some examples in Estonia where the food industry and researchers have managed to create successful solutions, such as

[9] Do We Need Doctors Or Algorithms?, Vinod Khosla http://techcrunch.com/2012/01/10/doctors-or-algorithms/

the use of the ME-3 bacteria by the dairy company Tere AS in cooperation with researchers from the University of Tartu. The main problem in the sector is scalability – exports of food products are usually geographically limited. However, further development of research in the sector will probably extend the preservation time of products, which in turn will increase the number of target countries. It must also be noted that those who took part in the qualitative analysis considered functional food the third most attractive area and emphasised the strength of research in the sector. As functional food remains too narrow of an area in Estonia (there will be no critical mass), 'health-promoting food' was selected as a growth area. The global trends also support demand for food products - the number of people in the world is constantly increasing and as the proportion of the middle class is also growing, this creates potential for the exponential growth of demand around the world.

3.3. FURTHER ACTIVITIES

Qualitative analysis is an important facet of smart specialisation, but still just one part of the overall process. The Estonian Development Fund will continue analysing smart specialisation and in Q1 and Q2 2013 it will highlight the problems of growth areas that need to be supported with measures to ensure that cooperation between entrepreneurship and research is as efficient as possible. The following analysis takes a closer look at problems, from concerns about the number of students graduating from university with degrees in these sectors to ways in which we could help Estonian companies grow bigger globally rather than settling for selling to foreign investors. It is also necessary to create quantitative models that can be used to evaluate problems in the future.

This qualitative analysis can therefore be considered just one part of the final analysis. The analysis of growth areas will become considerably more detailed after an analysis of problems and measures, moving towards finding the necessary activities to remove bottlenecks in growth areas.

This qualitative analysis can therefore be considered just one part of the final analysis. The analysis of growth areas will become considerably more detailed after an analysis of problems and measures

As it is important for smart specialisation that the specific niches in growth areas are selected in cooperation with entrepreneurs, it is therefore also important that cooperation between professional associations, clusters, CCs and entrepreneurs continue in the selected sub-sectors so that the growth areas can be even more precisely defined (e.g. biotechnology and materials science).

The **implementation** of a smart specialisation policy from 2014 must be considered very important, as smart specialisation requires regular monitoring and surveillance in terms of growth areas as well as regular assessment of projects and measures. Growth areas should not be rigidly determined for a long period. They must be flexible, and we must be prepared to adjust the division of growth areas and measures if a significant change occurs in the environment. The Estonian Development Fund also makes proposals to ensure that the quality of implementation is as high as possible.

A Annex 1. Process of smart specialisation in Europe

Research-intensive development is the priority set by smart specialisation in the EU and is also a part of Europe 2020, the growth strategy of the EU for the next decade (EC, Europe 2020). The Regional Innovation Scoreboard (RIS; Hollander et al., 2012) also points out that the role of innovation in regional development is very important and because the impact of RD&I institutions is largely location-based, innovation policies are increasingly being developed and implemented on the regional level rather than a national or EU one. Considering the small size of the Baltic States it is necessary to define the territory of the entire state as a 'region' and ensure that it benefits from the smart specialisation programme of Estonia. On the regional map of Europe, due to its being so small, Estonia is one of the few countries in Europe where region is equalised with state.

The understanding that prevailed in the past was that we must invest in research, but these investments are not necessarily associated with the structure of local business or industry, instead remaining in the research sphere. Social and service innovation and implementing social changes, including environmental, climatic, energy-related and demographic changes, and dealing with the problems of resource efficiency and energy security may be additional goals of smart specialisation.

Considering regional features, focussing attention.

RIS 2012[10] highlights significant regional gaps in levels of innovation. The smart specialisation initiative of the EU approaches this problem and encourages regions to select innovation strategies that are in line with their specific features. It is important that the risk of resource duplication is thereby reduced. For example, many provinces in China have declared themselves innovation leaders in solar energy and expect the central government to support their ambitions whilst reducing everyone's success by copying each other and repeating each other's activities. The goal of smart specialisation in the EU is to smartly find the specific features and strengths of states and regions so that resources and attention can be focussed on developing these specialisations at a globally competitive level. Overlapping strategies or initiations of regions with lower innovation levels that copy successful regions are not the goals of smart specialisation. The goal is to find a unique, location-based approach. All regions have their place in the international division of work if the critical mass of investments and attention is directed at developing everyone's strengths whilst considering features.

However, it is important to emphasise that the smart specialisation programme will have failed to achieve its goal if path dependence appears, especially in the public sector, which means losing the ability to see past the sectors that have already been chosen and given the status of investment priority. The entrepreneurial discovery process also helps policy-makers in the public sector stop supporting sectors that have run their course at the right time, as continuing to invest in activities with limited prospects would only waste public resources. The public sector's challenge is not to select the right sectors or measures, but to launch and support a constant 'discovery process' (OECD, 7 November 2012). Experimentation is highly recommended, and admission of errors and selection of new areas of specialisation are mandatory if this is supported by entrepreneurial discovery. The main tasks of the public sector are constant monitoring, surveillance and impact assessment.

In addition to the practical examples from Scandinavia given above, the OECD draws separate attention to theories in economics that help interpret the smart specialisation programme: "the theoretical bases of smart specialisation are deep and rooted in classical economic growth theories (e.g. Adam Smith's division of labour) as well as in trade specialisation. The economic theories of

[10] Regional Innovation Scoreboard 2012 or RIS 2012 is a publication that provides a comparative assessment of innovation performance across the (NUTS) NUTS 1 and NUTS 2 regions of the European Union.

later periods have yielded ideas of evolutionary economics; economics of agglomeration; knowledge spill-over; labour market flexibility; Marshallian externalities, industrial districts, flexible specialisation; and spatial economics" (OECD, 7 November 2012). This means that relatively systematic preliminary knowledge of the special branches of macroeconomics is useful in understanding the content of the programme in full. Smart specialisation is not so much a political action plan as a framework that carries a highly applicable macroeconomic goal and methodology. The OECD's publications, especially the sub-topic of Rural, Urban and Regional Development in the Territorial Review publications, give a better understanding of the content of smart specialisation (e.g. to policy-makers). Smart specialisation may come across as a new approach, but it is actually an opportunity to use existing macroeconomic disciplines that have been separated for a long time for the purpose of guaranteeing the economic success of states in a practical manner.

Smart specialisation resembles the so-called triple helix model, which calls for cooperation between the public and private sectors and universities (the education system), where universities hold the leading role (Stanford University). Regional specialisation in Scandinavia also started with the expansion of the network of educational institution and improvement of the quality of lower-level educational institutions.

"The Centre of Expertise Programme (OSKE in Finnish) is a programme of the Finnish Government for the use of regional resources and activities for development areas that are important to the nation. The programme works on the basis of clusters in order to increase regional specialisation and strengthen cooperation between centres of excellence. The national programme covers 13 clusters of expertise and 21 regional centres of excellence. The purpose of the centres of excellence is to create new innovation, products, services and jobs on the basis of the best available knowledge. This supports the specialisation of regions and the division of tasks for the creation of internationally competitive centres of excellence. Another goal is to increase the attraction of the regional innovation environment to bring international companies, investments and experts to the country. The programme of centres of excellence integrates the parties engaged in innovation at the regional, national and international levels and encourages them to exploit competence in order to achieve its goals. Clusters of excellence are formed in connections between the private and the public sector, where the mutual influence of the parties generates benefits that can be clearly observed." (Oske.net)

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