creating an innovative estonia

Innovation studies

Innovation in Estonian Enterprises

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Based on the Estonian results of the Fourth Community Innovation Survey (CIS4)

Andres Viia, Erik Terk, Rünno Lumiste, Aavo Heinlo etc

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Foreword

It may seem that our economic growth of the recent years has been a dream come true. The banks earn record profits from granting cheap loans, real estate developers build new houses at a high rate, employees demand higher wages and rush to replace the recently purchased apartment with a private house. Yet we often fail to wonder whether the given growth of living standards can be sustained and what should be done to sustain it.

I am happy to state that the present survey pays proper attention to the most primary basis of sustainable economic growth – innovation. It points out a significant growth of the share of innovative enterprises in Estonian economy compared to the period four years ago, which is welcome news. The nature of innovative activities in Estonian enterprises is presently often limited to mere increase of production volume and improvement of quality. Compared to countries with innovation-based economies, Estonia has a much smaller share of the enterprises systematically active in product development and finding new markets. But the competitive advantage based on the frequently low production cost of existing products is running out and they cannot be used indefinitely.

Among other things, we can conclude from the survey that we should try to add more value to products and services invented or manufactured in Estonia with potential for international sales, and make an example of successful innovators in Estonia. This could arouse interest among the youth in more complicated but also intriguing specialities. They would realise that it is quite possible to create something new in a way that would leave our people the rights on the intellectual capital created, rather than just satisfaction from the work. In fact, innovation has a much broader meaning than, for example, the development of a vaccine after years of efforts of a biotechnology lab. The DHL forwarding firm, for example, is considered one of the world's most innovative logistics enterprise and Statoil's advantage to its competitors is the fact that besides selling fuel, it offers a constantly developing broad range of services.

I hope that the present survey will provide food for thought to entrepreneurs as well as policy-makers and support the making of decisions, which would accelerate our progress towards innovation-based economy.

Edgar Savisaar
Minister of Economic Affairs and Communications

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Brief summary of the survey

In order to assess the innovation situation in Estonia as a whole or in some narrower sphere and to plan activities on its basis, it is vital to have a detailed survey of the innovation activities in the enterprises and their results. This survey addresses the 2002–2004 period and is based on the **Community Innovation Survey** methodology. The survey based on the *Community Innovation Survey* (CIS) methodology has been carried out in the European countries four times after every four years and Estonia participates in it for the second time. The latest survey or CIS4 covers the 2002–2004 time period, while the previous one or CIS3 covered the 1998–2000 period.

The frame of the survey included 3789 enterprises and the sample 2201 enterprises with more than ten employees and the response rate was very high (79%).

The present survey defines innovation **as a new or significantly improved product (goods/service) brought to the market by an enterprise, as well as the implementation of a new or significantly improved production or supply method in an enterprise.** The survey also considered as innovative the enterprises, which had started corresponding projects in the 2002–2004 period, but had not yet completed the project or had suspended it for some reason.

The survey results reveal an encouraging fact: Estonia has improved its indicators nearly all over the scale. The share of innovative enterprises among all surveyed Estonian enterprises amounted to 49%, which is a very good result, much higher than the EU average four years ago (44%) and according to preliminary data not lower than the EU countries average in 2002–2004. Compared to the results of the previous survey there has been a 13-percentage points growth. Innovativeness among Estonian enterprises is generally influenced by the same trends outlined in the previous EU surveys: the more innovative firms are those with larger number of employees and foreign partners, as well as those belonging to business groups. This survey reveals a significant difference from the previous ones, in comparison with previous surveys conducted in Estonia as well as in the EU. Namely, Estonian services enterprises have proven to be more frequent innovators in the 2002–2004 period. The corresponding percentage in manufacturing industry was 48 and in the services industry 51%. In comparison with CIS3 there were 32% of innovative services enterprises and 39% of industrial enterprises. On the other hand, the high ratings of the services enterprises could be expected, since the previous survey showed that there were more different types of innovative activities as compared to the industrial enterprises.

Four components of the expenses made by the enterprises on the implementation of innovation projects were studied: expenses on in-house research and development activity, expenses on outsourced research and development activity, expenses on the purchase of machinery and equipment and expenses on acquisition of other types of knowledge from outside the enterprise (including expenses on patents, acquisition of inventions, know-how or other types of knowledge). The general image is still lopsided – as before, most of the spending is done on the purchase of machinery and equipment and it may be claimed that only in a few sectors (e.g. financial and insurance sector enterprises) more is spent on in-house research and development activities than on the purchase of equipment.

45% of innovative enterprises in manufacturing industry and 42% in services were either regularly or occasionally engaged in research and development activities. In case of services the indicator has practically remained the same since the previous survey (CIS3: 44%), while in case of industry somewhat increased research and development activity can be noted (CIS3: 40%).

Since most of innovative activities are related to machinery and equipment, as well as the purchase of hard- and software, patenting activity in the Estonian enterprises is very low. Patent applications were submitted only by 3% of all enterprises participating in the survey (the figure in 1998–2000 was 4%). It is important to emphasise regarding this figure that in most cases the patent applications were filed by enterprises with foreign partners, who had developed their inventions outside Estonia.

The impact of innovative activity is above all noticed in the increase of product range and the improvement of quality, as well as, equally to the former, and, unlike the previous survey results, in the increase of market share. The most significant results of process innovation are the increase of productivity and improvement of flexibility of production/providing services. The effects of innovative activity were significantly greater in the enterprises with R&D expenditures, compared to enterprises that made no expenses. Average turnover growth in innovative industrial enterprises was 17%, in non-innovative 11%, in the services sector respectively 14% and 13%. As for the entire sample of enterprises under survey, the share of products new or significantly improved

for the enterprise out of net sales turnover was 7.6% in 2004 and the share of products new for the market 4.4%.

Innovation theory has begun to pay increasing attention to the so-called "softer" innovation areas. This survey observed in that respect the organisational and marketing innovations, which are not treated as directly (in terms of the CIS survey) innovative activities, yet their occurrence could significantly contribute to the improvement of the economic activities of the enterprise. Organisational innovations were carried out in a total of 41% of the studied enterprises and marketing innovations in 25% of the responding firms, while innovations primarily concerned the organisation of work in the enterprises (e.g. changes of management structure, merger of various sub-units, etc.). The frequency of carrying out organisational and marketing innovations in an organisation was very closely related to the size of the organisation: the larger the enterprise, the more corresponding organisational and marketing innovations it carries out over the years. It also applied to the "soft innovations" that enterprises belonging to business groups were more active innovators.

As in case of the previous survey, one third (34.8%) of the enterprises innovating in the years 2002–2004 had cooperation agreements with other enterprises and institutions on joint innovative activities. The most significant cooperation partners are the suppliers, clients and enterprises belonging to the same business group.

Innovation projects are significantly obstructed by the shortage of financing sources in the enterprise or business group, but the issue of qualified labour is becoming increasingly more prominent and especially in large enterprises.

State support to innovation projects has somewhat increased. In this regard, nearly all firms receiving support from the public sector in 2002–2004 admitted the effect of the support on the innovation process. The support beneficiaries pointed out most of all that as a result of the support the innovation process had speeded up and the enterprise had been more able to shoulder its cost.

1 Situation for innovation in 2002–2006 and onward

1.1 The innovation system in Estonia against the international background

The further on, the more is the ability to innovate and renew viewed as the key to competitiveness and economic development of firms, regions and countries. Technological development and the globalisation of economy are the factors propelling the given process. While an economy on a lower level of development can survive for a certain period on account of concentration and use of easily accessible production factors or by making extra investments in existing production systems and creating the so-called scale economy (larger production volume, lower per unit cost etc), it will no longer be sufficient in an economic environment turning more expensive and sophisticated[1]. The experience of several other countries (Central and Eastern European countries, Ireland) has shown that the capital, which has previously been attracted by low wages and production costs can begin moving towards an even cheaper environment, e.g. China, and the country with rising costs would inevitably have to prepare for entering the more complicated game. The previous competitive advantages of Estonia, which were largely based on unsophisticated business rules and low cost, will not last forever.

Although the capitalist market economy in itself is a rather efficient incentive for the introduction of new products and their production methods, it need not suffice in a more complicated technological environment. For example, special premises would be necessary as well as ties with other technological partners, which do not emerge on their own. Besides, the modern economy, unlike the Fordist one, is less standardised and more unpredictable, and requires from the enterprises, even when highly sophisticated technologies are not involved, rapid adjustment and constant additional and relearning. Therefore the contemporary economic reality has come to be viewed, beside its treatment as a production and economic system, as an **innovation system,** in order to determine its premises for rapid and successful introduction of products, business models, technologies, markets etc, and the related changes.

The term innovation system[2] includes firms as well as other organisations (e.g. universities and industrial associations), their connections, various rules and operating practices. These rules and practices can be either formal (laws, standards etc) or informal (traditions, habits, routines). The relations between firms and organisations in an innovation system can be market-based or non-market-based, i.e. they can be sales-purchase-type or other types, e.g. support and cooperation relations (Högselius 2005: 3-4). Innovation systems operate not as bilateral relations between firms and organisations but as networks, which may have partly emerged spontaneously (a firm has established relations with clients for the improvement of products or research and consultation cooperation with universities) or deliberately formed, partly with the help of the state or industrial association. The Nordic countries in particular, but also Ireland, have achieved remarkable success in recent decades by developing efficiently operating innovation systems within a state as a whole. Inter-company relations as well as their relations with universities, research centres etc, are increasingly international, let alone the trends shaping the firms' activities. Since the operating environment of firms is international, also their innovation environment and the respective system need to be open and international. Even the countries attempting to create competitive advantages for their activities need to do it in an increasingly international manner, e.g. by promoting the development of international cooperation clusters with the efforts of several countries (for example in biotechnology).

Innovation systems operate via activities such as the creation of common visions (of technological opportunities, possible markets etc), the definition of new possible products, the establishment of new knowledge (not only via research but also for example by combining existing knowledge in a new way), the foundation of shared competence, organisation of finances, networking, "lobby work", and the establishment of new organisations if necessary (Högselius 2005). In certain cases such activity can take place at the level of a sector of industry, in others it can occur within clusters of smaller firms – such a cluster can be formed of a certain number of equal partner enterprises or a leader enterprise with service providers; a cluster can also consist of only Estonian enterprises or include also foreign firms. Public sector policy may contribute to such activities, but it cannot produce them; successful innovation in a region or country can only work through the initiative and efforts of all participants.

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1 *The given problem has been presented in several publications issued in Estonia based on M.Porter's development cycle logic: the need for moving from investment-based stage of development to innovation-based one; for details see e.g. Kurik, Lumiste, Terk, Heinlo 2002 ja Tiits, Kattel, Kalvet 2005.*

2 *On the innovation system's theoretical treatment see Högselius 2005.*

In different regions and countries the various innovation systems operate in their own way and at various efficiency levels. This is partly a quality issue, partly related to various historic backgrounds, experience and peculiarities (so-called *path dependency*). Demands to innovation systems differ at various development levels of economy. Therefore, considerable efforts have been made recently for the development of methodologies enabling the measurement and comparison of the innovation systems of different countries (so as to make the different innovation systems comparable). Turning the innovation systems comparable is obviously a rather complicated task, as in addition to the specific status of indicators available from statistics (e.g. education level indicators or the number of patents), the connections between elements (e.g. cooperation between enterprises or enterprises and universities) should also be evaluated in principle, while determining not only the existence of connection (e.g. certain number of joint projects) but their quality as well. However, the determination of quality is rather difficult and the outcome may be subjective.

One of such relatively objective comparison tests is the *Scoreboard* methodology developed at the initiative of the European Commission Directorate General for Enterprise, which initially involved the identification of five components of the innovation systems and business environments of various countries:

1. Innovation drivers (Innovation input): S&E graduates per 1000 population aged 20-29, the percentage of the working-age population (25-64) with a tertiary education, broadband penetration rate, the percentage of the working age population in life-long learning, the percentage of young population (20-24) having completed at least upper secondary education.

2. Knowledge creation (Innovation input): the share of public R&D expenditures in GDP, the share of business R&D expenditures in GDP, the share of medium-high and high-tech R&D in total manufacturing R&D, the share of firms receiving public funding support for innovation, the share of university R&D expenditure funded by the business sector.

3. Innovation and entrepreneurship (Innovation input): the share of SMEs innovating in-house, the share of innovative SMEs participating in innovation cooperation, the total innovation expenditures as a share of total turnover, early-stage venture capital for product and technological innovation, ICT expenditures as a share of GDP, share of SMEs implementing non-technological innovations.

4. Application (Innovation output): the percentage of total workforce employed in high tech services, the percentage of total exports from high technology products, the percentage of total turnover from new-to-market products, the percentage of total turnover from new-to-firm products, the percentage of the total workforce employed in medium-high and high technology manufacturing.

5. Intellectual property (IP) (Innovation output): The five indicators give measures of IP per million population: EPO patents, USPTO patents, triadic patent families, new community trademarks, new community designs.

Two further components were added at a later date: **innovation governance** and **domestic demand** (for details see Arundel&Hollanders 2005). The first one concentrates the indicators, which reflected the level of organisation of the innovation system as a whole, including the use of e-government; the indicators of the second block were used to measure the tendency of the enterprises and individual consumers of the given country to purchase especially innovative products and services from the domestic market.

Based on the measuring and following analysis of the above seven[3] components it was possible to divide the innovation systems and environment of most EU member countries (unfortunately, the analysis did not include Ireland, which is of great interest to us) in four large groups[4]. See Figure 1.1.1. for examples of countries representing the different groups

The methodology enabled to outline quite clearly the so-called **leader countries** of innovation: Sweden, Finland, Switzerland, also Denmark and Germany. The second, so-called strong **intermediate group** involves 9–10 countries: the UK, Austria, France, the Netherlands, Belgium, Iceland, Ireland, Luxembourg, and Norway. Regarding Italy it is difficult to decide whether it should be placed in the given group or should it be omitted.

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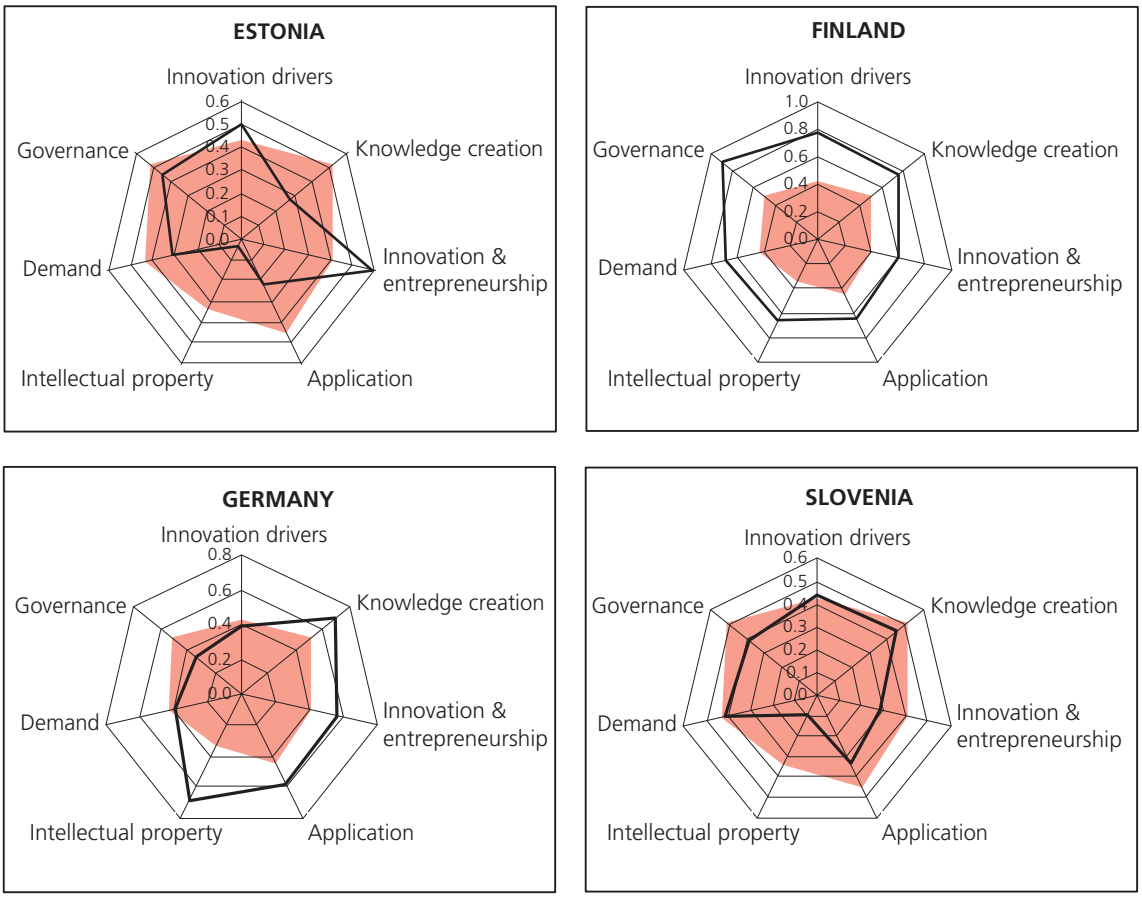
[3] *In case of the new EU member countries actually six, since it was decided after long debates that the per capita number of patents is not a relevant component at this level of development compared to the others.*

[4] *The scoreboard authors ranked the countries separately as to the five- and seven-component system, but since the end result did not differ much, we shall not concentrate on the differences due to details of methodology.*



Source: Arundel, A., Hollanders, H. Innovation Strengths and weaknesses (2005)

Note: The central shaded area gives the EU average percentage of firms by each innovation mode.

Figure 1.1.1 So-called innovation potential profiles of Estonia, Finland, Germany and Slovenia

The second or weaker half of the European countries as judged by the general innovation index consists of 16 countries (excluding Italy). Three groups could be pointed out here. First, the "leader group of the weaker half", which includes one of the countries of the "old Europe" – Spain – and three new EU member countries: Estonia, Slovenia and Hungary, although the latter only barely qualified. (Estonia was ranked at the top of the post-socialist countries due to its innovation potential and was ahead of some Southern European countries in the assessment carried out some years ago by Slavo Radosevic, who used a somewhat different methodology (Radosevic 2004) and in the scoreboard in 2004, thus the result could be expected.) At the end of the ranking comes a **group of six countries clearly detained in progress**: Turkey (clearly the most backward), Romania, Malta, Latvia, Greece and Slovakia. The remaining six countries, Cyprus, Portugal, Lithuania, the Czech Republic, Bulgaria and Poland rank between the two groups.

In addition to the absolute level of the innovation index, the authors of the 2005 scoreboard have also analysed the development dynamics of the different countries in the development of their innovation potential elements and Estonia was criticised in that respect: since its dynamics has been lower compared to the other countries and regress has been observed regarding some components, the 2005 scoreboard places Estonia, unlike e.g. Hungary and Slovenia, among the countries losing their positions in innovation. It is claimed about Estonia that it has failed to transform its strengths in "engines" and SMEs, for example, into the export and employment of high-technology sector enterprises, greater sales of innovative products and that the combined ranking of the knowledge creation block is low due to the small innovation-related investments of the business sector. Of course, a major weakness is also the intellectual property block, i.e. the very low number of patents, but this innovation potential component is weak in the other CEE countries as well. A closer analysis shows, however, that Estonia's loss of position compared to the other countries is largely caused by the fact that the analysed period included a setback through outside factors in the export of ICT components classified as high technology and the related employment (Elcoteq), yet in general the above criticism is quite adequate. Besides, when the increasing sales figures of subcontracts, relatively easily provided by Elcoteq, somewhat artificially boosted our innovation index, we did not hasten to explain that this rise has very little to do with the local innovation system.

Now let us observe the differences between the innovation profiles of the "leagues" of various countries.

The first or the leaders' group is very clearly distinguished from the others. The head start of the given countries is especially great regarding *innovation drivers* (as we saw previously, this is largely a matter of education indicators) and intellectual property.

Finland and Sweden are fairly similar as to the profiles of their innovation system and environment and are uniformly strong in practically all aspects. Denmark is weaker as to some components (in particular the *knowledge creation* block is weaker), but also makes a highly positive image as to a number of important innovation e parameters (lifelong learning, existence of venture capital) and due to other similarities allows to discuss collectively the Nordic innovation trio in the EU.

The latter half of the leader group and the next group are somewhat more heterogeneous, the "advantages" and "disadvantages" of the countries differ on a wider scale. While for example Germany is very strong as to the blocs *knowledge creation* and *IPR*, then France leads in the bloc *demand*, Belgium in the bloc *drivers*, Ireland in the bloc *application* and Austria as to good *innovation governance*. While several countries of the given group win "points" for their financing of research activities in universities (Germany, Belgium), Italy and Austria are characterised by the high significance of *public funding* in the financing of innovation.

The rear half of the innovation ranking of European countries is primarily characterised by major drawbacks in certain components of the innovation system and environment, the model is either heterogeneous, with some components relatively good, but others rather weak, or in worse cases almost all components being rather weak. An exception is Slovenia, which has managed to develop all its innovation potential components besides intellectual property at a level close to the European average. One also has to admit the unevenness of Estonia's innovation profile. While the bloc *innovation & entrepreneurship* (SMEs of Estonia are actively innovating and cooperating in the given area, investing in ICT etc.) is very strong, the *innovation drivers* (education indicators) bloc as a whole is also quite strong and the bloc *governance* is not weaker than the average of other countries (located at a relatively similar level as that of the other countries), there are major drawbacks in the remaining four blocs. Especially, besides the weak *IPR* bloc (a common problem of the Central and Eastern European countries) the very weak *knowledge creation* bloc stands out: the very low R&D expenses of the private sector and the relatively low significance of the high and medium-level technology sectors in economy, export and employment. The scoreboard authors claim that a more even innovation potential usually has better results at the state level than a heterogeneous system with some strong elements; in the latter case the prominent weaknesses often prevent the strengths from having any effect.

The aforementioned weaknesses of the innovation potential of Estonia need not have a noticeable effect at present. The innovation activity of enterprises, especially SMEs, at least in terms of the change of product modifications, adjustment of business models and making organisational changes is relatively high[5] and there are no signs of its possible decline. Estonia has so far operated as a so-called catching-up economy and until now, the general education level, openness and general activity of enterprises have often sufficed for the innovation of products, technologies and business models. But will this be sufficient in the future as well? The state of our innovation system, including its weaknesses, will determine what type and how radical innovations we can do in a longer run. But it would be better to return to the given subject after the completion of next sub-chapter.

1.2 The innovation profiles of enterprises

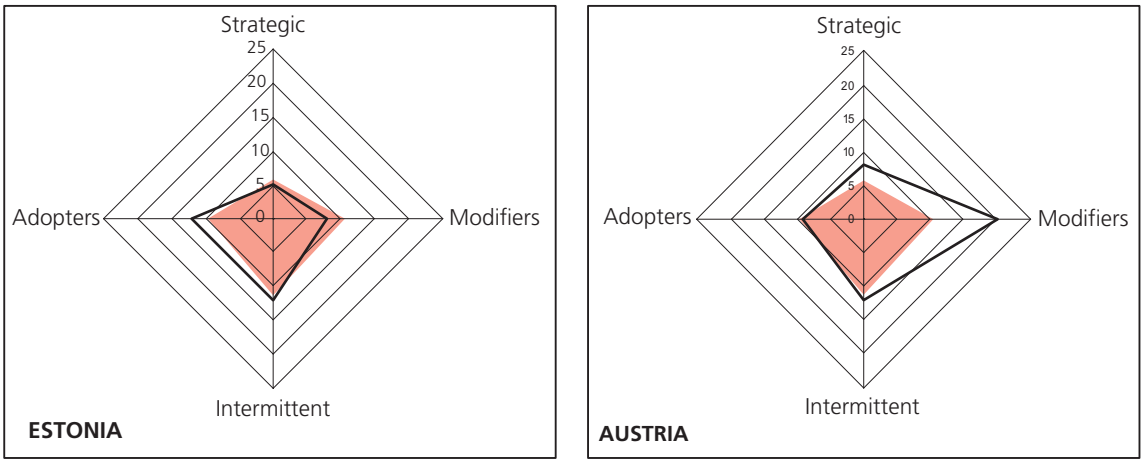
Although the innovative activity in enterprises depends on the innovation premises of the state as a whole, it is also fairly important **which type of innovations and innovation behaviour dominate in the enterprises of different countries**. Firms can be innovative in various ways, however, different ways presume different types of educational bases, similarly the access to capital and the need for some or other state support measures could differ as well. In that respect, the **methodology for the determination of dominating innovation modes**, recently introduced by the European Commission Directorate General for Enterprise, is of great interest**.**

According to the given methodology (for details see: Arundel, Hollanders 2005) a two-axis system is employed for the design of the innovation modes. Along the first, vertical, axis, the volume of R&D activities carried out in the firms is determined; the volume could be placed in firms specialised in the development of new technologies with the aim of selling them to other enterprises (named as strategic innovators in the methodology)

[5] *The EU study shows that the number of product and technology innovations made annually by enterprises of other countries losing their positions in innovation is not insignificant, the loss of positions is related to other indicators and the future will have to show how important or unimportant these are.*

or production firms, for which R&S and innovation are not the main occupation, but a necessary activity for retaining the desired level of production (*intermittent innovators*). The second, horizontal, axis maps the innovative activities outside R&D and is divided, first, into a mere adoption of a ready-made technology from outside the enterprise, and, secondly, into an activity where products or processes are modified (e.g. improvement and adaptation of technologies being used through process engineering).

As for firms practicing the development and sale of new technology as their main activity, their role is still low in all former post-socialist countries, currently new EU member countries. The only exception is Slovenia, however, the indicators of the Czech Republic and Estonia are not among the weakest either, among the old EU members the most outstanding are obviously the Scandinavian countries (Sweden, Finland), Germany, while Austria and France are also relatively strong. According to the given indicator, Southern European countries are fairly weak.



Source: Arundel, A., Hollanders, H. Innovation Strengths and weaknesses (2005)

Note: The central shaded area gives the EU average percentage of firms by each innovation mode.

Figure 1.1.2 The innovation profiles of enterprises: Estonia and Austria

Strong R&D in production firms can be detected in the countries that are defined as successful according to the development level criterion of technology firms (Sweden, Finland, Germany), but also among the countries defined as weaker according to the first criterion (Portugal, Lithuania). This apparently poses a strategic dilemma to Estonia: whether to invest strongly in firms directly specialised in the development of technologies (e.g. spin-offs in new breakthrough sectors like biotechnology and IT) or to support with innovation policy measures the introduction of R&D to existing production and services firms, and also the establishment of new production-specialised firms based on technological solutions developed elsewhere. The former version would enable more direct and independent economy transfer to high technology spheres, while the latter would bring along a greater cluster effect, the attraction of other enterprises to development, as well as greater employment. Foreign markets oriented technology enterprises, especially in case of the so-called high technology sub-contract, may not provide it. But in case of orientation to the alternative of technology adoption and use in production, such keywords as professional training and labour shortage are certain to emerge.

Naturally, the dilemma above does not require only a black-and-white solution of choosing one option out of two. For example, a reasonable compromise could be the use of high- technology solutions in traditional and local large-scale sectors of industry or services. An example could be the use of biotechnology in food industry or ICT in transport and logistics.

Perhaps even more important food for thought is provided by the second, horizontal, axis of defining the innovation mode. A position, which in principle holds true, has been often repeated in Estonia – even in case of possible success in the development of new technologies the main activity for Estonia as a small, internationalised and still a "catching up country" in terms of high technology would be technology transfer and the adaptation of technologies developed elsewhere, e.g. their employment for different purposes, within different business models etc. The described enterprise-centred methodology of innovation modes is highly useful as it differentiates, on the one hand, the (unchanged) adoption of simple technology or the so-called adaptation issue and on the other hand, the ability of the enterprise to adapt a technology creatively. Obviously, the adaptation issue in technology transfer need not be a simple one to overcome, it requires engineers who would understand the imported technology, adequately trained people to handle the equipment, the ability to communicate

with specialists of the supplier country, adequate maintenance etc. Yet the given problems have been sufficiently clarified[6] and Estonia possesses experience of handling them. As for the modification issue or the development of sufficient potential for modification, it has so far been practically a virgin territory. Based on the European Commission mapping, the Estonian companies are presumed to cope better at the level of simple adoption and introduction of technologies than in their adaptation and modification. The latter does not necessarily depend merely on good will and common sense, but for example also on the level of technical education of the staff or the availability of necessary expert support. In Estonia, unfortunately, even several major production sectors like the timber industry have problems with specialised education and expertise due to shortage of specialists.

Out of the European countries as technologies modifiers very high grades are awarded especially to Germany, Austria and Luxemburg, but also the Netherlands. The main emphasis in the Nordic firms naturally also concerns modified rather then simple adoption, yet their modification efforts were not rated as high as those of the aforementioned German-speaking nations. The Germans and Austrians certainly possess, besides the high level of production engineers, a professional education ensuring not merely that the workers can perform their allocated functions, but also very high skills in general, including creativity.

Even a small country like Iceland with a high wage level and general innovation index can be more successful in adopting innovations without change than in modifying them. The tendency to adopt technologies without change is sometimes considered a phenomenon typical of small countries due to the limited market and the resulting direction of innovation to business models and services than to technology.

Among the countries with lower standard of living and at the same time not particularly high general innovation level, the Italian, Portuguese and Belgian firms are relatively good modifiers. But it may be definitely stated about the new members of the European Union that they are presently better as adopters of innovation than as modifiers. It is true that some countries are weak in both aforementioned areas.

It is important to understand that some **innovation modes** can be ensured only by the innovation system of the particular country. If a country should want to be a strategic innovator like Finland, i.e. oriented to the establishment of technology firms at the forefront of technological progress, it would be apparently impossible without very strong research, patenting culture and venture capital. However, creating such conditions takes time and money. In order to be a good modifier of technologies one apparently does not need to have as complicated and expensive support systems, but the firms should certainly have well-trained and experienced engineers and skilled workers. However, the necessary potential does not develop here very quickly either. Knowledge in economic sectors usually develops in a cumulative manner with one ring of experience being built on another and it would be especially beneficial if a strong cluster-type cooperation culture emerged between enterprises working for each other. For example, for generations the Finns have been thus developing the machinery and equipment of their traditional industry sectors like the forestry and timber sectors and have reached a very high level.

1.3 Requirements for innovation and enterprises in new conditions

One could claim with some justification that there is never enough innovativeness, that nearly all European countries suffer from innovation deficit, regardless of the level of economic development of the particular country and the level of its organisation of individual systems for creating the basis for innovation, e.g. engineer training or availability of venture capital. The European Union as a whole is still incapable of meeting the Lisbon goals of catching up with the USA, and, as could be seen in the *Scoreboard* survey, it is not primarily the fault of the EU countries of lower economic development, but also that of the leader nations.

The investments of companies in R&D have declined even in the best-developed countries of the European Union (Finland is a positive exception in that respect), the countries have failed to create a system comparable in efficiency with the USA for motivating university professors towards innovation etc. Yet the problem is apparently even more acute in the former transition economies, presently new members of the EU, despite their current adequate economic growth rate. The European Commission warned even prior to the accession that the new member countries would find themselves in a situation, where the factors previously supporting their development (e.g. low labour cost) would not suffice for coping with increasing competition and consistent catching up with the economically advanced nations, and they would have to orient to innovation to a much

[6] *For details see: Enterprises in technology-intensive business. Toolkit for coping with international environment and developing management competences, pp. 40–53..*

greater degree (see Innovation policy. 2002). Only through innovation would they be able to increase the value added of the output and retain competitiveness in the long run.

The given position, which used to sound rather abstract only a few years ago, has become perfectly apparent by now and due to two factors. First, according to forecasts, the EU accession has been accompanied by an acceleration of cost rise of production input. It was predicted that Estonia should prepare for wage rise outpacing economic growth (Raim, Terk, 2001), and an indication of this is the wage rise of 11.4%[7] in 2005, and even higher in 2006. A failure to go along with the wage rise would simply result in loss of labour, since the opportunities for finding employment in other EU countries improve constantly; other production input is also becoming more expensive. The other factor is the constant growth of competition and not only due to the goods of the EU countries, but also due to the cheap goods from East Asia, especially China. As a combined impact of the two factors above, the contraction of labour-intensive sectors of industry (e.g. textile and sewing industry) has clearly already begun in Estonia and it is bound to continue. The enterprises of the low value added sectors of industry (especially exporting sectors) cannot remain in the old niches, but have to find new, more expensive and sophisticated opportunities to avoid closing down.

Although the Estonian economy as a whole is (still) going strong, from the viewpoint of the forecast necessities the restructuring of economy is not taking place at a sufficient rate. A large share of present investment activity is directed to real estate or simply to currently profitable production and businesses rather than to the development of new competence, which would ensure our long-term competitiveness. The operating logic of foreign capital has changed, the attractiveness of Estonia as a cheap production country is plummeting (we should consider not merely the salaries but also the labour taxation and the price dynamics of other production factors), at the same time investments oriented towards different goals are not growing fast enough, in case of businesses that carry on without major changes the foreign investors will limit themselves to reinvesting the earned profit rather than making additional investments. It is true that new advantages have emerged, especially due to the opened access to the EU structure funds (for infrastructure development, training, etc.), but they are still waiting for rational implementation.

In order to cope with the above trends, we need, on the one hand, to modernise and develop the general economic policy, but on the other hand, review the innovation profiles of Estonia presented briefly in the previous two sub-chapters at the state level and in terms of the innovation system, environment and the innovation mode of enterprises. We hope that the results of the innovation survey of Estonia presented in the given publication would provide useful basic materials for this effort. The European Commission experts emphasise that strengthening the weaker elements of innovation potential in particular could be highly beneficial. These weak elements of innovation in Estonia have been known for some years already: the insufficient innovation related investments of enterprises, the excessive tendency of innovation to rely on only limited the scale effect and modification of existing products, insufficient training of engineers in universities, insufficient focus on future issues, low patenting activity, limited access of starting innovative enterprises to financing opportunities. Obviously, the second approach – making better use of strengths – can also offer its own opportunities. For example, making use of the activity and cooperation ability of Estonian enterprises, especially SMEs, for the development of viable clusters or better integration of the Estonian enterprises into international clusters.

The changing external environment requires from the Estonian enterprises an ability to climb to the higher steps of the staircase of creating added value. There are several opportunities. A number of enterprises are likely to find themselves in a situation where minor product innovation no longer suffices in the new conditions and more radical transformations, including those linked to sudden change of the markets, will become necessary: new products for new markets. Other enterprises could find bold modification of adopted technology a more attractive option to the traditional acquisition and unchanged introduction of technology. In the third case the business model rather than the technology should undergo changes, possibly including the structure and organisation of the enterprise. All such changes presume the establishment of a necessary basis for their realisation, be it the launching of systematic product development in the enterprise, personnel training or the inclusion of new key specialists, market research, development of cooperation networks or merely the entrepreneur's mental readiness for changes. Innovation will become more multi-faceted, probably also more radical and massive in an environment of increasing costs and complexity. Even if we succeed greatly in some of the main directions of technological progress (e.g. biotechnology) and manage to create successful high technology enterprises on that basis (figuratively: another Estonian-developed breakthrough innovation like Skype or more), it would not be sufficient for overall modernisation of our economy. Innovation is a word, which touches every enterprise, each in its own way.

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[7] *Source: Soosaar, O., Viilmann, N., Kaasik, Ü. Tööturu ülevaade. Aprill 2006*

2 Description and analysis of innovation survey

2.1 General information about the survey

2.1.1 The methodology

The given survey carried out in Estonia and describing the innovative activities of enterprises is based on the methodology of the **Community Innovation Survey**. Four surveys based on the *Community Innovation Survey* (CIS) methodology have been carried out in the European countries after every four years and Estonia participates in this survey for the second time. The latest survey (CIS4) covers the time period 2002–2004.

The present publication includes comparisons with other countries based on the CIS3 (1998–2000) results[8], since the process of analysis of the results of the final round of the survey has not yet been completed in the other countries.

The sample of the survey was formed in accordance with the methodological recommendations of EUROSTAT based on the two basic indicators of the National Statistical Office statistical profile – main sphere of activity and number of employees.

The survey sample included enterprises of mining industry, manufacturing industry and the services sphere. It should be stated in advance that the results mainly reflect the latter two, while the mining industry has been reviewed only superficially. It is also important to note that regional analysis has not concentrated on details, since the spheres of activity need not be statistically representative in regional breakdown.

The present study reflects enterprises with ten or more employees. Enterprises with 50 or more employees were included in the survey in entirety; random selection was applied to enterprises with less than 50 employees[9]. As a sole exception, the enterprises specialised in research and development were not included in the survey this time, since it is very complicated to define innovation within this sphere of activities, as any R&D activities should belong to innovative activities.

The frame of the survey included 3789 enterprises and the sample 2201 enterprises and the percentage of respondents was very high at 79.4%. As a comparison: the EU average has remained at 55% in previous years and the percentage of respondents to the previous survey in Estonia was 74.3%. Naturally, it should be pointed out that this time the innovation survey was a compulsory part of the national statistics, unlike the voluntary one four years ago.

Besides the questions of the CIS-survey submitted by EUROSTAT, the present survey also includes some questions of local interest — the existence of foreign partners, the sharing of market area between the Commonwealth of Independent States and the rest of the world, sales to non-residents and the significance and effect of public sector support.

2.1.2 The sample of the study

The enterprises in the sample of the survey were divided between mining industry, manufacturing industry and the services according to Table 2.1.2.1. Compared to the previous study, the share of services enterprises has somewhat increased, whereas the share of manufacturing industry has slightly decreased.

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[8] *In some cases, however, there are also references to the initial results of CIS4 in the other countries.*

[9] *The following conditions were considered in case of random selection: the sample of the stratum includes at least 30 enterprises, the size of sample in a stratum with less than 226 employees was at least 25%, while in the stratum with more than 226 employees the sample included at least 20% of enterprises of the stratum.*

Table 2.1.2.1 Number and share of enterprises in the survey by activity field, 2004 and 2000

	2004		2000	
	Number of enterprises	*Share, %*	*Number of enterprises*	*Share, %*
Mining and quarrying	43	1.1	38	1.1
Manufacturing	**1 917**	**50.6**	**1828**	**52.4**
Food products and beverages	229	6.0	254	7.3
Textiles, wearing apparel, dressing of leather	331	8.7	343	9.8
Wood products, pulp & paper, printing	501	13.2	475	13.6
Chemicals, rubber, non-metallic mineral products	182	4.8	184	5.3
Basic and fabricated metal products	249	6.6	205	5.9
Machinery and equipment	236	6.2	207	5.9
Furniture	179	4.7	152	4.4
Services	**1829**	**48.3**	**1624**	**46.5**
Electricity, gas and water supply	108	2.9	143	4.1
Wholesale trade	803	21.2	682	19.5
Transport, storage and communication	641	16.9	521	14.9
Financial intermediation	53	1.4	60	1.7
Computer and related activities, architectural and engineering activities, technical testing and analysis	224	5.9	218	6.2
Total	**3789**	**100.0**	**3490**	**100.0**

As to the number of employees the responding enterprises were divided according to Table 2.1.2.2. As seen, small enterprises, i.e. with less than 50 employees, clearly dominate and this should be considered when interpreting the survey[10]. The size distribution of responded companies has remained the same compared to the previous survey.

Table 2.1.2.2 Number and share of enterprises by size, 2004 and 2000

	2004		2000	
Number of employees	*Number of enterprises*	*Share, %*	*Number of enterprises*	*Share, %*
Small				
10–19	1 709	45.1	1 605	46.0
20–49	1 257	33.2	1 136	32.6
Medium				
50–99	444	11.7	419	12.0
100–249	273	7.2	212	6.1
Large				
250+	106	2.8	118	3.4

The studied enterprises can also be divided according to their belonging to a business group and the share of foreign capital. Seventy percent of the responding enterprises did not belong to business groups; out of the members of a business group 6% were parent firms and the rest subsidiaries, whose parent firm was located in approximately half of the cases in Estonia and in the remaining cases in Finland, Sweden, Denmark, Germany or USA (in diminishing order). Compared to the previous survey, slightly more Estonian enterprises have concentrated in business groups.

[10] *The 2004 study included **small enterprises** in manufacturing industry 1362 (1489 in services), **medium-sized enterprises** in manufacturing industry 481 (209 in services) and **large enterprises** in manufacturing industry 74 (23 in services). A similar ratio of industry and services was also observed in the previous study.*

Table 2.1.2.3 Breakdown of enterprises as to belonging to business groups, 2004 and 2000

	2004		2000	
	Number of enterprises	Share, %	Number of enterprises	Share, %
Do not belong	2641	69.7	2 507	71.8
Belong	1148	30.3	983	28.2
Parent firms	233	6.1	193	5.5
Subsidiaries	915	24.1	789	22.6
Incl. as to location country of parent firm:				
Estonia	433	11.4	385	11.0
Finland	164	4.3	158	4.5
Sweden	122	3.2	85	2.4
Denmark	25	0.7	25	0.7
Germany	28	0.7	31	0.9
USA	23	0.6	22	0.6

Compared to the previous survey, foreign share has increased in larger enterprises, but has declined in the medium-size and smaller enterprises. Thus the increasing share of foreign capital in the enterprise corresponds to the increase in the number of employees (Table 2.1.2.4).

Table 2.1.2.4 Enterprises with foreign equity by size (%), 2004 (data for 2000 in brackets)

	Without foreign equity	With foreign equity
Total	**75.4 (74.1)**	**24.6 (25.9)**
Small	79.1 (77.7)	20.8 (22.3)
Medium	64.1 (62.0)	35.9 (38.0)
Large	46.4 (53.0)	53.6 (47.0)

Turnover in most of the larger enterprises exceeds 100 million kroons (Table 2.1.2.5). Out of the large enterprises 87% reported more than a 100-million-kroon turnover in 2004 (compared to 2000, the number of such enterprises increased 10 percentage points), while only five percent of the small enterprises had as large a turnover. While the turnover of half of the studied firms remained below ten million in the previous survey, the companies' turnovers have increased by now and the share of firms with turnover below ten million is 37%.

Table 2.1.2.5 Turnover by size (%), 2004 (data for 2000 in brackets)

	Net turnover			
	<1 mill.	1–10 mill.	10–100 mill.	>100 mill.
Total	**0.9 (4.4)**	**36.9 (47.9)**	**50.1 (39.2)**	**12.1 (8.5)**
Small	1.2 (5.5)	46.1 (57.9)	47.4 (32.9)	5.3 (3.6)
Medium	0.0 (0.2)	4.3 (13.2)	66.6 (69.7)	29.1 (17.0)
Large	0.0 (0.0)	0.0 (0.8)	13.2 (22.0)	86.8 (77.1)

Compared to the previous survey, the share of export in the turnover of the enterprises has remained almost the same and large or medium-size enterprises are more export-oriented as previously.

Table 2.1.2.6 Share of exports in turnover by size (%), 2004 (data for 2000 are in brackets)

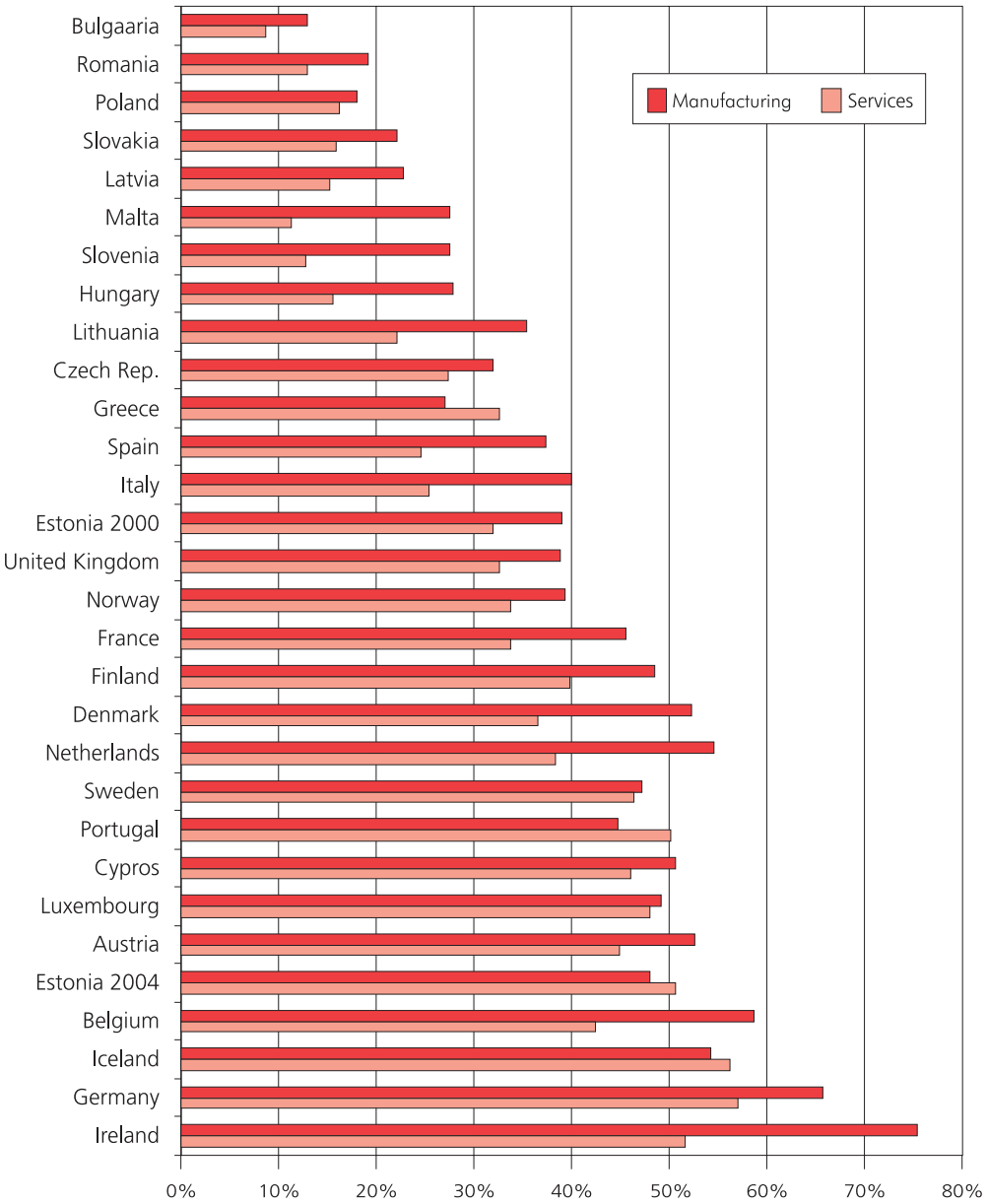
	Share of exports in turnover by size			
	<10%	10%–50%	50%–90%	90%
Total	**52.8 (53.6)**	**19.7 (16.5)**	**16.0 (16.5)**	**11.5 (13.4)**
Small	57.3 (58.0)	19.6 (15.9)	13.5 (13.8)	9.5 (12.2)
Medium	37.4 (37.2)	20.2 (18.9)	24.0 (26.0)	18.4 (17.9)
Large	33.0 (36.4)	20.8 (16.1)	29.2 (30.5)	17.0 (16.9)

2.2 Active innovators: who are they?

When answering the above question we need to adhere to the concept of innovativeness used in the survey. The survey treats as an **innovative enterprise** a firm, which had brought to the market new or significantly improved products (goods/services) or introduced new or significantly improved (compared to earlier ones) processes (production or supply methods, auxiliary activities to production) in the years 2002–2004. Additionally, the firms, which had started similar projects in 2002–2004, but had not yet completed them or had suspended the projects for some reason, were also considered innovative.

2.2.1 How many Estonian enterprises are innovative?

Previous surveys carried out in the European countries have shown that the enterprises of manufacturing industry are more innovative than the services firms. A similar ratio of manufacturing and services applied to Estonia according to the results of the previous survey, while the results of the 2004 survey show the opposite (see Figure 2.2.1.1). Reasons for this are discussed in the following chapters.



Source: Eurostat

Figure 2.2.1.1 Share of innovative enterprises (%), Europe 2000, Estonia 2004 and 2000

It may be stated that results for Estonia in 2002–2004 are relatively good albeit compared to the results of the European CIS3 of 2000. At the same time, preliminary data from the EU countries show that Estonia belongs to the stronger rather than weaker EU countries in that respect.

It should be emphasised, however, that the comparison of general indicators is not enough and one should concentrate on the facts behind the figures – the actual nature of innovativeness of the Estonian enterprises. The given issue will be discussed in the following sections.

Table 2.2.1.1 Share of innovative enterprises (%), 2004 and 2000

	Manufacturing	*Services*	*Total*
2002–2004			
Innovative enterprises	48	51	49
With innovation expenditure in 2004[11]	37	35	36
1998–2000			
Innovative enterprises	39	32	36
With innovation expenditure in 2000	30	27	29

The share of innovative enterprises of the total sample is 49% and the growth compared to the results of the previous survey can be linked more to the services enterprises as was pointed out above (see Table 2.2.1.1). According to the previous study (1998–2000), industrial enterprises were the more innovative (47%) on the average in the EU, unlike the results of the present Estonian study. The corresponding percentage in services was 40% and the share of innovative enterprises of the total sample in the EU was 44%. Additionally it would be of interest to single out a group of enterprises, which made expenses on innovative activities in 2004 so as to characterise the situation in 2004 and the continuity of innovative activities. In 2004 there were 36% of such enterprises and no significant differences were observed between the industrial and services sectors (37% and 35%, respectively).

2.2.2 Typical innovators: who they are?

When comparing the data of Estonia with the results of the previous EU innovation surveys CIS3 and CIS2 in 1998–2000 and 1994–1996, the same general principles apply in Estonia: the larger the number of employees of an enterprise or net sales turnover, the higher the likelihood that the enterprise has managed to innovate its products or processes during the period under observation. However, the relative increase is inverse to the size of firms, i.e. the largest increase in share of innovators is among small and only then medium and large firms (see figure 2.2.2.1).

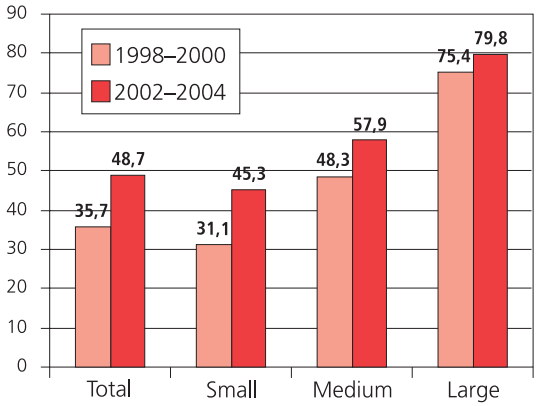


Figure 2.2.2.1 Share of innovators by size of enterprise (%), 2004 and 2000

When observing the manufacturing industry separately, the number of innovative enterprises has increased the most among medium-size enterprises (see Figure 2.2.2.2)

[11] *Innovation expenses were studied in this survey only as to four types of expenses; for details see subchapter 2.3.2.*

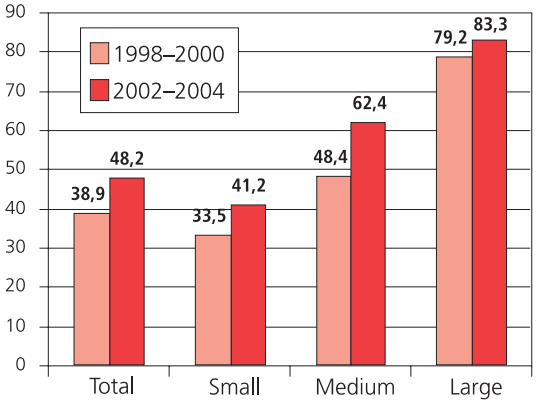


Figure 2.2.2.2 Share of innovators by size in manufacturing industry (%), 2004 and 2000

In the services sector, however, the largest increase of new innovation has occurred among small enterprises. Since a clear majority of services enterprises (especially the small ones) are oriented to the domestic market, it may be presumed that the increased intensity of innovation was influenced by the tougher competition for the domestic consumers with their increasing purchasing power. The second factor, which forces the services firms to intensify their innovative activities, is the decline of cheap labour resources and introduction of ICT, but this applies to industry as well.

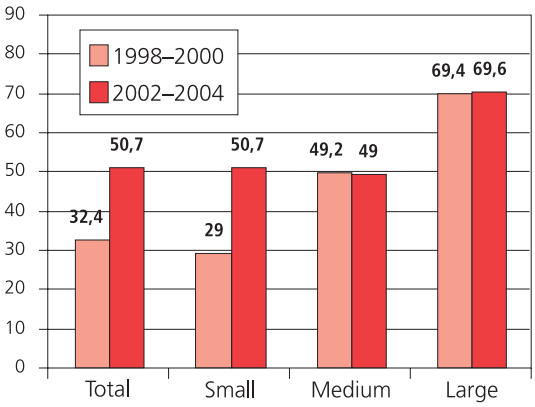


Figure 2.2.2.3 Share of innovators by size in services (%), 2004 and 2000

Somewhat unexpectedly, the high innovativeness of enterprises in Tartu has taken the South Estonian region to lead within four years ahead of North Estonia (see Figure 2.2.2.4). The corresponding indicator in Tartu actually increased 1.5 times. The indicator of Northeast Estonia is also above that of North Estonia. The Central and West Estonian regions still lag behind; growth figures were also lower there as the share of innovative enterprises increased only by one fifth compared to the Estonian average of more than one third. Thus the lagging of Central and West Estonia increased.

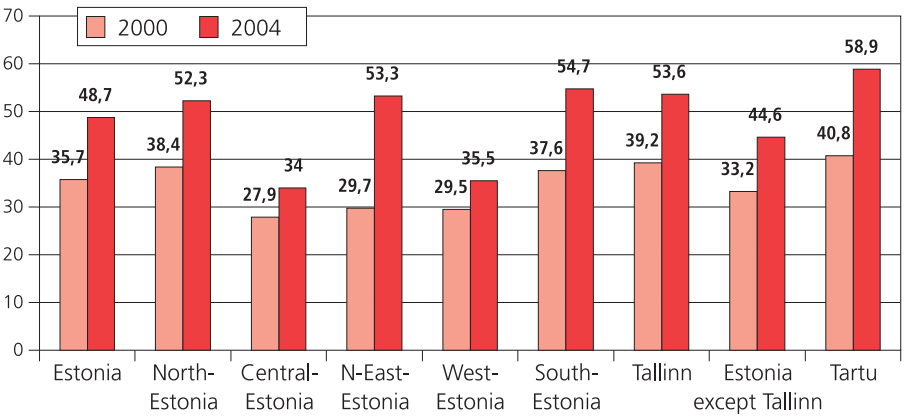


Figure 2.2.2.4 Share of innovators by location (%) 2004 and 2000

Table 2.2.2.1 Innovativeness based on various indicators (%), 2004 and 2000

	2004	*2000*
TOTAL	48.7	35.7
By economic activity		
Mining and quarrying	35.9	26.3
Manufacturing	48.2	38.9
Services	50.7	32.4
By number of employees		
10–19	41.9	27.6
20–49	50.0	36.1
50–99	55.6	45.2
100–249	61.5	54.5
250+	79.8	75.4
By belonging to a business group		
Not belonging	42.5	29.6
Belonging	62.9	51.4
By foreign equity		
No foreign equity	44.5	31.9
With foreign equity	61.4	46.7
up to 50%	59.2	41.3
50% to 100%	63.5	44.5
100%	61.1	51.3
By most significant market		
Local	33.7	27.4
National	57.0	38.6
EU+EFTA	50.6	…
Commonwealth of Independent States	34.1	41.8
Other	33.1	…
EU+EFTA+others	50.1	38.7
By turnover		
below million kroons	43.4	20.1
from million to 10 million kroons	34.2	27.5
from 10 million to 100 million kroons	54.4	42.3
over 100 million kroons	69.4	60.0
By share of export in turnover		
below 10%	48.7	34.0
from 10% to 50%	52.3	39.9
from 50% to 90%	42.8	38.1
90% and more	50.3	34.8

With individual exceptions innovativeness has increased in all spheres of activity (see Appendix 1). It should be considered in that respect that the less enterprises are active in a certain sphere, the greater the changes can be. Naturally, the growth potential is the higher the lower was the previous level of the indicator, therefore it is no surprise that the indicators grew more than 1.5 times in the services sector and mining industry when compared to the 25-percent change in the manufacturing industry. The vigorous increase of innovativeness in the enterprises with small number of employees should be considered especially significant.

It is apparent that enterprises with foreign partners (as revealed by the previous survey) are nearly 1½ times (61.4% *versus* 46.7%) more innovative than those without foreign partners; the same rule applied to enterprises belonging to a business group compared to those not belonging to business groups. There was no significant difference between Estonian-owned or foreign business groups. The positive effect of belonging to a business group is also rather logical: the relatively small firms of Estonia are not capable of realising major innovation projects on their own; therefore the support of the business group is of considerable importance.

A decline of innovativeness was only observed among the enterprises, which considered the Commonwealth of Independent States their most significant market (the 2000 survey used the term "Eastern market"). While

the enterprises exporting to the Eastern market were more innovative than those exporting to the Western market in the previous survey, the situation was reversed this time. At the same time the enterprises considering Estonia as a whole their most significant market area turned out to be more innovative than those working for the foreign market. This is connected to the structure of Estonian export, which includes a considerable amount of subcontract production and raw materials.

2.2.3 Product or process innovation?

The type of carrying out innovation enables us to check, whether: a) the enterprises have brought new or significantly improved goods and services to the market **(product innovation)**; or b) the enterprises have introduced new or significantly improved methods of production or supply **(process innovation).** The process innovation includes also the introduction of a new or significantly improved auxiliary activity of production (e.g. maintenance, supply, accounting, or computer system) by the company.

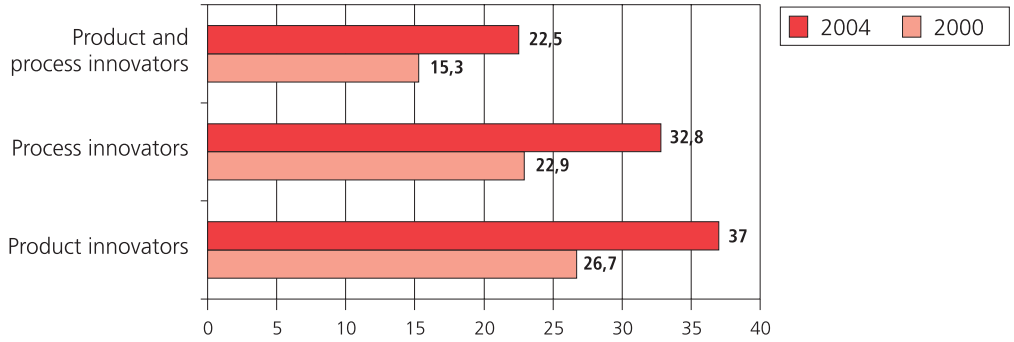


Figure 2.2.3.1 Breakdown of product and process innovators (%), 2004 and 2000

The innovation of processes and products has increased at an equal rate in the enterprises. When comparing manufacturing industry and services, one notices that the results in 2004 are quite similar (see next figure) and the differences between the sectors are minimal. However, when viewing the indicators of 2000 it appears that innovators of the services sector have been more active compared to industry. Progress in product innovation has been especially obvious – approximately 50 percent more intensive than in industry.

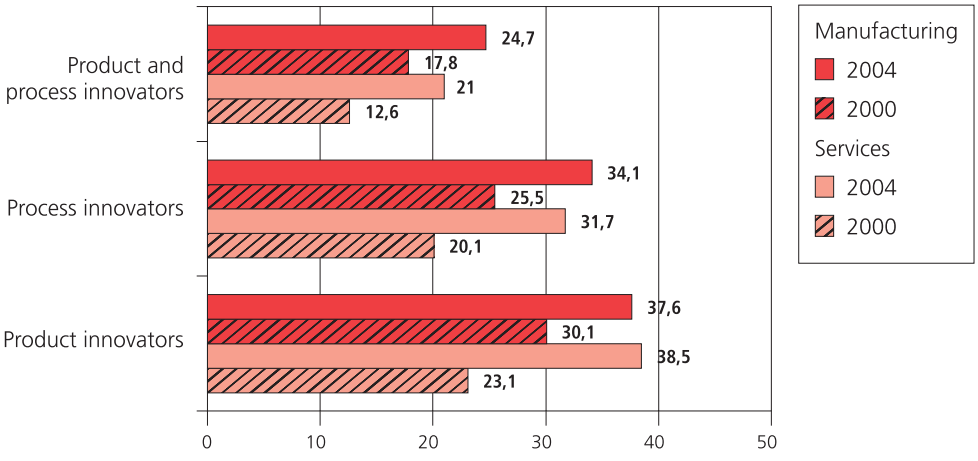


Figure 2.2.3.2 Breakdown of product and process innovators in manufacturing and services (%), 2004 and 2000

2.2.4 Authors of innovation projects – independent action versus cooperation

In case of product or process innovators it may be claimed that half of the enterprises are active in innovation on their own, approximately one quarter cooperate with others and the rest is equally divided between innovation carried out within a business group or outsourced from other enterprises/institutions. Services and manufacturing industry are somewhat different as to independent innovation; industrial enterprises are more independent in product development than the services enterprises, while the situation is more or less equal in

process development. When comparing the industrial and services enterprises, the more active cooperation experience of the latter becomes apparent. As shown in the previous survey, the services enterprises develop their projects in cooperation with other enterprises and institutions to a significantly greater degree than the industrial enterprises. This suggests that innovation in services is more dependent on networks external to enterprise.

Table 2.2.4.1 Breakdown of product innovation developers (%), 2004 (data for 2000 in brackets)

	In enterprise	*In business group*	*In co-operation*	*Outside*
TOTAL	56.4 (54.4)	10.1 (12.8)	20.9 (21.9)	12.6 (11.0)
Manufacturing	61.7 (61.9)	11.3 (11.6)	19.3 (19.0)	7.7 (7.5)
Services	50 (43.2)	8.7 (14.7)	23 (26.2)	18.3 (15.9)

Table 2.2.4.2 Breakdown of process innovation developers (%), 2004 (data for 2000 in brackets)

	In enterprise	*In business group*	*In co-operation*	*Outside*
TOTAL	53.9 (52.6)	10.0 (11.1)	23.4 (24.2)	12.7 (12.0)
Manufacturing	55.6 (57.3)	10.8 (11.3)	21.1 (20.2)	12.3 (11.3)
Services	52.4 (46.2)	8.6 (10.5)	26.5 (30.2)	12.4 (13.1)

The structure of the distribution of innovation project cooperation partners is similar to that observed in the EU (CIS3)[12]. The main difference in case of Estonia is that the adoption of other developers' results takes place somewhat more frequently, both due to the small size of Estonia and the lower development potential of our firms (regarding resources as well as R&D capability).

According to the survey results it may be claimed:

- Compared to the previous survey, the share of innovative enterprises has increased – while one third of enterprises had innovated their products, services or processes at the previous survey, the present one showed that half of the enterprises were innovative;
- Innovativeness in services enterprises has increased faster than in the manufacturing industry;
- The larger the enterprise and its net turnover of sales, the higher the likelihood of the enterprise being innovative;
- Enterprises with foreign partners and belonging to business groups are also more innovative;
- More than half of the enterprises developed their innovation projects on their own, slightly over 20% did it in cooperation with other enterprises or institutions.

2.3 Types of innovative activity and expenses on innovation

Innovation is a complex process, which involves technical as well as commercial activities. Innovative activities can be carried out within the firm or outsourced from other organisations. The present sub-chapter will address both innovative activities in enterprises and expenses made on them. It should be pointed out that although there were a total of seven innovative activities discussed, unfortunately, the survey only concerned the expenses on four of them.

2.3.1 Types of innovative activity

The given study broke down the innovative activities in the following manner:

- In-house R&D activity – creative activity carried out within the enterprise, aimed at increasing the amount of new knowledge and the use of that knowledge in the development of new or significantly improved products or processes;

[13] *The EU CIS3 combined the responses of an enterprise and the business group; the corresponding percentages for Estonia should be added for comparison. Breakdown of product innovators in the EU was as follows according to CIS3:* ***66****% developed by the enterprise or within the business group,* ***18****% combined with other enterprises or institutions and* ***9****% amounted to developments taken over from other enterprises or institutions. In case of process innovations the results were as follows:* ***57****% by the enterprise or the business group;* ***25****% in cooperation with others and* ***9****% other enterprises and/or institutions.*

- Outsourced R&D activity – activity described in the previous item, carried out by another enterprise or research institution;
- Procurement of machinery or equipment – machinery and equipment or hard- and software purchased for the manufacturing of new or significantly improved products or implementation of processes;
- Acquisition of other knowledge extramurally – acquisition (or licensing) of patents, unpatented inventions, know-how or other knowledge from other enterprises or institutions;
- Training – training of the staff (either in-house or extramurally) with the immediate goal of development and marketing of new or significantly improved products or development and implementation of processes;
- Marketing of innovations – marketing activity aimed at bringing new or significantly improved products to the market, incl. market research and preparatory advertising campaigns;
- Other preparatory activities – activities carried out for the development and implementation of new or significantly improved products and processes or technical preparations not applicable to the activities listed above.

Among the innovative activities, similarly to the previous survey, the acquisition of equipment and machines is still the most important type of activity (see Figure 2.3.1.1). Moreover, the share of enterprises that acquired machinery has increased further while the share of enterprises that have undertaken intra-mural R&D remained relatively constant. In case the enterprise had reported in-house research and development activities, the study followed it up with an additional question: is the activity constant or random. Thirty-one percent of the innovative enterprises in manufacturing industry and 27% in services responded that the corresponding activity is constant. The figure shows that innovative enterprises are fairly active in the training of their employees and no differences between industry and services can be observed in this respect. The level of training activity can largely be linked to the purchase of new equipment, including hard-and software, whose implementation requires certain training.

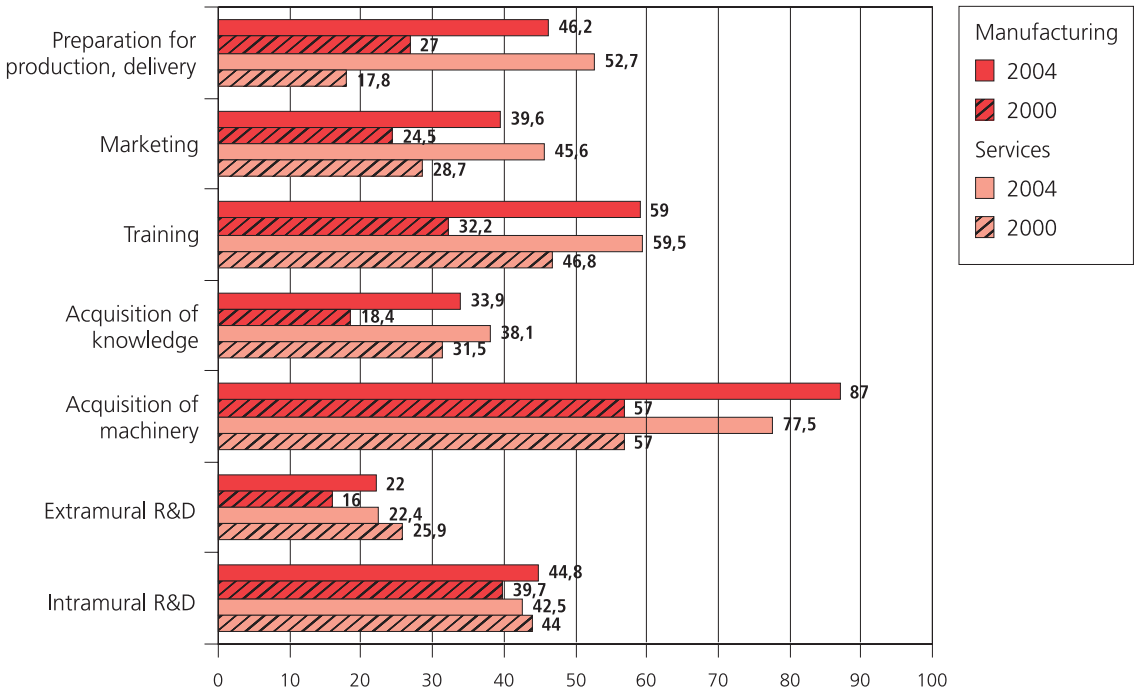


Figure 2.3.1.1 Share of enterprises engaged in particular type of innovative activity within the last three years among all innovative enterprises (%), 2004 and 2000

When analysing innovative activities as to the size of the enterprise, the large enterprises lead in case of most activities (see Figures 2.3.1.2 and 2.3.1.3). The exceptions for manufacturing industry lie in marketing activities and preparations for innovation, where the small and medium-size enterprises are more active than the large ones.

The greatest gap between large enterprises and SMEs, as was also shown by the previous study, can be found in the outsourcing of R&D. The difference was particularly significant in case of services firms. The large enterprises are also remarkably more active in in-house R&D, as well as acquisition of knowledge and training. In-house R&D activity in the smaller enterprises was more random. Only 26% of small innovative industrial enterprises claimed to be constantly engaged in it, while the percentage among services enterprises was 25%. In case of medium-size innovative enterprises, R&D activity was carried out constantly in 38% of industrial and

services enterprises. In large innovative enterprises the activities were significantly less random. Half of innovative large industrial enterprises reported that R&D activities are carried out constantly, while the share of services enterprises was even higher – 63%. The difference was relatively smaller regarding the purchase of machinery and equipment; this was the most widespread innovation activity in large enterprises as well as SMEs, regardless of whether these were services or industrial enterprises.

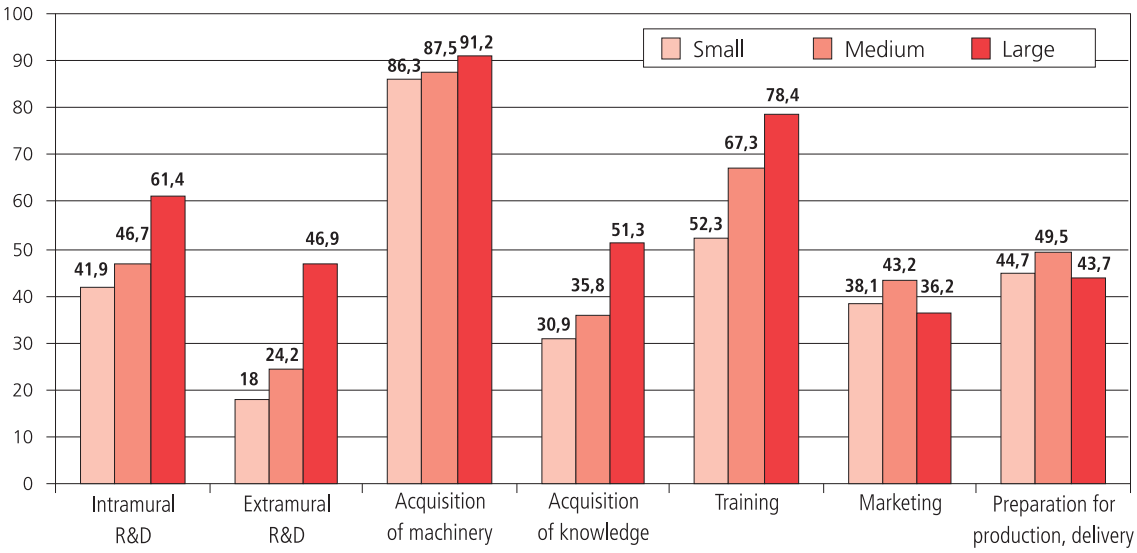


Figure 2.3.1.2 Share of enterprises engaged in particular type of innovative activity within the last three years among all innovative enterprises (%), manufacturing industry, 2004

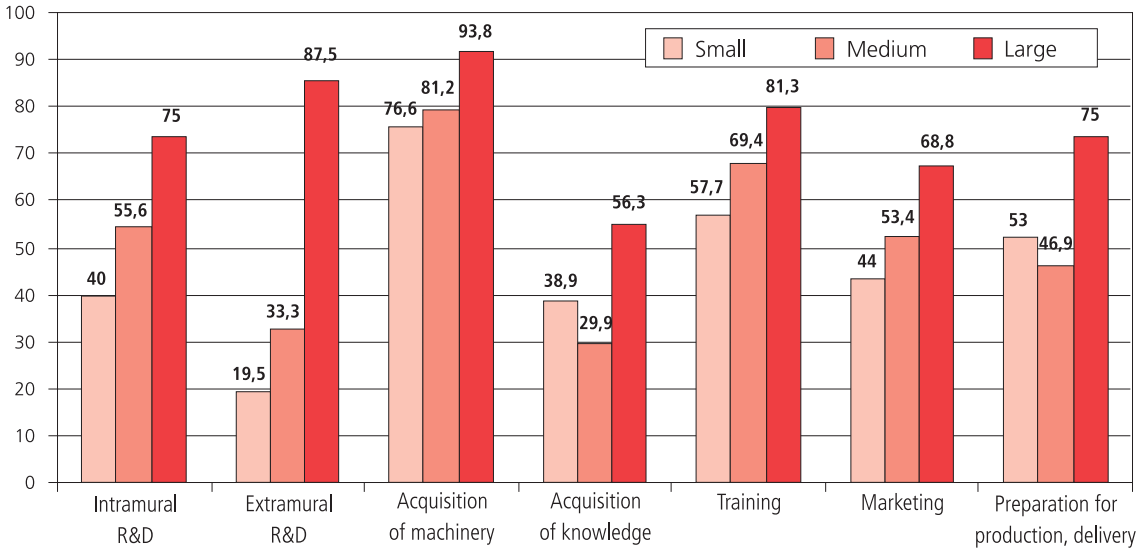


Figure 2.3.1.3 Share of enterprises engaged in particular type of innovative activity within the last three years among all innovative enterprises (%), services, 2004

2.3.2 Distribution of innovation expenditure

Specific financial expenditures on innovation were inquired about in 2004 regarding four types of activities: acquisition of knowledge, acquisition of machinery and equipment, expenses on intramural R&D activities and on extramural R&D. According to the study, only 36% of all surveyed enterprises made expenditures on these four types in 2004, which means that one fourth of innovative enterprises made no expenditures on the four types of activities in 2004 (73% of the innovative enterprises made these expenditures). The following figure depicts the breakdown of expenditures according to the types of expenses under observation.

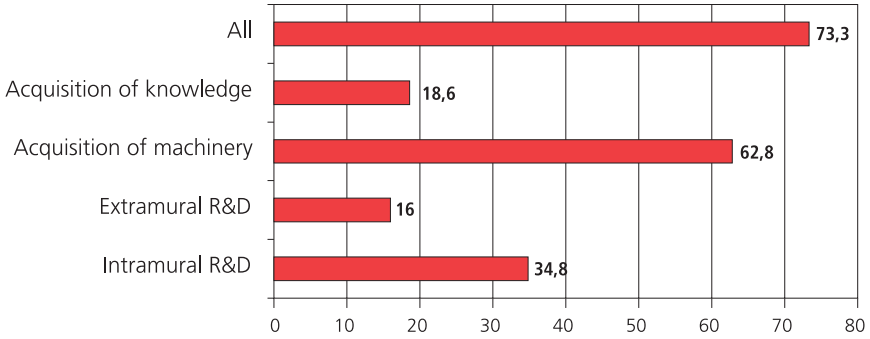


Figure 2.3.2.1 Innovative enterprises that made expenditures on innovation in 2004 by type of expenses (%)

One quarter of the innovative enterprises had made no expenditures in the listed four types of activities in 2004[13]. A majority of the expenditures is used as previously on the acquisition of machinery and equipment. When comparing the intramural and extramural R&D expenditures, the intramural expenditures are higher as shown also by the previous survey. To give a comparative example with the Nordic countries, the CIS4 initial results of in Denmark and Norway show that in-house R&D expenses (62% in Denmark and 64% in Norway) account for the main share of the innovation expenses of innovative enterprises and the share of machinery and equipment of the structure of innovation expenditures is quite modest compared to that of Estonia (18% in Denmark and 12% in Norway). On the other hand, when observing the innovation expenses of the other "new" EU member countries, the expenditures breakdown is similar to that of Estonia – the largest share is spent on the purchase of new equipment and machinery. For example, according to the CIS4 initial results, these expenses amounted to 46% of the overall innovation expenses of the Czech Republic, 72% of Hungary's, but as much as 85% of Slovakia's. The given countries expended on in-house research and development activities respectively 21%, 17% and 7%. Therefore the structure of expenditures is largely linked to the growth problems of the transition countries, which predominantly have to spend on the updating of their technical basis.

Although the present survey only asked about expenditures made on four[14] types of activities, one could claim with some reservations that innovation activity in Estonian enterprises is somewhat intermittent, since one quarter of the innovative enterprises reported no expenditures in 2004. Neither is it very positive that innovative activities are frequently limited only to the purchase of new machinery and equipment. Yet, greater expenses are being made on intramural R&D compared to extramural one (see the next figure).

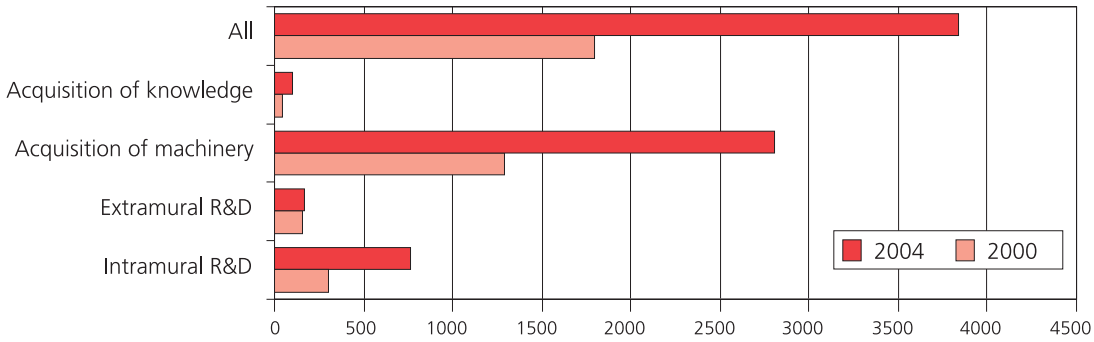


Figure 2.3.2.2 The expenditures on innovation by innovative enterprises in 2004 and 2000 (millions of kroons)

As mentioned, the purchase of machinery and equipment dominates innovation expenditures. Compared to the previous study, the industry sector in particular has increased the share of these expenditures. While according to the previous study the industry sector expended 717 million kroons on the purchase of equipment and the services sector 470 million kroons, the present study shows a significant increase of the industry-side expenditures: 2,075 million kroons of the industry *versus* 508 million of the services. Regarding this comparison of

[13] *The reader should note a highly significant fact in this respect. This study considered an enterprise innovative if it had made innovations in the 2002–2004 period or had carried out activities for their development;* ***yet the expenditures on innovations were studied only in respect to the last year, i.e. 2004****. The study does not cover expenditures made in 2002 and 2003. Neither did it study the enterprises' expenses in 2004 on training, marketing and preparatory activities.*

[14] *The previous survey also studied the expenses on marketing, training and preparatory activities.*

industry and services we should point out that in case of the industrial sector it may have been linked to the purchase of more expensive machinery. The fact that industrial enterprises expend more on machinery is in itself quite logical outcome. As for the expenditures on the acquisition of knowledge, the sectors are approximately equal according to this study as well (the corresponding figures in 2004 are 51/47 (industry/services) and in 2000 20/25 million kroons). While the expenses of in-house R&D activities were more or less even between the two sectors according to the previous study (industry 149 and services 152 millions), according the present study the services sector has started to spend slightly more on in-house R&D (352 *versus* 399 million kroons). The difference in extramural R&D expenses has begun to decrease as per sectors – while in 2000 the ratio of expenses in industry and services was 37/114 million kroons, in 2004 it was 57/97.

While large and medium-sized enterprises play an equally significant role among innovative industrial enterprises as to innovation expenditures and those of the small enterprises are more modest, in case of services enterprises both the small and the large enterprises spend 41% of the funds used on the innovation of services enterprises.

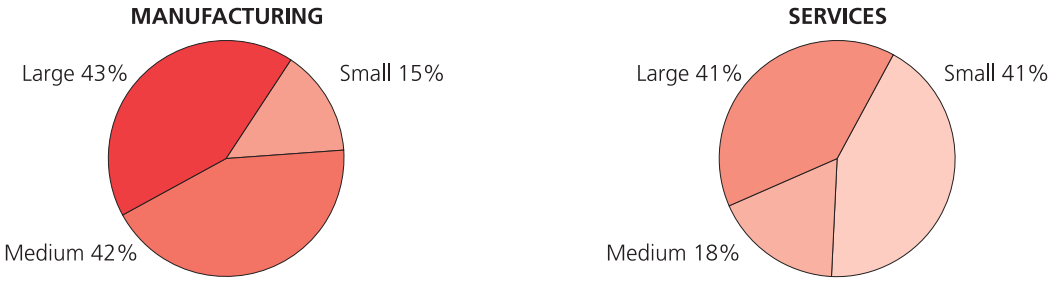


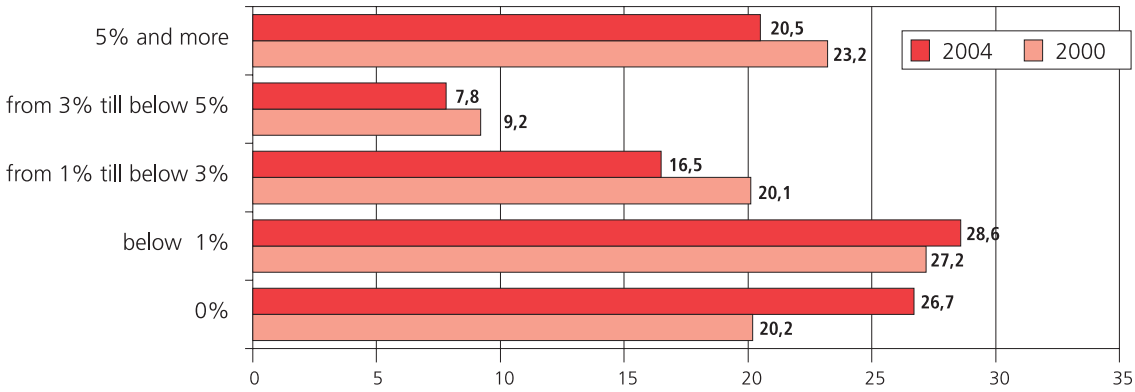
Figure 2.3.2.3 Breakdown of innovation expenditures as to the size of enterprises making the expenditures (%), 2004

Despite the methodologies of the two surveys being only partly comparable, one can nevertheless claim that in case of industry the expenditures of the large enterprises have increased, while the situation is vice versa among the services enterprises: it is the small enterprises that have started to spend relatively more on innovation.

2.3.3 Intensity of innovation expenses

The term 'intensity of innovation expenses' has been adopted in order to evaluate the level of expenses on innovation. Intensity of innovation expenses is the ratio of innovation-related expenditures to net sales turnover.

According to the survey, the expenditures on four surveyed types of innovation **expenditures of innovative enterprises** amounted to 2.4% of their total net turnover. The corresponding figure in manufacturing industry was 4.4%, but only 1.2% in the services sector. As for the breakdown of expenditures, it exceeded 5% of net turnover only in one fifth of the enterprises. The largest share of enterprises (29%) concerned those with innovation expenses remaining below one percent of net sales turnover (see Figure 2.3.3.1).



Note: The data are not fully comparable, since the expenditures in 2000 included other types of innovative activities (training, marketing, preparatory activities), their total share reached 17%.

Figure 2.3.3.1 Ratio of innovation expenditures to net turnover in innovative enterprises in 2004 and 2000

It may be said that the intensity of innovation expenditures widely varies as to the country. According to the initial CIS4 results, the intensity of large countries e.g. Germany and France was 3.3%. Indicators comparable to Estonia were displayed by countries like Hungary (2.3%), Ireland (2.4%), Lithuania (2.5%) and Poland (2.5%).

Although CIS3 measured seven types of expenditures, it is possible to calculate the comparable indicator for Estonia or the percentage of the 2000 turnover of the innovation expenditures of innovative enterprises as per four types of expenditures (excluding expenditures on training, marketing and preparatory activities). It appears that the corresponding figure in 2000 was 2.1%. Compared to the 2.4% of 2004 we could argue that the volume of innovation expenditures has remained more or less unchanged. The expenditures of innovative enterprises in manufacturing industry on the four types of expenses have increased (from 2.8% to 4.4% of net sales turnover) and decreased in the services sector (from 1.5% to 1.2). One of the reasons for the declining share of innovation expenditures in the services sector is the fact that significant expenditures on machinery and equipment (incl. various ICT implementations) were made in the previous period and the increase of these expenses has been smaller compared to the increase of turnover.

When studying the innovation expenditures intensity of **all enterprises** (share of innovation expenses of the turnover of all enterprises involved in the study), it should be pointed out also in this case that the volumes have not significantly increased: the corresponding percentage in 2004 was 1.6 and in 2000 1.2%[15].

It should be noted that the sizes of innovative expenditures of different sector of economy vary to a significant degree. The following table provided an overview of the intensity of innovation expenditures of the innovative enterprises in 2004. Out of the largest sectors, the timber sector and publishing houses have made the greatest expenditures on the industry side with most innovation expenses accounting for the purchase of machinery and equipment (see Appendix 2). On the services side, innovation expenditures were the most intensive in computer services; in this regard it is pleasing to note that the largest type of expenditures as percentage of net sales turnover was in-house R&D activity.

Table 2.3.3.1 Share of innovation expenditures of net sales turnover of the sector of economy (%), innovative enterprises, 2004

Sphere of activity	*%*
Mining of energy resources	0.5
Mining except energy resources	10.3
Food, beverages and tobacco products	3.9
Textile and textile products	3.3
Leather processing and production of leather products	1.1
Timber processing and wood products	9.8
Pulp, paper and paper products; publishing and printing	9.4
Coke, refined oil products and nuclear fuel	10.3
Chemicals, chemistry products an chemical fibres	3.2
Rubber and plastic products	3.5
Other non-metallic mineral products	3.6
Metal and metal products	2.9
Equipment and machinery not otherwise listed	2.1
Electric and optical equipment	3.2
Means of transport	2.6
Production not otherwise listed	3.1
Electric energy, gas and water supply	1.8
Wholesale and retail trade, except motor vehicles and motorcycles	0.6
Transport, storage and communications	1.8
Financial intermediation	1.1
Computers, architecture and engineering, testing and analysis	7.3

[15] *According to CIS3, the intensity of the innovation expenditures of all enterprises as to all seven types was 1.43%. The 2000 innovation expenditures intensity used here has been made comparable to the 2004 indicator, that is, in case of all enterprises, the ratio of four types of innovation expenditures to turnover has been calculated.*

It is important to emphasise that these figures should be viewed with some caution, as the share of innovation expenditures is greatly influenced by the number of enterprises operating in the given sector of economy[16]. E.g., the very high percentage in the production and mining of coke, processed petroleum products and nuclear fuel, where a relatively small number of enterprises operates.

The survey shows that:

- In 2004, innovative enterprises expended 2.4% of their net sales turnover on four types of innovation expenditures; the corresponding figure per all enterprises was 1.6;
- Only 36% of all enterprises under survey made innovation expenditures on four types of activities in 2004;
- A majority of the innovation expenditures are still made on the purchase of machinery and equipment;
- Only one fifth of innovative enterprises spends more than five percent of their net sales turnover on innovation expenses.

2.4 Protection of innovations

The goal of the protection of innovation is to ensure that the creators of the innovations would receive a fair compensation for their ideas and applications. One way or another, every seventh enterprise in Estonia (13.4%) was engaged in legal protection of its innovation or product during the period under observation. The most popular activities were the registration of trademark and application of patent. Enterprises apply for the recognition of their trademarks also in Latvia, Lithuania and Finland.

The Estonian Trade Mark Register contained as of December 31, 2004, approximately 32,000 registered trademarks, approximately seven thousand of which were the property of Estonian residents. The main firms to register are food production enterprises and trade firms. The most frequently registered trademarks include household goods, pharmacy products, various implements and household appliances.

Table 2.4.1 Intellectual property protection by different type of companies (%), 2002–2004

	Did not occur	*Occurred*	*Patent application*	*Registration of industrial design solution*	*Registration of trade mark*	*Copyright protection*
All companies	86.6	13.4	3.2	1.1	11.6	1.5
Foreign participation	84.7	15.3	3.7	0.8	13	2
Product innovative	75.4	24.6	6.3	2.5	21.7	3.6
Manufacturing industry	86.8	13.2	2.6	1.7	10.9	1.7
Services	85.6	14.4	3.9	0.6	13.2	1.3
Small	88.8	11.2	2.8	0.9	9.6	1.1
Medium	80.8	19.2	3.4	1.4	16.6	2.5
Large	64.3	35.7	12.3	5.5	32.8	5.1

Patent applications were submitted in 2002–2004 by 3.2% of enterprises participating in the survey (the figure was 4% in 1998–2002). To compare: in the European Union the share of enterprises applying for patents in 1998–2002 was 9%[17]. Regarding the figure provided by Estonia it should be pointed out that in most cases the patent applications were submitted by enterprises with foreign partners, which had developed the products outside Estonia.

It can be said that the level of patent applications and number of patents per residents in the Eastern European countries is several times lower than the EU average, while the latter is in turn below the figures in the USA and Japan. The situation is similar in Estonia as well. There are two main reasons for this tendency. The first is that the Western-style market economy model has had only the last 15 years to work. Besides, in the first years after the restoration of independence the business models of enterprises somewhat differed from those in the high wage level countries. For example, the countries that made rapid progress after WW2 like Ireland, Finland and Japan, took at least one generation's time or 25 years to raise their economies to a new level. Countries become strong patentors only after a certain level of GDP per capita.

[16] *For more detailed ratio of innovation expenditures to net turnover as to all enterprises and innovative ones see Appendices 2 and 3.*

[17] *The figures cannot be compared directly, as the samples, i.e. the structure of enterprises in the sample, vary.*

Technical progress has speeded up in the modern world and it may be presumed that in case of political and economic stability technical and intellectual creativity and therefore patenting would significantly increase in Estonia in the future. Several indicators like the use of computers, cellular telephones and other modern age appliances give evidence of the favourable attitude of the society towards technology.

Another factor is the so-called club members' advantage and the high entry barriers of most of the high technologies sectors. Due to the newcomer position, Estonian enterprises have had to start at lower levels. The investments of international enterprises have also been made primarily in production rather than development units. Another restrictive factor is the relative (to the size of the country) lack of labour (skilled professionals) compared to other countries[18]. Although Estonian researchers, engineers and project managers have successfully cooperated with a number of development projects, they have been patented primarily as achievements of the countries of the parent firms. For example, IBM has eight development centres in the world, but the location of all applicants, as registered at the United States Patent and Trademark Office, is the state of New York.

The survey shows that:
- The most common activity for protecting innovations is registration of trademark;
- Only 2.3% of Estonian enterprises have applied for patents.

2.5 Effect of innovative activities on competitiveness

Innovative activities may have different influence on an enterprise. The CIS classifies the results of innovative activities into the following three groups:

Product oriented effects:
- Improved quality in goods and services
- Increased range on goods and services
- Increased market or market share

Process related effects:
- Improved production flexibility
- Reduced labour costs per produced unit
- Reduced materials and energy per produced unit
- Increased productivity[19]

Other effects:
- Met regulations and standards
- Improved environmental impact or health and safety aspects

2.5.1 Impact of innovation projects

Compared to the previous survey, the enterprises have rated the effect of innovative activities as higher in all spheres when compared to 1998–2000, yet five fields can be pointed out, where the effect of innovative activities has been especially significant (see Figure 2.5.1.1) The increase of range of goods and services and the improvement of their quality were mentioned the most frequently among the effects of innovative activities, as were in the previous survey. It is important to point out that the expansion of market or increase of market share has made a significant leap in this survey. The results related to processes improvement show that, as previously, the most significant were the increase of productivity (CIS3: production capacity) and the improvement of flexibility in production of providing services.

[18] *In some specialities (specific technological spheres), only one group per year of approximately ten individuals graduate from the bachelor's course in the Tallinn University of Technology or Tartu University. This effectively rules out the finding of 50 or 100 specialists in these particular fields.*

[19] *The comparisons should consider the results of the previous study, namely that the 1998–2000 study asked about „increase of production capacity" instead of „increase of productivity".*

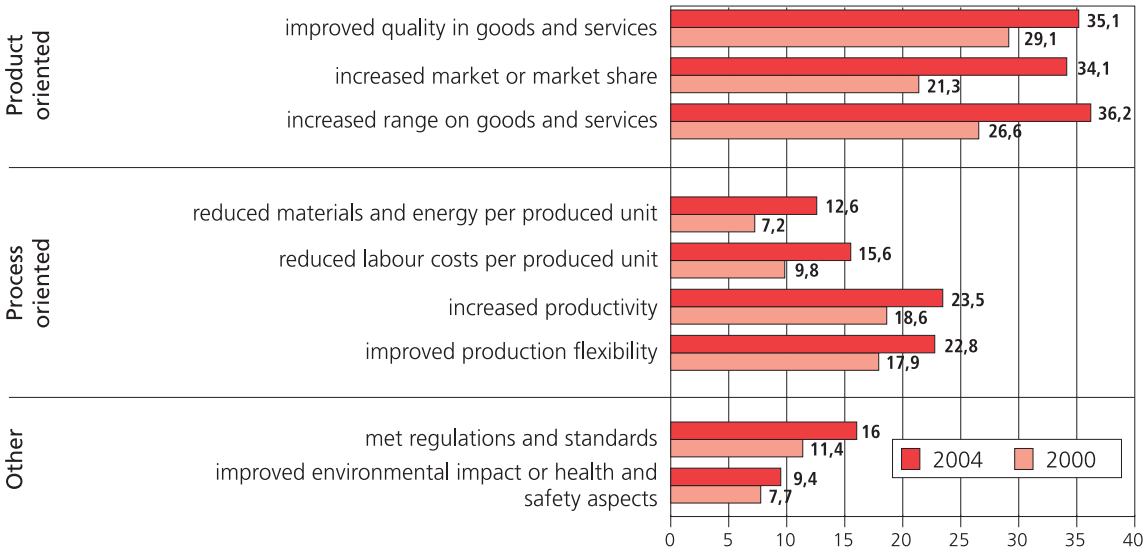


Figure 2.5.1.1 Share of innovative enterprises that considered that their innovation activity had a high impact in the sense of above effects (%), 2004 and 2000

When comparing the indicators of Estonia with the EU average of the years 1998–2000, it could be said that the estimates of impact were relatively similar. However, there are some differences. While in Estonia all product-related outcomes were rated as equally important, the EU results show that innovative activities had the greatest effect on the improvement of quality of goods and/or products (40%). This was followed by the increase of range of goods and/or products (29%; in Estonia 36%) and the growth of productivity and expansion of market or increase of market share (respectively 25% and 24%; in Estonia 24% and 34%). The EU rated somewhat higher than Estonia the impact of innovative activities on environment and working conditions and work safety (15%; in Estonia 9%).

Ratings of the effect of innovation on the activities among industrial and services enterprises are reflected in the following figure.

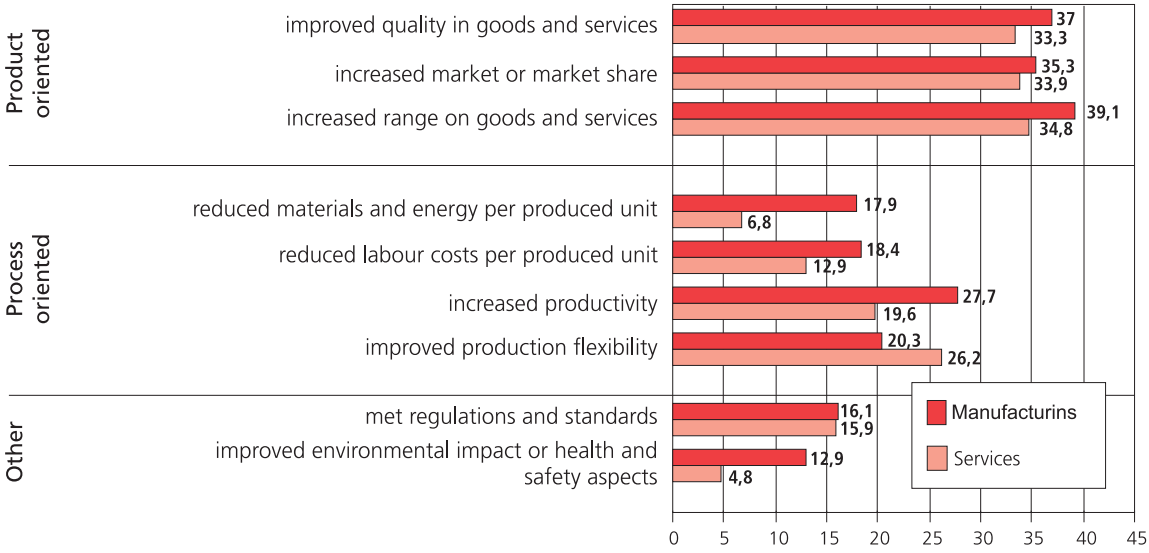


Figure 2.5.1.2 Share of innovative manufacturing and services enterprises who consider their innovation activity having a high impact in the sense of above effects (%), 2004

When comparing the industrial and services enterprise it may be noticed that the services enterprises rate the effect of innovation on their activities somewhat lower than the industrial enterprises, although the ranking of priorities is similar. The greatest differences concern environmental impact, work conditions and safety, as well as the expense of materials and energy. Services enterprises report to a significantly lower degree any changes in these spheres in connection with innovation. This result is logical, since the two factors are mainly production-related indicators. The differences as to sectors were practically nonexistent regarding the ratings to environmental impact.

The EU average results (1998–2000) showed that industry and services enterprises estimated the product-oriented effect of innovative activities more or less equally. On the other hand, regarding all other estimates the differences between industry and services were greater than in Estonia – those of the industrial enterprises were significantly higher. E.g., the effect on the increase of productivity was rated as very high by 30% industrial enterprises *versus* 16% of services enterprises, the effect on decrease of labour costs 11% of industrial enterprises *versus* 6% of services enterprises etc.

2.5.2 Effect of the size of the enterprise on results of innovation activity

It is reasonable to believe that the size of enterprise has an influence on requirements to the results of innovation projects. While the previous survey revealed that an expectation of outcomes related to process improvement dominated in the large and medium-size enterprises, this time it is difficult to define any clear trend. However, it is possible to point out some differences as to the breakdown of enterprises according to size. Compared to the previous survey, there are more results related to the increase of product range in the small and medium-size enterprises. The improvement of quality as a result of innovation was more frequently mentioned by medium-size and large industrial enterprises; the latter have started to emphasise more the innovation results related to quality improvement when compared to the previous survey. It is interesting to note that while according to the previous survey the small firms considered the effect of innovation on materials and energy consumption relatively insignificant (the smallest effect in the table), they have now started to value it even higher than the medium-size and large enterprises of manufacturing industry. The apparent reason is the constantly rising cost of energy, which can presumably cause financial problems to small entrepreneurs in particular.

Table 2.5.2.1 Share of innovative enterprises that considered their innovation activity had a high impact on the selected effects, breakdown as to size (%), manufacturing, 2004

	Product oriented results			*Process related results*				*Other effects*	
	Increased range on goods and services	*Increased market or market share*	*Improved quality in goods and services*	*Improved flexibility*	*Increased productivity*	*Reduced labour costs per produced unit*	*Reduced materials and energy per produced unit*	*Improved environmental impact or health and safety aspects*	*Met regulations and standards*
Small	39.4	36.2	34	18.9	28.2	17.7	20.1	14.7	17.5
Medium	39.9	33.2	40.9	21.1	27.7	20.3	13.9	9.9	13.3
Large	32.1	37.7	44.3	28.1	24.1	15.2	18.4	11.7	17.5

In case of services enterprises, whose general innovativeness has significantly increased as compared to the previous survey, the results related to products and processes improvement are more characteristic of the larger firms. Large enterprises described the improvement of service quality and increase of flexibility as the most important outcomes of innovative activity.

Table 2.5.2.2 Share of innovative enterprises that considered that their innovation activity had a high impact on the selected effects, breakdown as to size (%), services, 2004

	Product oriented results			*Process related results*				*Other effects*	
	Increased range on goods and services	*Increased market or market share*	*Improved quality in goods and services*	*Improved flexibility*	*Increased productivity*	*Reduced labour costs per produced unit*	*Reduced materials and energy per produced unit*	*Improved environmental impact or health and safety aspects*	*Met regulations and standards*
Small	35	34.3	32.8	26	19.8	12.4	7.3	4.6	14.9
Medium	33.7	30.4	33.1	23.7	16.9	13.8	2.4	6.2	18.3
Large	31.3	37.5	56.3	50	25	31.3	12.5	6.3	43.8

2.5.3 Results of innovation in enterprises involved in R&D

While the study covered a total of 49% of innovative enterprises, there were 21% (% of all enterprises) of innovative enterprises with R&D expenditures in the study, while 28% of innovative enterprises did not make such expenditures. In either case the groups were divided relatively equally among manufacturing and services enterprises.

In manufacturing industry the enterprises engaged in R&D received more positive results from innovation than the enterprises not involved in R&D. A very large gap was observed between enterprises with R&D expenses and other enterprises regarding the improvement of goods quality, while the differences in the growth of productivity, increase of assortment of goods and finding of new markets were also significant.

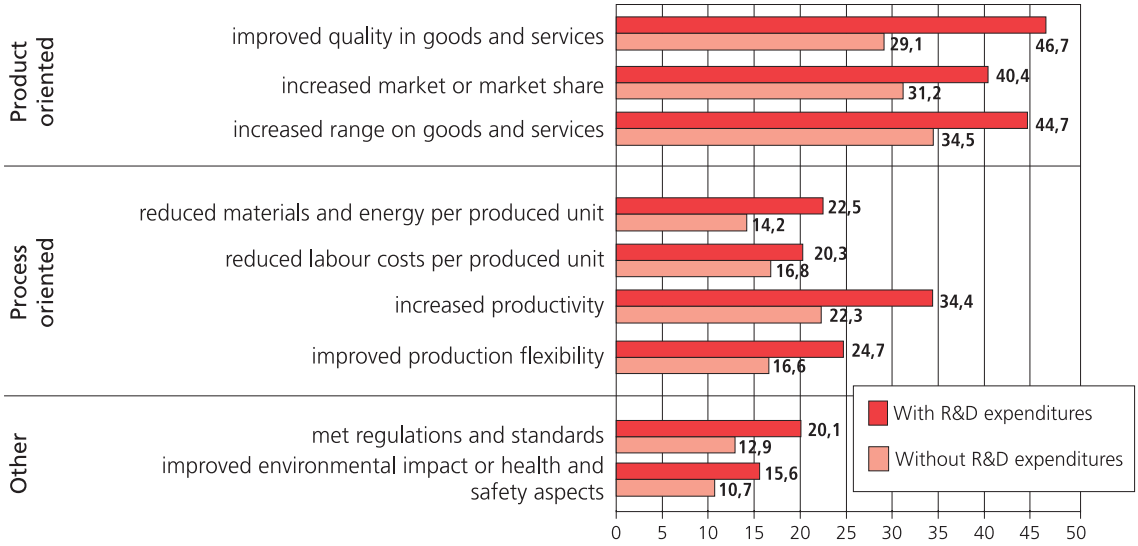


Figure 2.5.3.1 Highly significant results of innovative activities in enterprises with or without R&D expenditures (%), manufacturing industry, 2004

Similarly, in the services sector the enterprises engaged in R&D displayed better results in nearly all categories. Besides those listed in the field of industry, the difference between the two groups was significant in the categories of flexibility of performing services and observation of the requirements of legislation; the difference was particularly notable regarding the latter (see Figure 2.5.3.2). The given aspect suggests that organised R&D activity pays off.

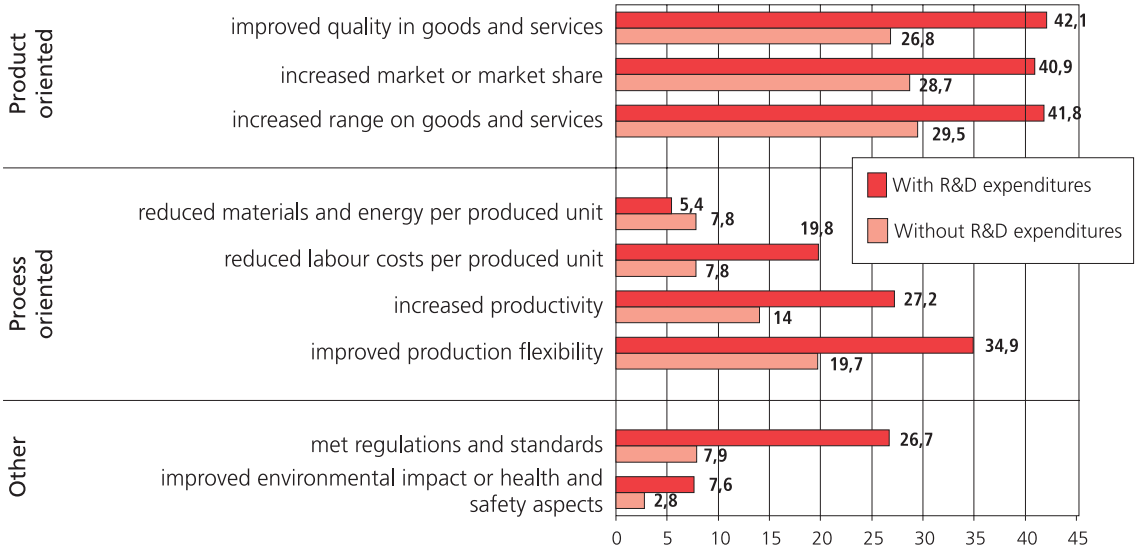


Figure 2.5.3.2 Highly significant results of innovative activities in enterprises with or without R&D expenditures (%), services, 2004

The given results show that expenditures on research and development activities have positive correlation to the various indicators of an enterprise – the estimates of innovation activity results by innovative enterprises that invested in 2004 in R&D are significantly higher than those of the enterprises that made no such expenditures. According to experts' opinion, this is a rather interesting fact, which should be considered in the development of innovation policy.

2.5.4 Profit from innovation

Within the present survey we also paid attention to the increase of the net turnover of the enterprises. It may be stated that, as viewed from the level of the general sample of the survey, there were no significant differences between the enterprises that introduced innovations (and attempted to introduce) in 2002–2004 and the ones that did not (see table 2.5.4.1).

Table 2.5.4.1 Average annual turnover growth dependent on the innovation behaviour of the enterprise (%), 2002–2004 and 1998–2000

	2002–2004	*1998–2000*
All enterprises	**13.9**	**10.8**
Innovative	14.4	16.9
Non-innovative	13.0	4.4

The period 2002–2004 in Estonia was one of rapid economic growth and both the innovative enterprises and those retaining their production processes and products unchanged, experienced growth. This is a significant difference in comparison with the 1998–2000 period, which was addressed in the previous innovation survey. During that period of less advantageous economic situation, the difference between the turnover growths of innovative and non-innovative enterprises was significant (17% and 4%, respectively). This affirmed the claim of the Finnish stock market expert Seppo Saario that innovative firms with a large portfolio of products endure hard times with less effort.[20]

One could pose a hypothesis that the present period is largely a scale-economy-centred period for the enterprises due to the expansion of markets (both domestic and foreign). They have been successful in boosting volumes (and presumably profits as well) even by using the existing products and services. But this need not continue the same way during the following development period. In fact, the situation is even more varied. It appears that the "innovation-turnover growth" connection has been sufficiently different in industry and services (see next table). Turnover growth of innovative industrial enterprises has been higher than that of non-innovative ones (17% and 11% respectively), but this does not apply to the extensively growing services sector. At the same time the connection between innovative activities and the growth of turnover becomes apparent during a longer period. In other words, innovative activities in the enterprises need not be automatically immediately reflected in the enterprise's turnover. It can be therefore expected that the corresponding link in the services sector will become more similar to that of the industrial sector in the next period (as the innovativeness of the services sector has increased when compared to the previous study).

Table 2.5.4.2 Average annual turnover growth as to type of enterprise and sector (%), 2002–2004

	Industry	*Services*
All enterprises	**15**	**14**
Innovative enterprises	17	14
Non-innovative enterprises	11	13

The opportunity of the enterprises to increase turnover without significant innovative undertakings is, according to several experts, one of the serious problems of the innovation situation in Estonia – there is no motivation for innovation.

We shall further observe which share of the net sales turnover of the enterprises the new or significantly improved products amount to, both in regard to products new for the enterprise and those new for the market[21].

20 Saario, S. 100 igihaljast börsivihjet: investeerimisnäpunäiteid, millest on kasu igas olukorras; Tallinn: EKE ARIKO, 1997.

21 ***Products new for the enterprise***: the enterprise brought to the market a new or significantly improved product or service, which was already being supplied by the competitors in the market. ***Products new for the market***: the enterprise brought to the market a new or significantly improved products or service before the competitors did so (although it may have been previously available in other markets).

Table 2.5.4.3 Share of new or significantly improved products of net sales turnover (%), 2004 and 2000

	Products new for enterprise		*Products new for market*	
	2004	*2000*	*2004*	*2000*
All enterprises	**7.6**	**9.8**	**4.4**	**4.5**
Incl:				
Industry	13.5	16.3	3.6	6.2
Services	5.2	6.8	5.2	3.7
Small	6.7	7.1	5.5	3.7
Medium-size	7.4	11.5	3.9	4.9
Large	9	11.6	3.4	5.1
Innovative enterprises	**11.6**	**17.7**	**6.7**	**8.1**
Incl:				
Innovative industry	18.8	24.5	5.1	9.4
Innovative services	8.6	13.6	8.6	7.3
Small	13.1	20.8	10.8	10.8
Medium-size	11.3	19.4	6	8.2
Large	10.7	14.6	4	6.4

The table shows that the share of products new for the enterprise of net sales turnover has somewhat declined compared to the results of the previous study. The share of products new or significantly improved for the market has remained the same on the average, since it has fallen in industrial enterprises, but increased in services enterprises.

The decline of the share of products (goods/services) new for the enterprise of net sales turnover can primarily be observed among innovative SME-s. It is apparently a case of the SME-s having found certain market niches for themselves with certain goods providing most of the turnover and innovations are made within the limits of a small share of the product list. It may also be claimed that the Estonian enterprises are in the stage of scale economy and the increasing cost of production input has no yet forced them to restructure towards new production. In other words, the market is still happy with the "old products" and the enterprises can manage by producing it on larger capacity. It may be presumed, however, that the situation will change within the next few years.

As we view the net turnover on new or significantly improved products, 32% of it is provided by small and large enterprises and 36% by medium-size enterprises. Compared to the large EU countries, this turnover has been very evenly distributed in Estonia between enterprises of various size, since according to the CIS3 results, large enterprises e.g. in France and Germany provided approx. 80% of total turnover of new or significantly improved products. Compared to the results of the previous survey, the share of small enterprises in Estonia has slightly increased and that of the large enterprises declined. The corresponding figures for 2000 were: small enterprises 28%, medium-size 37% and large 35%.

The survey shows:

- While the previous study revealed that the enterprises could improve the quality of their goods and services and increase their range via innovation projects, the present survey included the expansion of the market share;
- The most significant results oriented to process improvement were the increased flexibility of production and providing services and increased productivity;
- Services enterprises are more modest in their estimates than the industrial ones, although the priorities are rated in a similar manner;
- Higher rating of the effect of innovative activity was provided by enterprises engaged in R&D activities;
- The share of products new or significantly improved for enterprise of net sales turnover in 2004 was 7.6% and products new for the market 4.4%.

2.6 Innovation co-operation

Cooperation with other enterprises and organisations is one of key factors of success in the activity of firms in general and in carrying out innovation in particular. Cooperation in innovation process means the planning and implementation of more or less complicated joint operations. Primarily due to the complexity of the planning of the outcomes, this can be considered a display of great prowess in cooperation between firms, comparable to or even more complicated than marketing cooperation.

The survey broke down the innovation-related cooperation partners of the enterprises as to their type and location in the following manner:

Types of cooperation partners:
- Other enterprises of business group
- Suppliers of equipment, material, semi-manufactured goods and/or software
- Clients and consumers
- Competitors and other enterprises of same sector of economy
- Consultation firms, commercial labs and enterprises providing R&D services
- Universities and colleges
- State-financed or public research institutions

Location of cooperation partner:
- Estonia
- European countries[22]
- USA
- Other countries

2.6.1 The innovation-related cooperation partners of the enterprises

Similarly to the previous survey, one third (34.8%) of the innovating enterprises in 2002–2004 had cooperation agreements for joint innovative activities with other enterprises and institutions. This indicator is high, nearly twice as high as the EU average of 19% recorded in the CIS3. In addition, a similarly high share of cooperation was reported four years ago by other then EU candidate nations, while in Lithuania, Latvia and Hungary it neared even 50%.

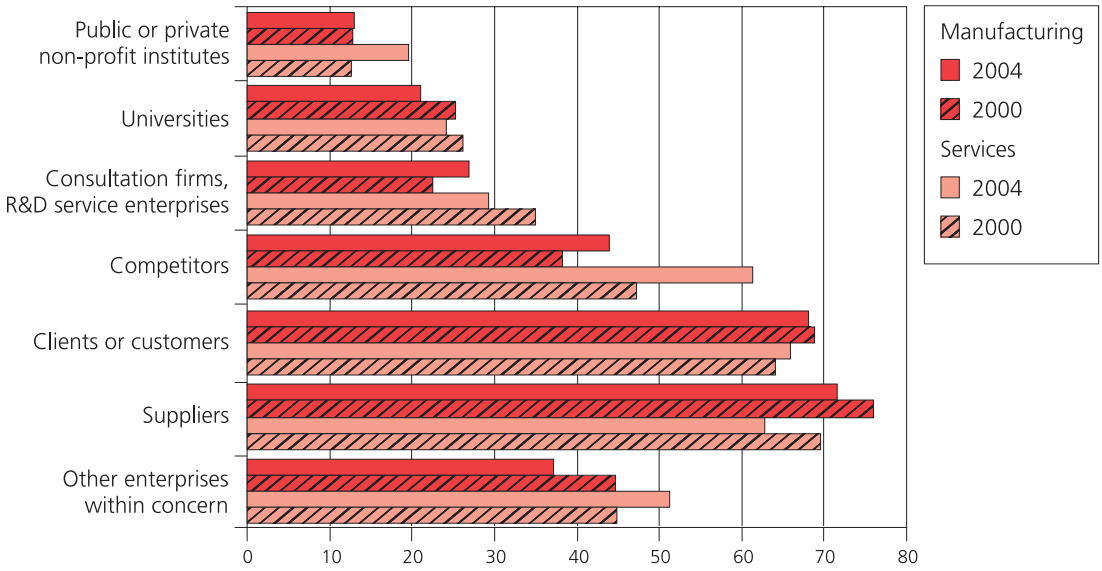


Figure 2.6.1.1 Breakdown of innovation-related cooperation partners[23] (%), 2002–2004

[22] *The EU and EFTA member or candidate nations (except Estonia): Austria, Belgium, Bulgaria, Spain, the Netherlands, Croatia, Ireland, Iceland, Italy, Greece, Lithuania, Liechtenstein, Luxemburg, Latvia, Malta, Norway, Poland, Portugal, France, Sweden, Romania, Germany, Slovenia, Slovakia, Finland, the United Kingdom, Switzerland, Denmark, Czech Republic, Turkey, Hungary.*

[22] *NB! These are innovative enterprises, which had in the years 2002–2004 cooperation agreements for joint innovative activities with other enterprises and institutions.*

Close innovation-related cooperation with suppliers and clients (i.e. cooperation of the value chain) is traditional, typical of Estonian as well as enterprises in other EU countries. A more reliable indicator of progress is the success in establishing cooperation with other groups of partners. It is important to stress in the given context the significance of a national innovation system, which can make a considerable contribution to the emergence of such ties.

When comparing industrial and services enterprises, it is pleasant to note that the latter have significantly increased cooperation with their competitors, while the services enterprises are also somewhat surprisingly more active in business group level cooperation. While the previous survey showed the number of inter-concern cooperation partners at approximately 45% in case of both industry and services, the share of such cooperation ties has declined among industrial enterprises for some reason, while it has increased among the services enterprises. Compared to the previous survey, the cooperation of services enterprises with public or private non-profit institutes has somewhat increased.

2.6.2 Location of co-operation partners

As shown by the previous CIS survey, most of the innovative enterprises cooperate within the limits of the same country. While the services enterprises were more prone to intra-Estonian cooperation than the industrial ones according to the previous survey, the percentage has by now become more or less equal. The services and industrial enterprises are also equal as to cooperation with partners in the European countries.

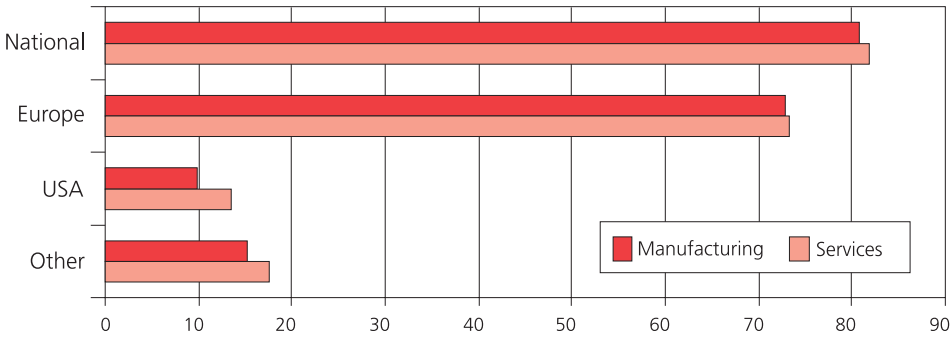


Figure 2.6.2.1 Location of innovation-related cooperation partners (%), 2002–2004

Compared to the previous survey cooperation with the European countries has increased and as the Figure shows, it has reached relatively close to the share of cooperation partners of Estonia. This shows the importance of both national innovation system as well as the European innovation systems for innovative activity of Estonian enterprises.

2.6.3 Importance of the co-operation partners

There is usually a rather clear connection between the closeness of cooperation and the estimated significance of the partner. In case of the groups of partners with closer cooperation (suppliers, clients-consumers, as well as enterprises within the same business group) the level of cooperation is judged as more significant; the previous survey showed the same. The remaining cooperation partners are rated as significantly less important. One can say that the estimates by the enterprises of the significance of their partners have remained the same compared to the previous survey[24].

The rating of suppliers as the most important cooperation partners seems relatively logical, considering that the innovative activity of more than half of the enterprises is concentrated on the acquisition of machinery and equipment. On the other hand, the suppliers of machinery need not be the ones supplying raw materials necessary for production. Thus, the essence of cooperation for the enterprises is presently still determined by the direct ties in the supply chain of the production process. Research institutions and universities are still relatively insignificant as cooperation partners according to the enterprises. The weak cooperation can apparently also be explained by the rapid economic growth period in Estonia (incl. real estate boom), when profit can be earned without having to seek new competitive advantages together with research institutions.

[24] *An accurate comparison with the previous result is not possible, as the research methodology of this particular question differed slightly in the previous survey.*

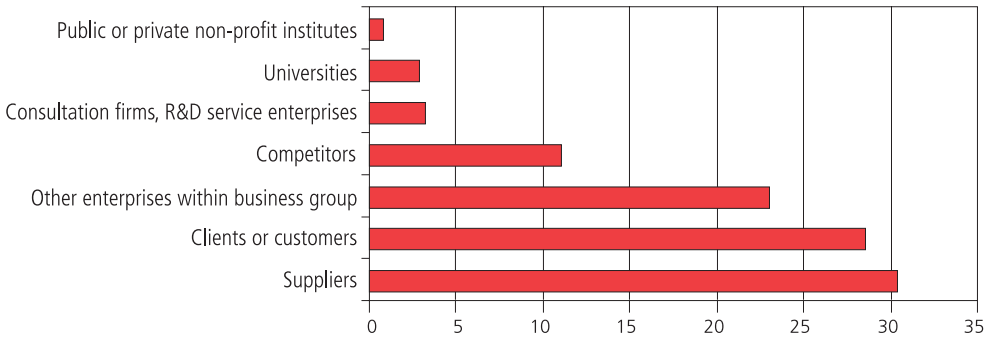


Figure 2.6.3.1 Share of cooperation partners (most valuable cooperation partner, %), 2002–2004

When rating the significance of cooperation partners as to the size of the enterprise, large enterprises considered in-concern cooperation significantly more important compared to SMEs. This is a rather logical outcome, since business groups include above all large enterprises. The same could be stated regarding cooperation with suppliers and universities. The size of the enterprise did not result in other significant differences.

The survey shows that:
- One third of innovative enterprises cooperated with other enterprises in innovation related matters;
- Most of the cooperation takes place within Estonia;
- The most important cooperation partners are equipment suppliers and clients.

2.7 Sources of information for innovation

An enterprise may receive information necessary for innovation from various sources. The present survey studied the use of the following sources of information:

The own information of the enterprise
- Within the enterprise or business group

Market information
- Suppliers of equipment, material, semi-manufactured goods and/or software
- Clients and consumers
- Competitors and other enterprises of the same sector
- Consultation firms, commercial labs, private R&D institutions

Public sources
- Universities and colleges
- State-financed or public research institutions

Other sources
- Conferences, fairs, exhibitions
- Science journals, business and technical publications
- Professional and industrial associations

As the survey results show, the sources of information necessary for innovation are the staff of the enterprise, other firms connected with the enterprise and suppliers of equipment, machinery and software. Suppliers are sources of innovative information equal to the clients and consumers. Consultation firms, universities and research institutions are rarely used as sources of innovation knowledge. Beyond the direct business contacts of the firm, only fairs and exhibitions are significantly used for the acquisition of information. No significant changes have been recorded as to the use of most sources of information compared to the previous survey[25]. General communicating to non-immediate business partners has somewhat increased in connection with the overall increase of innovativeness.

[25] *Note: The authors point out that the classification of sources of information has somewhat changed since the previous survey (see Table 2.7.1).*

Table 2.7.1 Information sources by importance (%) 2002–2004 and 1998–2000

2002–2004

	Sources within enterprise or business group	*Suppliers as sources*	*Clients and customers*	*Competitors and other enterprises of the same industry*	*Consultation firms, commercial labs, private R&D institutions*	*Universities and higher education institutions*	*State-financed or public research institutions*	*Conferences, fairs and exhibitions*	*Science journals, business and technical publications*	*Professional and industrial associations*
High	34.4	22.8	25.9	11.2	4.1	3.1	1.3	13.9	5.1	2.4
Medium	31.5	36.3	35.3	34.5	9.5	4.7	3.9	34	26	6.3
Low	10.7	10.1	17.4	19.4	15.9	11.2	9.9	20.6	22.8	16.5
Not at all	23.4	30.8	21.5	34.8	70.5	81	84.9	31.5	46.1	74.8

1998–2000

	Sources within enterprise	*Other enterprises within business group*	*Suppliers as sources*	*Clients and customers*	*Competitors and other enterprises of the same industry*	*Consultation firms*	*Universities and higher education institutions*	*Government or private non-profit R&D institutions*	*Professional conferences, meetings, journals*	*Fairs and exhibitions*
High	36.3	14.8	25	25	10.9	4.4	1.6	0.8	8.3	14.5
Medium	38.5	9.9	33.7	35.6	33.2	10.6	7.7	3.4	32.2	34.6
Low	8.3	4.2	14.6	15.7	21.8	16.5	10.4	7.1	18.4	17.7
Not used	16.9	71.1	26.7	23.8	34.1	68.6	80.3	88.7	41.1	33.2

There are no remarkable changes on the average regarding the sources of innovation knowledge of the Estonian and European enterprises. The Estonian enterprises themselves are to some degree more passive in innovation and therefore in the use of various information sources. It should be pointed out, however, that the results can significantly differ as to the country. For example, as compared to the neighbouring Finland, the intramural sources of information are in Estonia significantly less used and the information from the supplier of the equipment is employed to a greater degree. (Source: CIS3)

Table 2.7.2 Use of different information sources in Estonia (1998–2000; 2002–2004) and the EU (2000), % of enterprises

	CIS 3 (EU)	*CIS 3 Estonia*	*CIS 4 Estonia*
Intramural sources of information			
In-house sources	38	36	34
Other enterprises of the business group	9	15	
Market information			
Suppliers of equipment, materials, parts and software	20	25	23
Clients	28	25	26
Competitors and other enterprises in the same field	12	11	11
Institutional sources			
Consultation firms		4	4
Universities and higher education institutions	5	2	3
Public and private non-profit R&D institutions	3	1	1
Other sources			
Professional conferences, meetings, journals	11	8	19
Fairs, exhibitions	16	14	

In the development of new products the main source of information is the company's own body of knowledge. Clients and consumers also play an active role in the development of new products. When comparing the partners of process innovators with the partners of product innovators, the suppliers of equipment, software and materials hold the more important place.

Table 2.7.3 Activity in using different sources of information by product and process innovative firms (%), 2002–2004

	Product innovative	*Process innovative*
Sources within enterprise or business group	37.3	34.8
Suppliers of equipment, materials, semi-manufactured goods, software	20.3	26.3
Clients and consumers	28.5	24.9
Competitors or other enterprises in the same field	11.9	12.1
Consultation firms, commercial labs, private R&D institutions	3.8	4.5
Universities and higher education institutions	3.6	3.3
State-financed or public research institutions	1.1	1.5
Conferences, fairs, exhibitions, etc.	15.5	14
Science journals, business or technical publications	5.7	5.6
Professional or industrial associations	2.4	3.2

Process innovative enterprises in the manufacturing industry and knowledge-intensive (incl. e.g. banking, financial mediation services) services differ to considerable extent. Manufacturing industry uses, dependent on the sector of industry and the firm, various sources of information, both intra- and extramural. In knowledge-intensive spheres of services like telecommunication and financial services predominantly in-house information is used for process innovation. However, in connection with the development of the services market it may be expected that most of activities not related to the core business like the maintenance of computers etc. would be outsourced. Similar developments have already occurred in banking.

There were no significant differences in the sphere of innovation information of industry and services. The services enterprises receive somewhat more information from their competitors, while the industrial enterprises from science journals and technical publications.

Table 2.7.4 Use of different information sources between services and industry enterprises (%), 2002–2004

	Sources within enterprise or business group	*Suppliers as sources*	*Clients and customers*	*Competitors and other enterprises of the same industry*	*Consultation firms, commercial labs, private R&D institutions*	*Universities and higher education institutions*	*State-financed or public research institutions*	*Conferences, fairs and exhibitions*	*Science journals, business and technical publications*	*Professional and industrial associations*
Manufacturing	33.7	23.6	25	9.8	4.4	2.9	1.2	15.4	6.7	1.9
Services	34.6	21.5	26.9	12.7	3.1	3.4	1.4	12.5	3.4	2.4

In case of enterprises with foreign partners, the innovation sources within the enterprise or business group are more significant than in case of enterprises owned by domestic investors. Firms with foreign majority shareholders had closer relations with their suppliers. This could reflect long-term relations with suppliers, closer exchange of information between them and the existence of so-called preferential relationships. Firms with foreign partners also emphasised client feedback, which has proven useful in innovative activities. No significant differences were noticed among other sources of information.

Besides those listed in this questionnaire, there are also other ways of acquiring technological information. Information is carried by Estonian specialists returning from abroad, as well as the movement of foreign specialists to and from international firms. In other words, the opening labour market between Estonia and the EU has increased the mobility of the people and thus the various forms of information exchange. One of the most important sources of information for smaller firms is to hire (i.e. induce to defect) specialists from stronger enterprises. Such donor firms in Estonia have been, for example, Elcoteq Tallinn, Microlink and Tele2.

The use of various sources of information depends to a considerable degree on the size of the enterprise. Larger enterprises are more active in using both in-house and outside (clients, suppliers) sources of information, i.e. they seem to be more networked than small firms.

Table 2.7.5 Use of different information sources as to size of enterprise (%), 2002–2004

	Sources within enterprise or business group	*Suppliers as sources*	*Clients and customers*	*Competitors and other enterprises of the same industry*	*Consultation firms, commercial labs, private R&D institutions*	*Universities and higher education institutions*	*State-financed or public research institutions*	*Conferences, fairs and exhibitions*	*Science journals, business and technical publications*	*Professional and industrial associations*
Without foreign owners	28.5	20.2	24.8	11.5	3.7	3.1	1.2	14.2	4.5	3
With foreign owners	47.2	28.5	28.2	10.7	5.1	3.4	1.6	13.2	6.3	1
Foreign share 0–49%	39.4	15.4	31.9	17.3	3.8	1.8	0	11.8	7.3	0.7
Foreign share 50–100%	49.8	32.8	27	8.5	5.5	3.9	2.1	13.6	5.9	1.1

Table 2.7.6 Use of different information sources as to size of enterprise (%), 2002–2004

	Sources within enterprise or business group	*Suppliers as sources*	*Clients and customers*	*Competitors and other enterprises of the same industry*	*Consultation firms, commercial labs, private R&D institutions*	*Universities and higher education institutions*	*State-financed or public research institutions*	*Conferences, fairs and exhibitions*	*Science journals, business and technical publications*	*Professional and industrial associations*
All	34.4	22.8	25.9	11.2	4.1	3.1	1.3	13.9	5.1	2.4
Small	30.6	20.8	25.4	11.3	3.1	2.5	1.1	13.9	5	2
Medium	41.3	25.4	25.3	10.3	7.1	4.2	1.8	12.8	4.1	2.7
Large	58.7	40.6	35.9	15.4	5	7.3	2.4	18.4	10.1	6.2

The survey shows that:
- The most important source of information is knowledge moving within the enterprise or business group;
- The clients and consumers are equally to the suppliers very important sources of information on the market;
- Universities and research institutions provide little necessary information, the enterprises find much more useful information on conferences, exhibitions and fairs.

2.8 Organisational and marketing-related innovations in an enterprise

The innovation theory has recently began emphasising to a greater degree than previously the significance of so-called "softer" innovation areas, which remain outside immediate product and process innovation, but are necessary for the success of production as well as the operations of the enterprise. As the latter the present survey studies the organisational and marketing innovations. They are not directly treated as innovative activities, but their occurrence can significantly contribute to the improvement of the economic activities of the enterprise.

The present survey observed as **organisational innovations** the following changes:
- New or significantly improved knowledge management system (for better in-house use or exchange of information, knowledge and know-how);
- Significant change in the organisation of work (e.g. changes in management structure, merger of different sub-units, integration of activities);
- New or significantly changed relationships with other firms (e.g. alliance, partnership, outsourcing of services or providing subcontract work.

Marketing innovations were viewed as:
- Significantly changed design or packaging of goods or services (not including routine or seasonal changes, e.g. fashion);
- New or significantly improved sales or marketing method.

Organisational innovations had been carried out by a total of 41% of the studied enterprises and marketing innovations by 25% of the respondents[26]. As for the sub-types of changes, changes in the organisation of work were the most widespread (see Figure 2.8.1). These are followed by improved communication with other enterprises and improved knowledge management in the enterprise. It may be presumed that the exchange of information, its speed and information exchange channels (incl. their convenience and accessibility) will become progressively more important in the future for the enterprises in increasing their market share, entering new markets, developing new products etc. It should also be pointed out that modern information exchange methods enable the enterprises minimise their office expenses on the one hand and save the time of their partners and consumers on the other. E.g. in Ireland, where half of the firms (50.5%) had carried out organisational innovations, the initial survey results (CIS4) show that the knowledge management system was evaluated the highest – by as many as 38% of respondents. This was followed by changes in the organisation of work (35.8%) while improved relations with other firms were mentioned as organisational innovations in significantly smaller number of cases (13.6%).

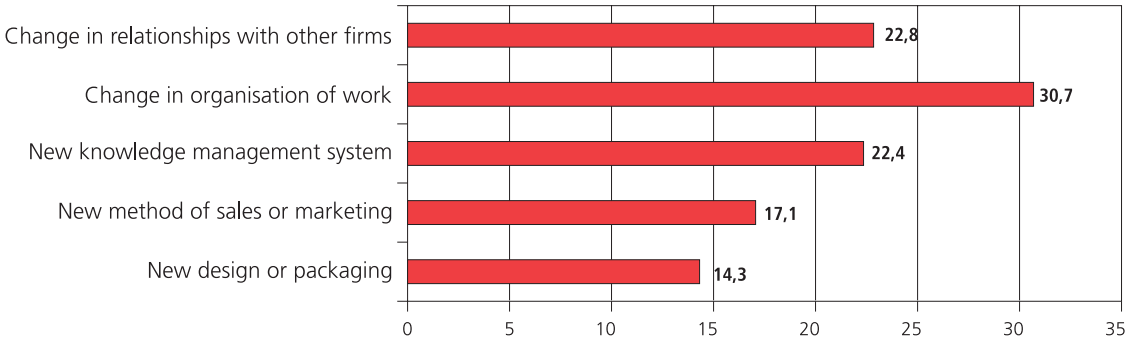


Figure 2.8.1. Sub-types of changes of enterprises having carried out organisational and marketing innovations (%, 2002–2004)

Analogous to several other parameters, the larger enterprises or ones belonging to a business group are more active in making changes in this sphere as well. When comparing industry and services we can see that the intensity of organisational and marketing changes is slightly higher in services as well. Organisational innovations have been carried out by a total of 43% of services enterprises, in case of industry 38%, with the approximately 5% difference in favour of services applies to all subtypes of organisational innovations. The services enterprises are also more active in marketing innovations (29% *versus* 22%) and especially in the area of marketing and sales methods improvement. On the other hand, industrial enterprises are slightly more active innovators in the sphere of design and packaging, which is a quite logical outcome, since the idea of packaging in services is somewhat vague.

Table 2.8.1. Sub-types of changes of enterprises having implemented organisational and marketing innovations as to their size (%, 2002–2004)

	Manufacturing industry				*Services*			
	All	*Small*	*Medium*	*Large*	*All*	*Small*	*Medium*	*Large*
New knowledge management system	19.8	14.1	31.6	48.5	25.5	24.5	29.2	56.5
Change in organisation of work	28.3	21.1	42.9	67.5	33.6	31.7	42.2	73.9
Change in relationships with other firms	20.9	18.5	25.6	34.9	25	24.6	26.1	39.1
New design or packaging	16.4	11.8	27.2	30.9	12.8	12.5	11.8	39.1
New method of sales or marketing	12.4	10.3	15.7	30.7	23.1	22.1	28.3	43.5

Table 2.8.1 shows that the frequency of implementation of organisational and marketing innovations in an organisation is directly related to the size of the organisation. The larger the enterprise, the more corresponding innovations it implements in the course of time. In case of small enterprises the share of innovations is relatively lower, which should not be viewed as natural, since small enterprises are generally considered more dynamic. The volume of activities of small and medium-sized enterprises is completely comparable only in two spheres and this applies to services firms: regarding new design and packaging and also new or significantly improved manner of communication (with other enterprise or institutions).

[26] *In case of the given chapter, no comparison has been made with the previous survey, since the wording of the questions has been significantly altered.*

When organisational innovations took place in the enterprise during the period under observation, the most widespread result they were able to specify was the speeding up of communication with client/supplier. A total of 47% of enterprises rated the impact of innovation on that factor as high. The impact of organisational innovations on the improvement of quality of goods or services was rated by the enterprises, somewhat surprisingly, as relatively high (39%). 26% believed that organisational innovations contributed to the reduction of per unit expenses and only every fifth mentioned the increase of employees' satisfaction or decline of staff turnover.

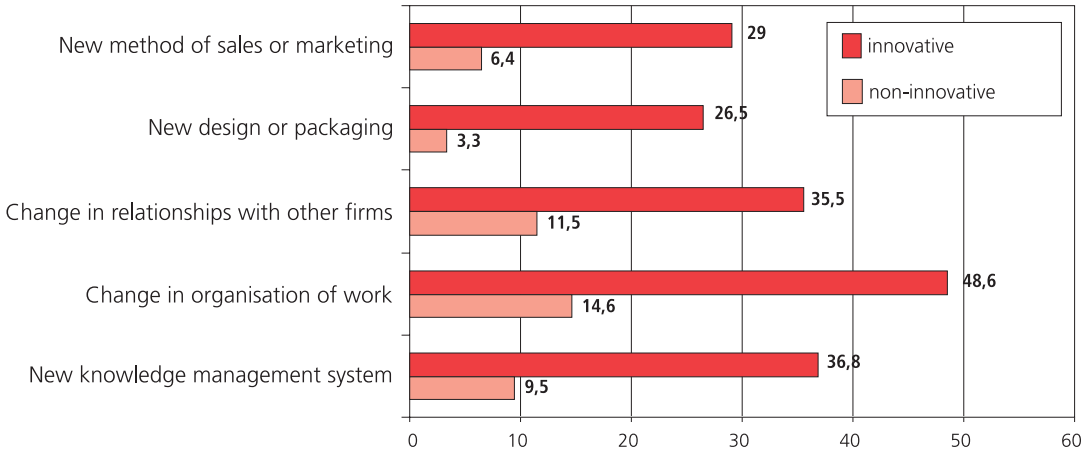


Figure 2.8.2 Share of innovative and non-innovative enterprises having implemented organisational and marketing innovations as to type of innovation (%), 2002–2004

Figure 2.8.2 shows that significant differences as to the intensity of organisational and marketing innovation occur between enterprises, which have innovated (or attempted it) their products and processes (e.g. "innovative" as to the basic definition of this survey) and enterprises, which had not done so. Accordingly, 62% of the first type of enterprises have innovated their organisation, while only 22% of the second type of enterprises have done so. An even greater difference, nearly five times, was observed in the marketing activities – 43% *versus* 9%. Yet regarding the marketing activities an even higher number could have been expected due to the ever-increasing pressure of competition. The above percentage, however, points out that the innovation of products and processes is generally a complex process for the enterprise and it is relatively difficult to implement one innovation without accompanying reorganisations in the other spheres. Innovative enterprises have primarily innovated their internal organisation of work, followed by almost equal percentage of innovations in the knowledge management system and in relations with other enterprises. The ranking is similar in case of enterprises not having innovated their products and processes, but the percents are notably lower.

The survey shows that:
- Innovative enterprises, compared to non-innovative, have carried out significantly more organisational and marketing innovations;
- The most frequently implemented changes have occurred in the organisation of the work of the enterprises;
- The greatest impact of the organisational innovations was considered to be the fast response to the needs of the clients and suppliers.

2.9 Problems with the implementation of innovation projects

According to the present survey, the factors obstructing innovation activity can be divided into three groups[27]:

Economic factors:
- Lack of finance from sources outside enterprise
- Innovation costs too high
- Markets dominated by established enterprises
- Uncertain demand for innovative goods or services

[27] *The factors observed in the previous CIS3 survey were somewhat different, therefore comparisons with the previous survey are only partly possible regarding this aspect.*

In-house factors:
- Lack of funds within enterprise or business group
- Lack of qualified personnel
- Lack of information on technology
- Lack of information on markets
- No need to innovate due to prior innovations

Other factors:
- Difficulty in finding cooperation partners for innovation

It is interesting to observe in this sub-chapter, which factors have obstructed innovative activities in innovative enterprises, as well as what the non-innovative enterprises consider to be the main obstructions.

Table 2.9.1 Factors obstructing innovative activities (% of innovative and non-innovative enterprises), 2002–2004

Obstructive factor	*Enterprises with innovation activities*	*Non-Innovative enterprises*
Lack of funds within enterprise or business group	71.8	54.9
Lack of finance from sources outside enterprise	47.5	37.7
Innovation costs too high	58.5	37.1
Lack of qualified personnel	68.2	45.8
Lack of information on technology	50.5	35.2
Lack of information on markets	51.5	36.3
Difficulty in finding cooperation partners for innovation	46.5	33.1
Markets dominated by established enterprises	57.5	45.3
Uncertain demand for innovative goods or services	54.5	38.2
No need to innovate due to prior innovations	38.9	53.7

Based on the results of the study we may state that **innovative enterprises** are significantly more active in pointing out various factors, which obstructed the corresponding activities. As many as 72% of innovative enterprises pointed out the shortage of in-house resources. Shortage of external sources of financing as an obstruction was reported less frequently. In case of the innovative enterprises, an obstructive factor equal to the shortage of in-house sources of financing is the finding of labour with the necessary skills for carrying out innovation projects. One third of enterprises, which had experienced the problem considered this particularly acute. The assessments of obstructive factors have been included in Appendix 4. The innovative enterprises experienced the lack of necessity as an obstacle in the least number of cases due to previous innovations – 39%. When asked about the significance of the obstacle, half of the respondents stated that although this factor had been encountered, its significance had been low. The opinion concerning technological and market-related information was the same. Although half of innovative enterprises encountered this factor, it was not considered a particularly significant obstruction (more than half of the assessments of this factor were "the level of significance of the obstruction is low").

Due to earlier innovations, **non-innovative enterprises** experienced mainly the shortage of in-house finances and the lack of need as obstructive factors. The latter factor apparently means that significant expenditures were made in the past (primarily on the purchase of necessary machinery and equipment with relatively long service period); accordingly they consider starting new activities relatively unnecessary. Compared to innovative enterprises, the staff problems are somewhat less significant for the non-innovative firms, but when experienced, 30% of the enterprises considered the problem acute. Similarly as the innovative enterprises, they seem to have sufficient information about technologies and the market. Finding innovation is a relatively less important obstacle for the non-innovative enterprises[28].

The structure of the questionnaire regarding the obstructive factors was different from the previous one, but the ranking of the obstructive factors in the previous study (1998–2000) also placed financing issues at the top – the absence of sources of finances or too high cost of innovation.

The following passage observes the obstructive factors as to the size of the enterprise, considering all manufacturing and services enterprises (see following tables).

[28] *According to experts, the issue related to the finding of information is somewhat complicated: "we do not know what we do not know and therefore think that we know enough". But a study of the use of various international marketing-, technologies-related or patents databases by the companies shows it to be extremely modest.*

Table 2.9.2 Frequency of factors obstructing innovative activities by size of industrial enterprises having encountered these factors (%), 2002–2004

	All	*Small*	*Medium*	*Large*
Lack of funds within enterprise or business group	67.2	67.5	65.7	70.6
Lack of finance from sources outside enterprise	44.5	44.9	42.4	50.6
Innovation costs too high	50.2	47.8	55.7	56.8
Lack of qualified personnel	59.9	57.4	64.7	74
Lack of information on technology	48	45.4	52.8	65.6
Lack of information on markets	46.4	44.2	51.1	57.9
Difficulty in finding cooperation partners for innovation	40	38.7	42.5	48.4
Markets dominated by established enterprises	51.4	51.3	51.6	50.5
Uncertain demand for innovative goods or services	45.1	42.5	50	59.3
No need to innovate due to prior innovations	46.9	45.6	51.2	41.4

One can notice in case of many obstructions that, compared to the small and medium-size industrial enterprises, large enterprises have experienced them significantly more frequently. In case of services enterprises, the opposite effect can be noticed as well – it is the SMEs, which have encountered more of various obstacles in some instances. E.g., the SMEs are more concerned, compared to large services enterprises, with the domination of firms, which have already established themselves in the market.

Table 2.9.3 Frequency of factors obstructing innovative activities by size of services enterprises having encountered these factors (%), 2002–2004

	All	*Small*	*Medium*	*Large*
Lack of funds within enterprise or business group	58.8	60.5	46.6	60.9
Lack of finance from sources outside enterprise	39.9	41.5	29.5	30.4
Innovation costs too high	44.9	46.1	34.7	60.9
Lack of qualified personnel	54.4	55.9	41.8	69.6
Lack of information on technology	37.4	37.4	35.1	52.2
Lack of information on markets	42.1	43.3	33.5	39.1
Difficulty in finding cooperation partners for innovation	40.5	42.3	27.8	39.1
Markets dominated by established enterprises	52.7	55.3	36.7	26.1
Uncertain demand for innovative goods or services	48.7	50.4	37.3	39.1
No need to innovate due to prior innovations	46.3	46.3	47.1	34.8

When comparing industry and services with each other, the industrial enterprises have encountered the shortage of financing sources more frequently and the amount of innovation expenses has been a somewhat greater problem. The latter outcome is logical, since the equipment (the most widespread type of innovation) is somewhat more expensive in industry. Industrial enterprises also mentioned the shortage of qualified labour somewhat more frequently, but the shortage of technology-related information significantly more frequently. Large services enterprises have apparently made previously significant expenditures in innovation, which due to the cyclical nature of innovation makes it for them somewhat less necessary to introduce new innovative activities.

Due to obstructive factors, on the average every fifth enterprise had to postpone significantly its innovation project, every tenth enterprise suspended the project and 15% of enterprises did not start the project. These figures are significantly higher in case of innovative enterprises: 41% had to significantly postpone an innovation project, 20% interrupted the project and 32% never started it. These indicators are somewhat higher than four years ago, but on the other hand these results are a natural accompanying phenomenon of higher innovativeness intensity: the more one tries, the more one fails.

The study shows that:

- Innovation projects are significantly obstructed by lack of financing sources in the enterprise or business group;
- The importance of skilled labour increases, especially in large enterprises;
- Compared to previous study, the number of firms experiencing problems has increased.

2.10 Public sector as a supporter of innovation

Estonia has set a goal of boosting the volume of public sector R&D investments to 1.05% of GDP by 2010 and the R&D total investments goal is 1.9% of GDP. The 3%-share of R&D investments of GDP agreed upon within the Lisbon strategy is planned to be achieved by 2014[29]. The EU aims at increasing overall R&D investments to 3% of GDP by 2010.

Overall volume of the R&D activities investment in Estonia has increased from 0.73% of GDP in 2001 to 0.94% of GDP in 2005. Yet Estonia lags far behind the corresponding average indicator of the EU 25 member countries (in 2004 1.9% of GDP). Finland invested in R&D as early as in 2004 3.51% of GDP and Sweden 3.74% of GDP[30].

The state support measures of innovation policy are implemented by Enterprise Estonia (EAS) – an institution financed from the state budget, one of its goals being the development of entrepreneurship in Estonia by supporting technology-related and innovative projects. The EAS allocated innovation support in the 2002–2004 period via programmes like the Spinno Programme, the Technology Competence Centres Programme, the Enterprise Incubation Programme[31], the R&D Financing Programme.

The results of the present study show that the public sector contribution as supporter of the innovation projects[32] of enterprises has somewhat increased compared to the 1998–2000 period (see table). The supported innovative enterprises have received the most support from the state – 7.9%, and this support has increased compared to the results of the previous study. Financial support to innovation activities from local governments and the European Union have remained essentially the same.

Table 2.10.1 Getting financial support for innovation activities by public sector, innovative enterprises (%), 2002–2004 and 1998–2000

	Funding from local government	*Funding from state*	*Funding from the European Union*	*Support from EU R&D framework programmes*
2002–2004				
All	0.7	7.9	1.9	0.5
Manufacturing	1	8.8	2.1	0.8
Services	0.1	6.8	1.2	0.2
1998–2000				
All	1.1	4.9	1.6	0.9
Manufacturing	0.6	5	0.6	0.5
Services	1.7	4.8	3.1	1.4

While the support by the local governments and the European Union in the 1998–2000 period was primarily directed to the services enterprises, in the 2002–2004 period the focus has shifted to manufacturing industry, while the state has been a neutral supporter in that respect during both periods.

Compared to the European average results of the 1998–2000 period, indicators of Estonia are significantly lower and especially regarding the innovation support by local governments. As many as 15% of innovative enterprises received local government support in the EU, an equal percentage received state support and 7% the EU support. It should obviously be reminded in that connection that the average local government in the EU is significantly larger, wealthier, more autonomous etc. compared to Estonia. When observing the sectoral preferences, Europe generally supports the industry side, while unlike Estonia, there is especially large difference of preferences regarding the state support (18% *versus* 9% in favour of industry).

[29] *Action Plan for Growth and Jobs 2005–2007. For Implementation of Lisbon Strategy (Eesti majanduskasvu ja tööhõive tegevuskava 2005–2007 Lissaboni strateegia rakendamiseks).*
[30] *Knowledge-based Estonia 2007–2013. The R&D&I strategy in Estonia (Teadmistepõhine Eesti 2007–2013. Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia. Tööversioon 30. mai 2006.)*
[31] *It should be pointed out in this case that the Enterprise Incubation Programme was launched at the end of 2004 and basically had no effect on the statistics of these years.*
[32] *It is important to note that subsidized credits and credit guarantees have been considered regarding this question.*

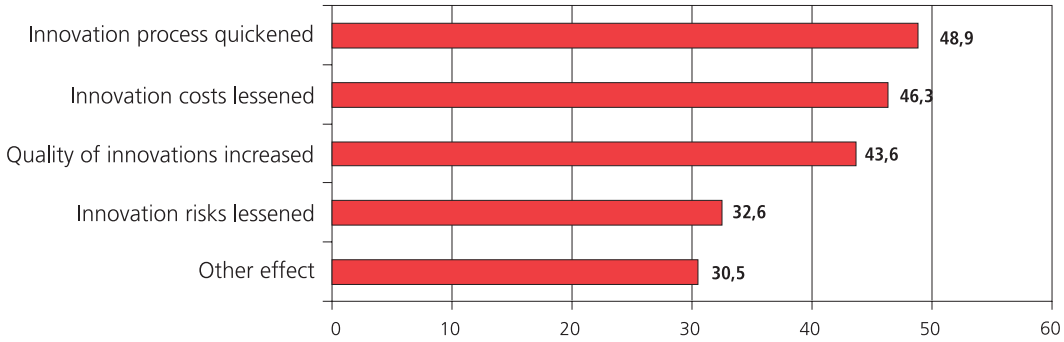


Figure 2.10.1 Assessment of enterprises supported by public sector of results of support (%), 2002–2004

According to the assessment of nearly all enterprises receiving public sector support in 2002–2004 the support had an impact on the innovation process and only 3% claimed that there had been no effect. The enterprises receiving support emphasised most of all that the support enabled them to speed up the innovation process and made its cost easier for the enterprise to bear. It was also pointed out that the support enabled the development of higher-quality innovations.

The study shows that:
- State support to innovation projects has slightly increased;
- Compared to the EU average, the number of support recipients is significantly lower;
- Public sector support resulted in the speeding up of innovation process and reduction of expenses.

3 Innovativeness as to groups of technology intensity

3.1 Technology intensity and world economy

The rating of the technology intensity of economic sectors is based on the share of research and development expenditures of the overall turnover of the sector. It should be pointed out, however, that the high-technology sectors can include also non-high-tech enterprises, and vice versa, low-technology sectors can have high-technology enterprises. Inasmuch as high-technology sectors are often the engines of economic growth in the developed countries, the inclusion of the given treatment in this publication is justified.

Contemporary knowledge- and technology-intensive economy is not limited only to the production of sophisticated products as previously. Knowledge-based economy also includes the services sphere, which uses knowledge, skills and in most cases expensive and sophisticated equipment. The reason for the growth of the knowledge- and technology-intensive services sector is the concentration of industrial enterprises on production and outsourcing the services, as well as the improved standards of living and the corresponding increased demand for various services.

The following table includes the classification of the European Statistical Office – Eurostat – on the breakdown of the industrial and services sectors as to knowledge- and technology-intensity.

Table 3.1.1 Breakdown of sectors of economy based on the Eurostat classification

Manufacturing
High-technology: Aerospace, Pharmaceuticals; Computers, office machinery; Electronics-communications; Scientific instruments
Medium-high-technology: Electrical machinery; Motor vehicles; Chemicals; Other transport equipment; Non-electrical machinery
Medium-low-technology: Coke, refined petroleum products and nuclear fuel; Rubber and plastic products; Non metallic mineral products; Shipbuilding; Basic metals; fabricated metal products
Low-technology: Other manufacturing and recycling; Wood, pulp, paper products, printing and publishing; Food, beverages and tobacco; Textile and clothing
Services
Knowledge-intensive high-tech services: Post and Telecommunications; Computer and related activities; Research and development **Knowledge-intensive market services:** (excl. financial intermediation and high-tech services): Water transport; Air transport; Real estate activities; Renting of machinery and equipment without operator, and of personal and household goods; Other business activities **Knowledge-intensive financial services:** Financial intermediation, except insurance and pension funding; Insurance and pension funding, except compulsory social security; Activities auxiliary to financial intermediation **Other knowledge-intensive services:** Education, Health and social work; Recreational, cultural and sporting activities
Less-knowledge-intensive market services: Retail- and wholesale trade, motor trade; hotels and restaurants; land transport; transport via pipelines, supporting and auxiliary transport activities; activities of travel agencies. **Other less-knowledge-intensive services:** Public administration and defence; compulsory social security; sewage and refuse disposal, sanitation and similar activities; activities of membership organization n.e.c.; other service activities; activities of households as employers of domestic staff; extra-territorial organisations and bodies

Source: Technology and knowledge-intensive sectors, http://europa.eu.int/estatref/info/sdds/en/htec/htec_sectors.pdf

The classification of services as to knowledge-intensity is relatively new and certainly also arguable. For example, providing real estate services is considered knowledge-intensive. Several areas of real estate services, e.g. purchase, sales and architectural services certainly are that by their nature. On the other hand, it would be difficult to describe services involving administration or guarding knowledge-intensive. National defence has been included among the less knowledge-intensive services, yet all military commanding larger collectives have received long and exhaustive training, while the technology used in the military system of developed countries is in most cases high technology.

To determine the various complexity levels of manufacturing, production is divided into high-technology, medium-high-technology, medium-low-technology and low-technology. In this respect, until the recent decades the production of sophisticated and expensive industrial goods used to be a quality clearly separating the highly developed countries from others. The developed countries manufactured various production equipment and more sophisticated consumer goods like household electronics. The role of the medium-level countries was the

processing of raw materials and usually the manufacturing of less sophisticated, but high labour-intensity consumer goods. The traditional breakdown of countries and their sectors of industry began to change in the 1990s with the growth of the so-called Asian tigers (South Korea, Hong-Kong, Taiwan and Singapore). Unlike before, the US and Japanese large enterprises also invested in high-technology sectors. The development units stayed in most cases in the developed countries, but a significant share of production was transferred to the areas with lower labour cost and/or located closer to the customers.

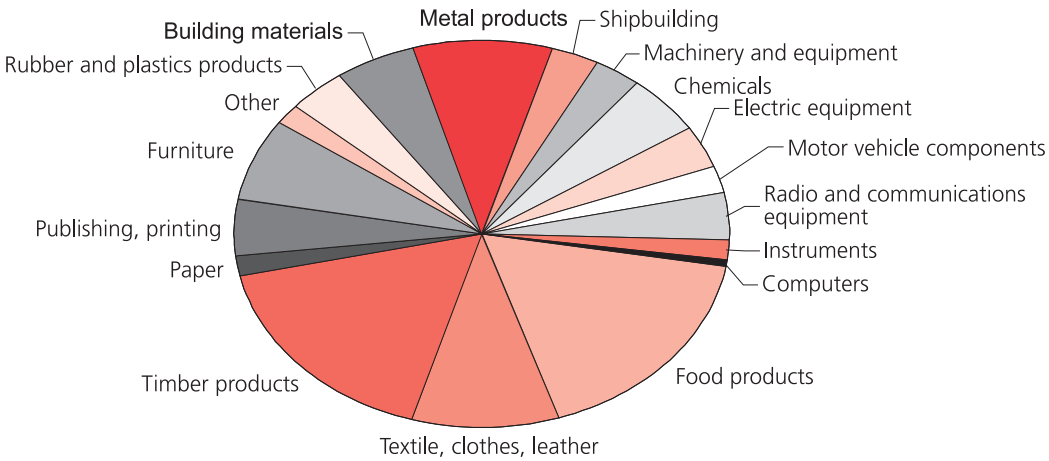
High-technology production amounts to a significant share of the economy of developed countries (see Appendix 5). It amounts to roughly one third in the United States, approximately one-eighth in the European Union (EU15) and one-seventh in Japan[33]. It is favourable to Estonia that several high technology concentration areas are located in its vicinity: Sweden and Finland.

As a trend working in the world economy, one could point out the move of the growth of increase and the volume of economy further away from Europe. Whether or not it may start to obstruct the development of Estonian enterprises in global value chains, only time will tell, but we cannot afford to ignore this shift.

China and other developing Asian nations have made great efforts for the development of high-technology production (see Appendix 6). While the development of high technology in the past decade primarily involved the attraction of corresponding investments, contemporary China is already characterised by the acquisition of European and US firms by Chinese enterprises, production for the domestic market and the establishment of local development centres.

3.2 Innovation in groups of Estonian industry and services sectors as to their technology-intensity

Out of total output of the Estonian industry, approximately six percent is high-technology (see next figures). Estonian high technology predominantly concerns the manufacture of communication equipment and to a smaller degree of computers and scientific equipment. Due to the relatively high labour intensity and lower capital intensity, Estonian high-technology sectors are characterised by relatively lower value added compared to medium-high technology. Yet it may be claimed that the capitalisation of the high technology sector and above all the electronics industry is rapidly growing and therefore the increase of value added may be forecast.



Remark:
6% - High technology: computers, instruments, radio and communications equipment
14% - Medium-high technology: motor vehicle components, electric equipment, chemicals and machinery
21% - Medium-low technology: shipbuilding, metal products, building materials, rubber and plastic products
59% - Low technology: food products, textile and sewing industry, timber products, furniture

Figure 3.2.1 Sectors of different technology-intensity as to value added (%), 2005

The largest share out of individual sectors of industry in Estonia belongs to food industry, which is considered a low-technology sector. Compared to other EU countries, (see Appendix 5), the share of high-technology production in Estonia is significantly lower (the share of high-technology sectors in EU-15 in 2003 was 12.3 %). Compared to the Nordic countries in turn the share of the high-technology sectors is 3–5 times lower.

[33] *However, significant regional differences should be pointed out in that respect.*

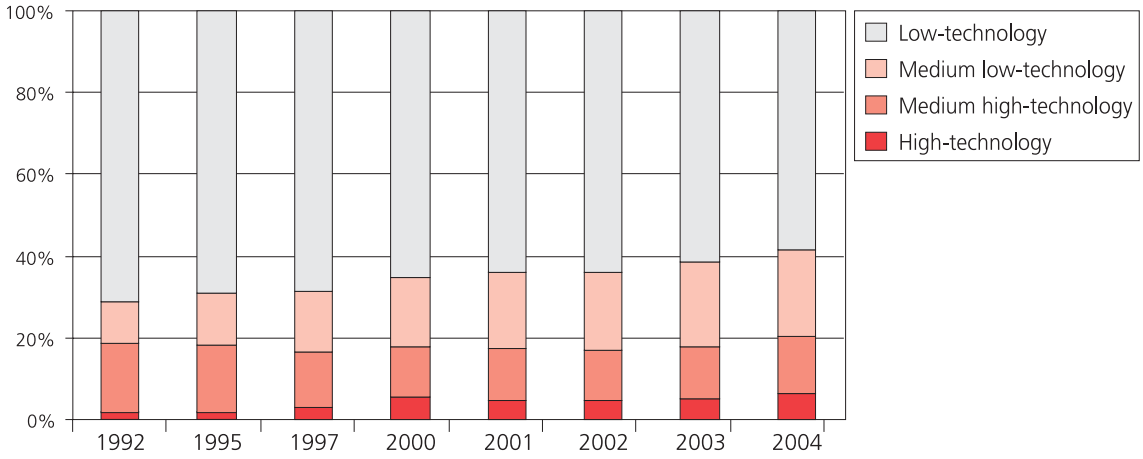


Figure 3.2.2 Breakdown of Estonian industry as to technological groups (%), 2002–2004

Technology intensity has increased relatively slowly in the period of existence of the Republic of Estonia and the development of high technology sector has primarily taken place with the support of the Nordic electronics firms. The development of Estonian high technology is also characterised by the relocation of labour from less technological sectors. For example, labour from agriculture and textile industry has moved to the electronics industry.

The number of innovative enterprises in the sector is closely related to the technological level of the enterprises (see next table). Out of the high technology sectors enterprises three quarters were innovative. The situation in the high technology services sphere is generally similar to that of the high technology industry.

Table 3.2.1 Share of innovative enterprises dependent on technology level (%), 2002–2004

	Innovative enterprises
High-technology sectors	74
Medium high-technology sectors	59.5
Medium low-technology sectors	45.2
Low-technology sectors	46.3
High-technology services	70.8
Incl.	
Knowledge-intensive market services (air transport, water transport, lease of machinery)	40
Knowledge-intensive financial services	74.8

The survey showed that the size of the enterprise and its technological level also influence the intensity of innovation. In most cases the larger enterprises are more active in the development of innovations (see next figure). Small enterprises in the high technology sector are active as well.

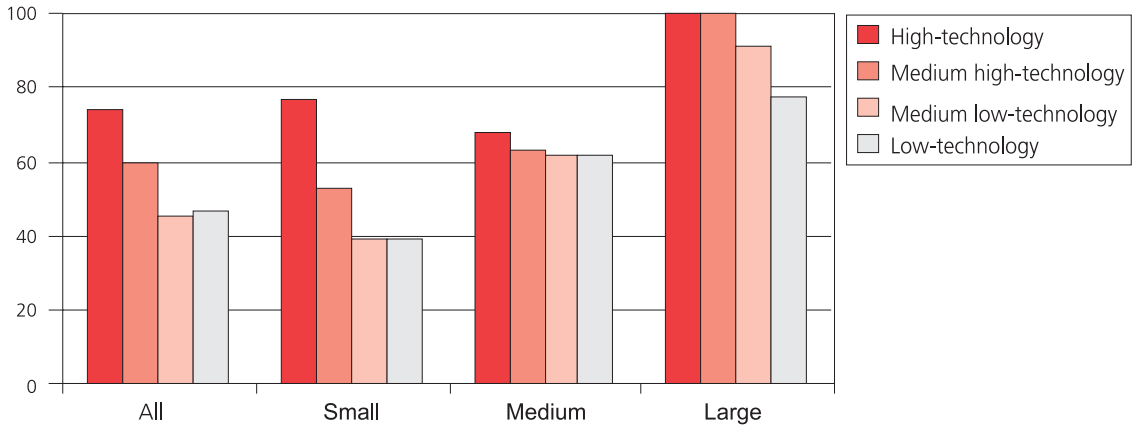


Figure 3.2.3 Share of innovative enterprises as to technological level and size of enterprise (%), 2002–2004

The nature of innovative activities depends to a remarkable degree on the technological level of the enterprise. While the purchase of new equipment dominates in the low-tech sectors, development activities and design become progressively more important as the technology intensity increases. Investments in equipment are the highest in the low-technology sector.

Table 3.2.2 Ratio of innovation expenditures to net sales turnover as to technology level (%), 2004

	In-house R&D	*Extramural R&D*	*Machinery and equipment*	*Purchase of knowledge*	*Sum of four types*
High-technology sectors	1.20	0.10	0.83	0.03	2.16
Medium high-technology sectors	0.70	0.05	1.99	0.04	2.79
Medium low-technology sectors	0.24	0.07	1.94	0.02	2.28
Low-technology sectors	0.34	0.07	3.16	0.09	3.66
High-technology services	0.94	0.22	0.71	0.03	1.90
Incl.					
Knowledge-intensive market services (air and water transport, lease of machinery)	1.52	0.04	1.01	0.02	2.59
Knowledge-intensive financial services	0.71	0.20	0.09	0.06	1.07

Knowledge-intensive high-technology services are also characterised predominantly by the high share of R&D expenses. At that R&D activity can take place in Estonia as well as outside, but also in case of the latter version it has to be considered that the implementation of R&D applications developed elsewhere requires qualified labour.

Table 3.2.3 Share of new or significantly improved products of net sales turnover (%), 2004 and 2000

	Products new for enterprise		*Products new for market*	
	2004	*2000*	*2004*	*2000*
High-technology sectors	26.4	43.3	7	16.5
Medium high-technology sectors	18.5	23.5	5.8	9.9
Medium low-technology sectors	14.2	10.3	2.5	3.7
Low-technology sectors	10.3	14.5	3	5.4
High-technology services	5.2	12.1	3.7	6.4
Incl.				
Knowledge-intensive market services (air and water transport, lease of machinery)	11.7	-	8	-
Knowledge-intensive financial services	3.2	-	9.8	-

The significance of new products to turnover depends on the level of technology; the higher it is the higher is the new products' share of turnover. The table shows that the share of net sales turnover of products new for the enterprise has declined, however, compared to the results of the previous survey, and especially in the turnover of high-technology sectors, regarding both products new for the enterprises and products new for the market. It may be pointed out as a cause hereby that we are dealing with a scale-economy-centred period, where the increasing cost of production input has not yet forced the enterprises to restructure on new products and they can carry on by providing the existing goods and services by supplying them in a greater volume. Accordingly, it is logical that while according to the previous survey, small enterprises accounted for a greater share of the high-technology sector industrial enterprises, the numbers of small and medium-size enterprises are more or less equal at present[34].

[34] *The share of large enterprises of the high technology sector is marginal.*

Table 3.2.4 Most important cooperation partners depending on technology level (%), 2002–2004

	No cooperation	*Cooperation registered*	*In-concern*	*With suppliers*	*With clients*	*With competitors*	*With private research institutions*	*With universities*	*With public research institutions*
High-technology sectors	55.7	44.3	16.1	31.4	30.5	12.3	14.9	11.3	5.5
Medium high-technology sectors	79.0	21.0	10.3	14.0	14.6	11.5	9.5	11.0	5.6
Medium low-technology sectors	85.1	14.9	7.6	9.7	11.1	6.7	4.5	3.0	3.0
Low-technology sectors	87.7	12.3	3.6	9.2	7.9	5.6	2.3	1.7	0.9
High-technology services	59.15	40.85	17.72	25.99	31.41	18.3	8.53	11.63	3.63
Incl.									
Knowledge-intensive market services (air and water transport, lease of machinery)	79.32	20.68	5.46	13.91	15.14	13.28	5.53	8.28	6.76
Knowledge-intensive financial services	63.35	36.65	27.97	25.9	23.25	25.33	20.05	13.44	9.67

Technological level has a significant effect on the enterprise's choice of cooperation partners. Low-technology enterprises make significantly lesser use of cooperation partners than high-technology enterprises. The main development partners of the high-technology enterprises are located in the European Union. Other countries outside Europe are used relatively infrequently (see Appendix 6).

High-technology enterprises are significantly more active in the use of cooperation partners than other groups of enterprises. Nearly half of high-technology enterprises led active cooperation with various partners. In most cases, the cooperation partners were the suppliers of equipment and software and the clients of the enterprises. It should also be emphasised that every ninth high-technology enterprise has cooperation ties with universities.

Table 3.2.5 Impact of obstructive factors in innovation process dependent on technology level (%), 2002–2004

	No impact	*Impact present*	*Project dropped in idea stage*	*Project dropped after launching*	*Project postponed significantly*
High-technology sectors	29.1	44.9	24.6	17.8	35.2
Medium high-technology sectors	21.4	38.1	21	11.2	32.8
Medium low-technology sectors	21.7	23.6	13.4	9.7	17.7
Low-technology sectors	19.6	26.7	13.7	8.9	19.6
High-technology services	30.7	40.1	25	21.2	29.3
Incl.					
Knowledge-intensive market services (air and water transport, lease of machinery)	20.8	21.3	8.7	7.4	20
Knowledge-intensive financial services	25.3	49.4	40.2	27.8	45.7

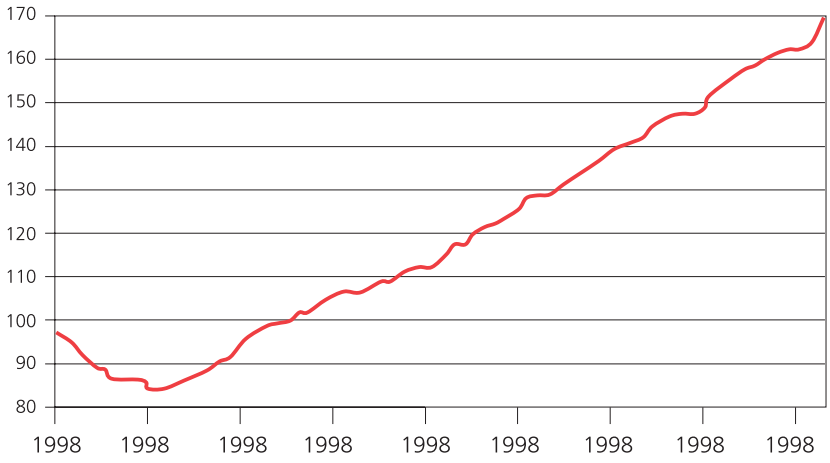
All groups of technology are influenced by different obstructions. Due to financial problems, projects were postponed in one third of high-technology enterprises. The development of new products and improvement of processes were the most hindered in the higher technology level sectors. It was apparently caused by the need to carry out innovations faster than in the other more slowly innovating traditional enterprises. However, the main reason for the slowing of the innovative activities in all sectors were financing problems, but there is an interesting fact that the high technology sector industrial enterprises faced problems only with finding in-house financing sources and no difficulties with finding outside sources. The high technology industrial sector representatives also found that the amount of innovation expenses was not a significant obstruction. Another major issue was the finding of necessary staff. The high technology services sector perceived this to a somewhat lesser degree, while the industry sector showed a rather clear connection: the more technologically developed sector, the harder it was to find qualified labour.

4 Peculiarities of innovation in Estonian industry and services

The present chapter discusses in detail the innovation indicators of industry and services and observes the situation in selected significant sectors of Estonian economy[35]. On the manufacturing industry side we shall discuss in greater detail the timber sector, electronics and food industry; on the services side the transport, information and communication technology sector and the financial mediation and insurance sector. At the end of the chapter we will enlist the factors, which characterise lowly and highly innovative sectors of economy.

4.1 Innovation in industrial sector of Estonia

Estonian industrial output has shown a rising trend since 2000 (see figure 4.1.1). Thus, industrial output increased in 2000 14.6%, in 2001 8.9%, in 2002 8.2%, in 2003 11%, in 2004 8% and in 2005 9.7%[36]. The average annual growth rate of industrial output in the years 2002–2004 was 9%.



Source: Statistics Estonia

Figure 4.1.1 Industrial output volume index trend[37] (January 1998 – May 2006)

Compared to the previous survey **the share of innovative enterprises in the industrial sector has increased 9 percent** and 48% of the industrial enterprises selected to the survey sample can be considered innovative.

Innovativeness, i.e. the innovation of processes and products, has increased nearly in all spheres of activity of the industry sector, having more than doubled in some. It should be hereby kept in mind that the less enterprises operate in a field, the greater may be the changes. Innovativeness has increased the fastest in the couple of sectors involving a small number of enterprises like the production of office equipment and computers. However, observing the situation in the larger sectors is more interesting. To illustrate, in the forestry and timber sector the share of enterprises introducing new products or processes (or attempting to do so) is slightly below the average in the industrial sector (on this sector see details in sub-paragraph 4.1.1). The food and drinks production sector continues to be somewhat more innovative than the average in the industrial sector – both the current and previous surveys showed that the given sector contained approximately 10 percent more enterprises that had implemented innovations (or had attempted to do so). The following table shows the shares of innovative industrial enterprises of the corresponding sub-sectors.

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[35] *It should be pointed out hereby that the chosen sectors are important for Estonian economy for various reasons: e.g. share of economy, export share, employment, possible growth potential etc.*

[36] *Source: Eesti põhilised sotsiaal- ja majandusnäitajad. Kuubülletään 1/06.*

[37] *The trend is a time-series cleared of seasonal and random disturbances, which shows the development direction and rate of the time-series.*

Table 4.1.1 Share of innovative enterprises of industrial sector (%), 2002–2004

Low	*Medium*[38]	*High*
Manufacture of wearing apparel (26.4%)	Manufacture of textiles (50.1%)	Manufacture of food products and beverages (58.6%)
Manufacture of wood and of products of wood (41.5%)	Tanning and dressing of leather (54%)	Manufacture of paper and paper products (60.5%)
Manufacture of fabricated metal products, except machinery and equipment (35.3%)	Publishing, printing and reproduction of recorded media (56.8%)	Manufacture of chemicals and chemical products (88.7%)
	Manufacture of rubber and plastics products (56.2%)	Manufacture of other non-metallic mineral products (63.3%)
	Manufacture of machinery and equipment (52.2%)	Manufacture of radio, television and communication equipment apparatus (72.2%)
	Manufacture of electrical machinery and apparatus (56.2%)	Manufacture of medical, precision and optical instruments, watches and clocks (67.2%)
	Manufacture of motor vehicles, trailers and semi-trailers (54.4%)	
	Manufacture of other transport equipment (48.5%)	
	Manufacture of furniture (50.5%)	

The higher innovativeness of foreign-owned enterprises compared to domestically-owned enterprises of the same sector may be discussed, for instance, in textile industry, publishing and printing, metal products manufacturing, engineering, rubber and plastic industry. The situation is less straightforward in large sectors like food industry and furniture industry – 100% foreign-owned enterprises are somewhat more innovative, but this does not apply to foreign majority ownership (50–99%).

When observing the implementation of new products or introduction of new production processes, it may be stated that compared to the previous survey greater attention is paid to process improvement (see Appendix 7). When comparing the results of the sectors [39] regarding the improvement of products and processes in 2002–2004, the paper industry has been clearly more oriented to the introduction of new products to the market paper industry, but the leather and footwear industry and food industry have been active as well. The production of radio, television and communication equipment and devices has been significantly more oriented to the improvement of their production or supply methods and auxiliary activities (compared to the introduction of new products to the market).

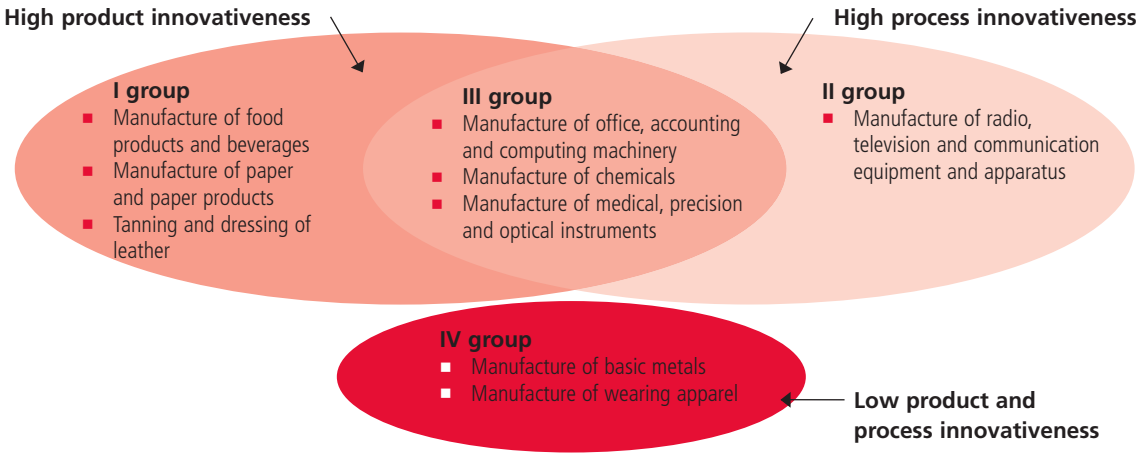

Figure 4.1.2 Breakdown of selected sectors of industry as to product and process innovativeness, innovative enterprises (%), 2002–2004

[38] *There were 48% of innovative enterprises of the entire manufacturing industry.*
[39] *It should be pointed out again that the number of enterprises in some sectors is relatively small, requiring caution in the interpretation of results.*

When comparing the present breakdown of sectors of industry with the results of the previous survey (1998–2000) as to product and process innovation, the situation has not undergone significant changes. The only clear shift is the change in the paper industry: it used to be placed among the sectors with high process innovativeness and slightly below average product innovativeness. However, now it has moved to the group of high product innovativeness, while process innovativeness is average. The other changes are not as radical. For instance, the product innovativeness of medical equipment and precision instruments manufacturing enterprises did exceed the industry average in the previous survey, but not very significantly; it is therefore arguable whether it was previously placed in the "average" or "above average" group. But now it is clearly in the above average group, regarding both product and process innovativeness. The sewing industry[40] and metal products manufacturing are located, according to both the present and previous surveys, in the low process and product innovativeness group.

It is important to point out that between the two surveys the process innovativeness of Estonian industries has increased faster than product innovativeness (respectively 1.7 times *versus* 1.2 times). It is apparent (see Appendix 7) that process innovativeness has increased in the relatively traditional sectors of industry like the textile industry, leather and footwear industry, rubber and plastics industry. It is natural to pay attention to process innovativeness in the given sectors. Theoretical works generally point out that process innovation is an activity saving labour and product innovation an activity creating new jobs. The toughening competition has apparently forced the enterprises to consider saving labour; hence the increased attention to process innovation.

While manufacturing industry in general emphasised the **results of innovative activities** such as the increase of selection of goods, the improvement of their quality and increase of market share, then observing other results of innovation activities in **innovative industrial enterprises**, the improvement of production flexibility is considered especially important by enterprises manufacturing electric machines and equipment. The increase of productivity was emphasised primarily by timber production enterprises. The latter, together with manufacturers of non-metal mineral products and metal producers, emphasise above average the reduction of labour cost per unit. Chemical industry enterprises mentioned more than others (again together with timber industry) that due to innovative activities the cost of materials and energy could be reduced. It is also logical that the chemical industry enterprises emphasised the reduction of environmental impact and/or improvement of working conditions and safety. Innovative chemical industry and food industry enterprises, which clearly encountered new requirements due to the EU accession of Estonia, remarked more frequently that the innovations improved conforming to the requirements of legal acts.

The **cooperation pattern** of innovative enterprises mentioned in Chapter 2 was quite similar – cooperation was mainly developed with clients and suppliers of equipment and a substantial part of cooperation took place at the business group level. When observing the various innovative sectors of manufacturing industry, paper producers and manufacturers of electric machines and equipment cooperate in most cases with competitors and enterprises of the same sector. Consultation firms, commercial labs and private research institutions are considered the most valuable partners primarily by innovative producers of medical equipment, optical devices, precision instruments and timepieces. Chemical industry enterprises and manufacturers of motor vehicles, trailers and other means of transport have developed close cooperation with universities. It is therefore logical that when observing the sources of **information necessary for innovative activity** of various sectors of industry, enterprises of chemical industry emphasise above average the universities and other research institutions as important sources of information. The given enterprises also (together with publishers) find above average amount of useful information in scientific journals. It is interesting to note that the producers of medical equipment (as well as recycling) consider conferences, fairs and exhibitions their most important sources of information. The importance of professional and industrial associations was emphasised primarily by the manufacturers of motor vehicles, trailers and other means of transportation.

While in manufacturing industry in general the **hampering factors** of innovative activities are primarily related to finding sources of financing and qualified staff, the singling out of certain most acute factors in different sub-sectors showed that the shortage of internal financing sources was primarily raised in innovative paper and sewing firms, while the greatest problem of leather processing firms is finding outside financing sources. The chemical industry enterprises reported that the innovation costs are very high. Paper industry, which is a relatively small subsector of Estonian industrial structure, considers finding qualified staff a very serious problem. In case of the paper industry another factor obstructing innovation is the uncertain demand for innovative goods. Publishing is a sphere where innovative activities have been obstructed by the domination of enterprises that have established themselves in the market. The manufacturers of medical equipment and optics devices face more problems than others with the finding of cooperation partners and the same applies to clothing producers.

[40] *Textile production not included.*

4.1.1 Innovation in Estonian forestry and timber industry

Estonia holds the fourth place in Europe after Russia, Finland and Sweden as to per capita forest resources[41], therefore the sectors of industry related to timber – forestry, timber processing, paper and furniture industry – occupy an important position in overall development of economy (the given sectors of industry combined in 2005 5.3 % of GDP and 8% of employment[42]). The greatest sub-sector of timber sector is timber processing and manufacture of timber products (55.4% of the sector turnover in 2005), followed by furniture industry (19.5%), forest maintenance and forest industry (18.9%) and paper and cellulose industry (1.63%). Production volume in these sectors has been growing steadily in the past years and Estonia has thus become Europe's third in per capita output of timber boards and fourth per capita timber producer[43]. One could claim that the timber sector is the greatest balancer of the Estonian foreign trade balance.

Estonian timber, paper and furniture industry is significantly more oriented to the foreign markets than the average manufacturing industry[44] and this fact is reflected by the present innovation survey – 60.6% of the timber sector enterprises consider other EU or EFTA countries their primary market area. Since most of the timber sector products have attained the stage of maturity[45] and the growth of main export markets is relatively slow, the enterprises' export capacity has been so far based on cheap labour as well as access to the domestic timber resource. The rapidly growing cost of labour, low productivity and increasing competition of the Asian countries has gradually reduced the surplus profit[46] of the furniture industry and made it negative in 2005[47]. The declining supply of domestic timber combined with the increasing processing capacity of the timber sector has significantly increased the import of timber – the export-import ratio of unprocessed logs was already negative in 2005. Dependence on logs imported primarily from Russia may become an important obstruction to further development of Estonian timber processing. Due to the above developments the pressure for development activities is very high in all the given sectors.

The innovation activity of Estonian timber sector enterprises has significantly intensified in recent years. While the survey covering the years 1998–2000 included 35.8% innovative enterprises in the timber sector, the percent survey has 53.2% of such firms. One important reason could be the increase of innovation awareness among the respondents, but it should be pointed out that the share of innovative enterprises has increased significantly faster than the average in the manufacturing industry (growth during the same period from 39% to 48%). Nevertheless, most innovation activities are related to the purchase of machinery and equipment, e.g. in the largest sub-sector of timber sector – timber processing and manufacture of timber products – the ratio of innovation expenses of innovative enterprises to net sales turnover was 9.6% (industry average 4.4%), but 8.7% of this was spent on the purchase of machinery and equipment while in-house and extramural R&D activities only took 0.7% of turnover (= average result of industry). The corresponding indicators in other sub-sectors of timber sector, both the expenses on the purchase of machinery and equipment and on R&D activities, as percentage of turnover, lower than the average indicators of manufacturing industry.

Significant foreign investments have been made in the Estonian timber industry enterprises in recent years, yet the share of foreign capital has remained below the average level of manufacturing industry. Primarily thanks to the export demand, but also largely due to direct foreign investments, rather rapid technological development has generally taken place in the Estonian timber sector. The main technologies and processes of the timber-based sectors of industry have not essentially changed in recent years and the innovations are mainly related to new information and communication technologies-based solutions in timber processing and logistics, broader use of chemical technologies in the analysis of timber structure and the increase of timber durability; timber is also increasingly combined with other materials, e.g. in construction, window and door industry[48]. Process and product innovation are very closely related in these sectors – gradual innovations in production

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41 *Calculation based on UNO data for 2004. [http://faostat.fao.org/faostat/].*

42 *Calculations based on Statistics Estonia electronic database [www.stat.ee]. Only cost of the end production of the aforementioned sectors has been considered.*

43 *Calculations based on UNO data for 2004. [http://faostat.fao.org/faostat/].*

44 *Analysis of the timber sector in previous years may be found in Varblane, U., Ukrainski, K. (toim) (2004)* 'Eesti puidusektori konkurentsivõime', *Tartu: Tartu Ülikooli Kirjastus.*

45 *Frühwald, A., Solberg, B. (eds) (1995)* Life-Cycle Analysis – A Challenge for Forestry and Forest Industries. *EFI Proceedings, No. 8.*

46 *Share of value added, which is retained in the firm after labour and capital costs and which can be used for investments in the development of the firm.*

47 *More detailed analysis of surplus profit see Varblane, U. (2006)* Eesti majanduse ning olulisemate sektorite lühi-, kesk- ja pikaajalise konkurentsivõime analüüs tootlikkuse, loodava lisandväärtuse ning ekspordivõimekuse valguses. *Unpublished manuscript.*

48 *Ukrainski, K. (2006) 'Tehnoloogia mõju Eesti puidusektoris vajatava tööjõu teadmistele ja oskustele' collection of articles* Haridus ja majandus, *Tartu: Tartu Ülikooli Kirjastus.*

processes add important new qualities to the end product[49]. Therefore the share of enterprises in the timber sector, which carried out both types of innovations, was unusually high – 34.8% of all innovative enterprises.

Expenses on machinery, equipment and software have increased the fastest and are in the timber sector on the average over twice as high as in the other sectors of manufacturing industry. The latter is also the reason why the timber sector expended on all analysed spheres of innovation on the average nearly the double amount (the expenses of an average enterprise on innovative activities were in 2004 in the timber sector 7.6 million kroons, in case of a median enterprise – 1.2 million kroons; the average figures for the other sectors of manufacturing industry were respectively 3.9 and 0.7 million). It is remarkable that in the previous innovation survey the average expenses of the timber sector were significantly lower than those of the other sectors.

Compared to the previous survey, innovative activities have become more efficient (see Table 4.1.1.1). **Innovation results** are mainly related to the increase of production efficiency and improvement of product quality, which the timber sector enterprises have rated as significantly more efficient than in previous years, but also other sectors.

Table 4.1.1.1 Results of innovative activities in timber sector, 2002–2004 and 1998–2000

Results of innovative activity have been calculated as average of following ratings: 3 = high effect, 2 = medium effect, 1 = low effect, 0 = insignificant	*Timber sector*		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Increased range on goods and services	1.63	1.63	1.88	1.54
Increased market or market share	1.73	1.86	1.73	1.72
Improved quality in goods and services	1.91	2.10	1.98	1.89
Improved production flexibility	1.55	1.68	1.57	1.59
Increased production capacity	1.76	-	1.55	-
Increased productivity	-	1.83	-	1.27
Reduced labour costs per produced unit	1.48	1.59	1.17	1.07
Reduced materials and energy per produced unit	1.23	1.36	1.05	0.72
Improved environmental impact or health and safety aspects	1.08	1.24	1.10	0.69
Met regulations and standards	0.96	1.02	1.18	1.17

The developers of innovations are increasingly more often the timber sector enterprises themselves, the role of the business group in the development of process innovations, for instance, has declined in the timber sector (from 11.6% to 6.1% of innovative enterprises) unlike in other sectors of manufacturing industry where it has grown by an average from 11.3% to 13.9%. The most significant **cooperation partners** in timber sector are suppliers (especially in case of furniture industry), clients and consumers. The main **sources of information in the implementation of innovations in the timber sector** are the suppliers of equipment, materials and semi-manufactured products whose role has significantly increased in recent years (see Table 4.1.1.2). The role of universities and research institutions in the timber sector innovative activities continues to be low. The analysis of the previous innovation survey results showed that the issue of in-house sources of information was more significant in the enterprises, which also revealed the presence of greater labour problems[50]. Thus the declining significance of in-house sources of information can be considered as an increase of the absorption capability of the timber sector enterprises[51] – the enterprises are capable of making greater use of information from outside sources in their innovative activities.

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[49] *Regarding timber industry see Palmberg, C. (2000) The many faces of absorptive capability in low-tech industries – the case of glue-lam timber and foodstuffs, Paper presented at the DRUID Summer Conference on* Industrial Dynamics of the New and Old Economy–who embracing whom? *Copenhagen/Elsinore 6-8 June and on paper industry Laestadius, S. (1998) Technology level, knowledge formation and industrial competence in paper manufacturing., in Eliasson, G., Green, C. (toim)* Microfoundations of economic growth – a Schumpeterian perspective. *Ann Arbour: The University of Michigan Press.*

[50] *Ukrainski, K., Varblane, U. (2006) Sources of Innovation in the Estonian Forest and Wood Cluster, pp 143–168 Hannula, H., Radoševic, S., von Tunzelmann, G.N., (toim),* Estonia, the New EU Economy: building a Baltic miracle? *Aldershot: Ashgate Publishing Ltd.*

[51] *We have used here the development of Cohen and Levinthal (1990)* absorptive capacity *concept by Meeus, Oerlemans and Hage (2004) according to which enterprises with very low and very high levels of in-house knowledge make less use of external sources of information compared to enterprises with medium level of knowledge. Absorptive capacity of outside knowledge is highly significant for innovation development and implementation, but enterprises with very low in-house knowledge level do not recognise the opportunities of external sources; enterprises with high knowledge level generally have the necessary specific knowledge available within the enterprise and the effect of use of outside sources is low. [see also Cohen, W. M. and Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective of Learning and Innovation,* Administrative Science Quarterly, *35, pp. 128–152. and Meeus, M.T.H., Oerlemans, L.A.G. and Hage, J. (2004). Industry–Public Knowledge Infrastructure Interaction: Intra- and Inter-Organizational Explanations of Interactive Learning.* Industry and Innovation, *11, 4, pp. 327–352.]*

Table 4.1.1.2 Use of information sources in timber sector, 2002–2004 and 1998–2000

Sources of innovation-related information have been calculated as Average of following ratings: 3=high significance, 2=medium significance, 1=low significance, 0=not used	*Timber sector*		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Enterprise	1.84	-	1.89	-
Business group	0.59	-	0.54	-
Enterprise or business group	-	1.68		1.95
Suppliers	1.61	1.84	1.55	1.69
Clients	1.56	1.58	1.64	1.65
Competitors	1.24	1.18	1.07	1.16
Consultations firms	0.33	0.44	0.43	0.53
Universities	0.13	0.20	0.34	0.37
R&D institutions	0.12	0.15	0.13	0.26
Conferences, journals	0.69	-	0.98	-
Fairs, exhibitions	1.35	-	1.33	-
Conferences, fairs	-	1.53	-	1.43
Journals	-	0.79	-	0.99
Professional and industrial associations	-	0.36	-	0.47

The results of the innovation survey show that the timber sector enterprises with their significantly intensified innovation activities, as well as notably increased investments in new technologies have reacted to the growing competition in the foreign markets and the increasing cost pressure in the domestic labour market. The more significant **factors obstructing innovative activities** are the shortage of in-house sources of financing, shortage of competent staff and high innovation expenses, which affect the timber sector enterprises more strongly than the other sectors of manufacturing industry (see Table 4.1.1.3).

Table 4.1.1.3 Factors hampering innovative activities in timber sector, 2002–2004 and 1998–2000

Factors hampering innovative activities have been calculated as average of following ratings: 3=high significance, 2=medium significance, 1=low significance, 0=insignificant	*Timber sector*		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Excessive economic risk	0.88	-	0.97	-
High innovation costs	1.38	1.40	1.36	1.10
Lack of finance sources	1.67	-	1.48	-
Lack of funds – enterprise	-	1.70	-	1.45
Lack of funds – outside	-	1.09	-	0.92
Organisational rigidity	0.54	-	0.50	-
Lack of competent personal	1.28	1.54	0.91	1.24
Absence of information on technology	0.99	1.00	0.73	0.78
Absence of information on market	1.02	0.92	0.78	0.77
Difficulty in finding cooperation partners	-	0.78	-	0.69
Markets dominated by established firms	-	0.98	-	1.00
Insufficient flexibility of legislation	0.66	-	0.63	-
Uncertain demand	0.98	0.62	0.95	0.87
Lack of necessity because of existence of previous innovations	-	0.54	-	0.91

In the long run, process innovations will continue in the timber sector enterprises, which are related to more efficient technologies both material- and labour-wise, as well as the improvement of management and services processes. The increasing significance of product innovations in the future can also be foreseen with innovation-related information from consumers obtaining increasing importance. The emphasis in the sub-sectors moves towards energy (bioenergetics) in the more remote future, but regarding the value chain the production enterprises will primarily move closer to the consumer and will partly adopt the role of mediators.

4.1.2 Innovation in Estonian electronic industry

Contemporary electronics industry is one of the most globalised and rapidly developing economic sectors. Due to various factors such as the advantageous geographical location, the standards of exact sciences and general economic development, Estonia is participating in the global sharing of labour of electronics industry.

Estonia houses the production units of international firms, local electronics enterprises as well as development units of international companies. To illustrate, out of the world's fifty largest providers of electronics manufacturing service (EMS) three have production facilities in Estonia: Elcoteq Tallinn, Enics and Scanfil. Among the development units, the Elcoteq Tallinn engineering centre and National Semiconductor Estonia may be mentioned. Besides the electronics industry enterprises, the closely related manufacturers of plastic products, metal industry enterprises, logistics firms and software developers are operating in Estonia. Since this is a global business, the innovations should be primarily characterised in the global context. The digital revolution and telecommunications boom of the recent decades have created a high demand for electronics products.

The organisation of work in electronics industry has a dual nature. This means that there is a need for a relatively large number of labourers performing simple operations, while a great need exists for engineers and extensive knowledge so as to create new products. There is a rather widespread trend of directing these two needs to different regions. In other words, the concept is separated from implementation.

Different countries have found different solutions to the problem. Japanese firms carry out the manufacturing of the top products in Japan. The production of less sophisticated products has been transferred to lower labour cost countries. The production of more sophisticated components line e.g. lenses, larger LCD panels ands some semiconductors also takes place in Japan. The production and final assembly of less complicated products, e.g. plastic details, takes place in China, Malaysia, Thai and Philippines. The US firms have largely transferred their manufacturing to low labour cost countries like Mexico and China. Development labs and research centres initially remained in the USA, but in recent years outsourcing of development services to the firms of other countries (Hong-Kong, Taiwan, India) has also began. The USA has retained predominantly management, crucial development units and marketing management.

The strategy of European firms is not as clear-cut. There are somewhat more similarities with the US firms. The relocation of production has taken place from Western Europe primarily to Eastern Europe and Asia. The fastest to transfer their production from Western to Eastern Europe were non-European large firms like Sony and LG. As for European large companies, a significant share of production has remained in Western Europe but extensive changes will apparently take place within this decade.

The relocation of production and technological development are also the two trends that have influenced Estonian electronics industry. The main partners and sources of influence of Estonian electronics industry are large Nordic corporations like ABB, Nokia, Ericsson and the Swedish car manufacturers.

The relocation and development of production in Estonia has been gradual, as the confidence and market have increased. Hereby an example is the Swedish-Swiss firm ABB that began operating in Estonia in 1991. A sales unit was established first for marketing its products and providing services to large clients. The need to produce according to the demands of the clients and do it rapidly led to the establishment of an electric distribution equipment plant. The enterprise was established initially as a joint venture, but ABB later acquired 100% of ownership. A major step was made in 2003 as a wind generator plant was established. Step-by-step development cannot be viewed only by major steps like the establishment of various plants, but also at the level of various processes like the transfer of purchase and development activities to the Estonian-located units.

Innovativeness of electronics industry enterprises has increased equally to the average growth of manufacturing industry. While according to the 1998–2000 survey, there were 51% of innovative enterprises in electronics industry, the present survey shows an increase to 60%. When observing the ratio of innovation expenses to net sales turnover of innovative enterprises in the various sub-sectors of electronics industry, we notice that it is the highest among the electric machines and equipment manufacturers – 5.6%, most of it being spent on the purchase of machinery and equipment (5.1%) and 0.5% on in-house research and development. The ratio of innovation expenses to net sales turnover is significantly lower among office equipment and computer manufacturers – 0.9%, but out of this, 0.8 is spent on in-house R&D and 0.1% on the purchase of machinery and equipment. In electronics industry, the R&D expenses are prominent among the innovative manufacturers of radio, TV and communications equipment and devices, whose correspondent percentage of turnover was 2%, with most of it being spent on in-house R&D and less being spent on equipment (1.2%). As for the manufacturing of medical equipment, optical devices, precision instruments and timepieces the R&D expenses were equal to those on equipment – 0.7% of net sales turnover.

The most significant **result of innovative activities** in the electronics industry enterprises was the increase of production flexibility and (relative) decrease of labour costs (see Table 4.1.2.1). The decline of labour cost was primarily based on increased capital intensity of production.

Table 4.1.2.1 Results of innovative activities in electronics industry, 2002–2004 and 1998–2000

Innovative activities results have been calculated as average of following: ratings: 3=high effect, 2=medium effect, 1=low effect, 0=insignificant	*Electronic industry*		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Increased range on goods and services	1.50	1.19	1.88	1.54
Increased market or market share	1.50	1.44	1.73	1.72
Improved quality in goods and services	1.41	1.56	1.98	1.89
Improved production flexibility	1.48	1.71	1.57	1.59
Increased production capacity	1.45	-	1.55	-
Increased productivity	-	1.54	-	1.27
Reduced labour costs per produced unit	1.57	1.75	1.17	1.07
Reduced materials and energy per produced unit	1.45	1.58	1.05	0.72
Improved environmental impact or health and safety aspects	1.40	1.37	1.10	0.69
Met regulations and standards	1.12	1.07	1.18	1.17

Dependent on the nature of the enterprises and the markets, the innovations carried out in the enterprises differ. In the larger, mainly foreign-owned production enterprises, innovations are concentrated on process improvement[52] and increase of productivity. The process development is primarily expressed in the investments in new equipment, the accompanying training and the improvement of cooperation between the various units of the enterprises. Equipment suppliers are the most valuable cooperation partners of electronics industry.

The larger enterprises with more than 250 employees[53] carry out the largest part of innovation spending made in Estonia (Figure 4.1.2.1). Compared to 2000, these expenses increased in electronics industry more than twice in 2004. Due to the increasing labour cost in Estonia and its close neighbourhood, the main direction of investments concerns relative reduction of labour cost per production. Investments in equipment are primarily made for replacing operations previously made manually by automatic ones. Another major factor for investments is the coming in force of the EU Directive on the use of hazardous materials (RoHS) in summer 2006. Accordingly, the materials related to soldering process and partly the equipment had to be replaced.

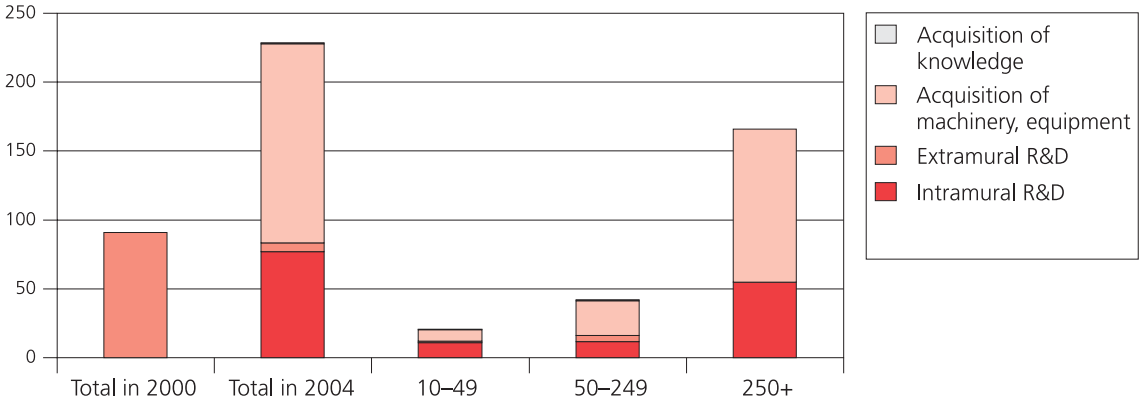

Figure 4.1.2.1 Volume of innovation expenses dependent on the size of enterprise in 2004, millions of EEK

Compared to the larger enterprises, smaller and medium-size enterprises invested proportionally more to the purchase of knowledge and outsourcing of development work.

[52] *High labour intensity is retained in order to use our labour cost advantage. This is hinted at by the low labour productivity of the present sphere. It was below the Estonian average in 2004 – close to furniture and textile industry. But the trend of improving capital and labour ratio exists according to experts and therefore a choice can be expected in near future – certain enterprises will no longer produce in Estonia and leave, while others will carry on with investments in equipment and wider process innovation.*

[53] *The sample of this survey included seven electronics industry enterprises with more than 250 employees.*

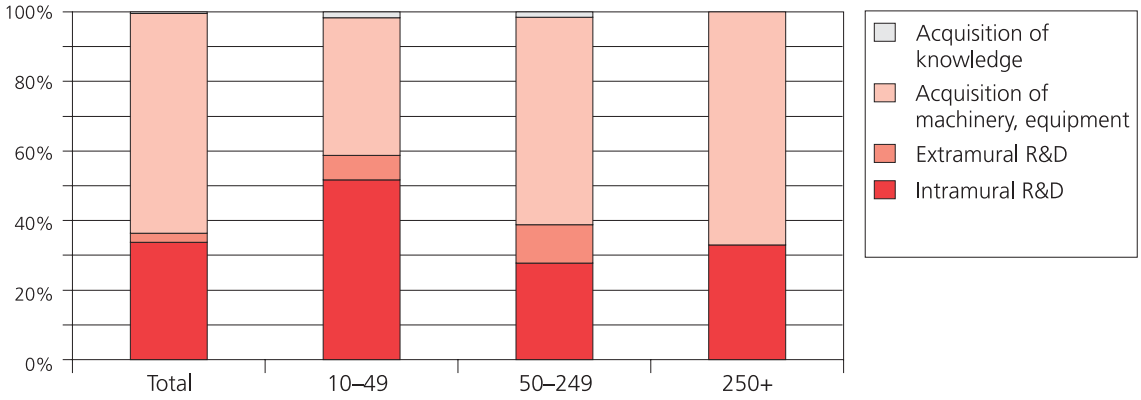

Figure 4.1.2.2 Breakdown of innovation expenses in electronics industry as to the size of enterprise (%), 2004

Electronics industry is largely characterised by its geographic concentration in Tallinn and its close environs, electronics industry also has a significant impact on regional development. Electronics industry has been the largest provider of new jobs in several regional centres. Labour released from light industry has found new employment in Pärnu, Sindi, Ida-Virumaa and Tallinn; former agricultural workers in Elva, Saaremaa and Koeru.

The most valuable **cooperation partners** for innovative electronics industry enterprises are the clients and consumers and the suppliers (useful cooperation with suppliers was emphasised especially by enterprises manufacturing medical equipment, optical devices, precision instruments and timepieces), but a large part of cooperation also takes place within the business group. An important channel of transfer of technological information is the movement of people between firms and various countries. New investments in operating firms and the entry of new electronics firms led to a movement of employees and especially managers in Estonia in the period 2002–2006. As a new trend we should point out the leaving of Estonian managers to foreign units of international concerns and the rotation of some employees back to Estonia. As for the **sources of information**, the primary impact belongs to in-house source, but also to the movement of information to Estonian-based enterprises via international firms (business groups) of the same owners. Compared to the previous survey, the use of information from the company's own staff and suppliers has largely increased within the four-year period. The use of information from clients has remained relatively the same or slightly increased. Using universities as a source of information is also gradually increasing.

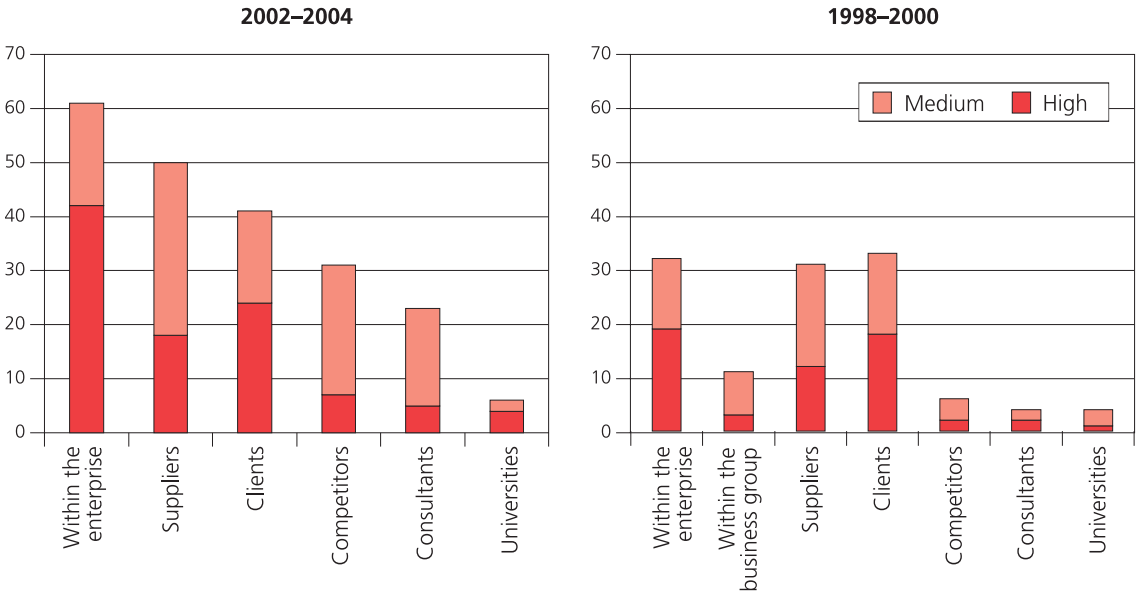

Figure 4.1.2.3 Significance of innovation information for electronics enterprises, % of enterprises, 2002–2004 and 1998–2000

Compared to other sectors of Estonian manufacturing industry the most significant **obstructive factor** in electronics industry is not the shortage or lack of capital, but the level of skills and information (see Table 4.1.2.2). Electronics industry is mostly owned by foreign capital and the acquisition of capital should not pose a problem. The expansion of production and widening of the range of products are primarily obstructed by the lack of information on market and technologies.

Table 4.1.2.2 Factors obstructing innovative activities in electronics industry, 2002–2004 and 1998–2000

Factors obstructing innovative activities calculated as average of following ratings: 3=high significance, 2=medium significance, 1=low significance, 0=insignificant	*Electronic industry*		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Excessive economic risk	1.08	-	0.97	-
High innovation costs	1.09	1.00	1.36	1.10
Lack of finance sources	0.94	-	1.48	-
Lack of funds – enterprise	-	0.90	-	1.45
Lack of funds – outside	-	0.77	-	0.92
Organisational rigidity	0.85	-	0.50	-
Lack of competent personal	1.16	1.16	0.91	1.24
Absence of information on technology	1.14	1.33	0.73	0.78
Absence of information on market	1.09	1.12	0.78	0.77
Difficulty in finding cooperation partners	-	0.90	-	0.69
Markets dominated by established firms	-	0.81	-	1.00
Insufficient flexibility of legislation	0.88	-	0.63	-
Uncertain demand	1.08	1.06	0.95	0.87
Lack of necessity due to previous innovations	-	0.91	-	0.91

To sum up: contemporary knowledge-based economy depends on knowledge and the combination of various technologies and knowledge. As examples we could mention the production of medical equipment resulting from the combination of electronics and medicine and also the so-called "intelligent home" based on the combination of real estate administration with information technology. In the information society a large number of products are created by combining different technologies. Estonian electronics industry has excellent chances of participating in the creation and development of new products thanks to the opportunity for combining high-technology production with excallent knowledge of biology, physics, music and other spheres. Therefore it is necessary to be as close as possible to the end market so as to know the consumer's wishes and preferences and to react to them in a flexible manner.

4.1.3 Innovation in Estonian food industry

Food industry is one of the most traditional and largest sectors of industry Estonia. As for technology intensity it is placed according to Eurostat classification among low-technology sectors. Food industry provides 18% of Estonian industrial output and employs nearly 15% of all labour employed in manufacturing industry. This sector of industry accounts for approximately three percent of Estonian GDP and five percent of overall export (Ministry of Agriculture 2005). Out of total volume of food industry, the dairy industry amounted to 28% in 2000, the meat industry 15.8%, fishery industry 15.3%, drinks production 21.5%, flour and grain products 0.7% and bread and bakery products 8.7%. Unlike several other sectors of industry, the developments in food industry have not been linear, but cyclical and involved large fluctuations.

The period after the restoration of independence in early 1990s was characterised by the emergence of various small enterprises like bakery and butchery shops. Due to the Russian crisis and heightened health standards, the concentration of industrial enterprises started as a counter-reaction in the second half of the 1990s. In the new century the food industry has been characterised by continued concentration and the taking over of several enterprises by foreign business groups.

Estonian food industry primarily meets the demand of the residents of Estonia. Approximately one quarter of the food industry output is exported. While at the beginning of independence Estonia was a food products net exporting country, since the beginning of the mid-1990s the foreign trade balance regarding foodstuffs has been negative. Food is primarily exported to neighbouring countries: Latvia, Russia, Finland and Lithuania. A remarkable share of export is provided by export by international enterprises to other countries in the same geographical region.

Most of the raw materials of food industry are supplied by Estonian agriculture and most of the output of the food products industry is sold to wholesale and retail trade. Both sectors have significantly influenced the food products industry between them. The greatest economic change in agriculture is the significant increase of agricultural subsidies from the state (the SAPARD programme was launched in 2001). Agriculture subsidies have certainly contributed to the increased profitability of the entire supply chain. The largest change in retail trade is the significant concentration of food trade to large distribution enterprises. This in turn has forced also the suppliers, i.e. the food industry to concentrate.

While compared to the previous survey, the selection of total manufacturing industry enterprises increased from 1,828 (2000) to 1,917 (2004), the number of food industry enterprises declined from 254 to 229. Together with the general economic development the share of innovative enterprises has increased. In the 1998–2000 innovation survey, the share of innovative enterprises of food industry was 48% and in the 2002–2004 survey 59%. In all surveyed manufacturing industry sectors the corresponding figures were 39% and 48%. Thus the share of innovative enterprises in food industry has increased proportionally compared to the average growth of innovativeness in all sectors of manufacturing industry. The ratio of innovation expenses to net sales turnover of innovative enterprises in the food industry in 2004 was 3.9%, with 3% being used in the purchase of machinery and equipment and the remainder mainly on in-house R&D (0.7% of net sales turnover).

The number of employees in the sector presents a declining tendency. While in 2000 the food industry enterprises (over 10 employees) employed 20,200 people, the corresponding figure in 2004 was 17,100. The number of employees is declining with mechanisation and the closing down of relatively labour-intensive fishery industry enterprises. Food industry has witnessed one of the fastest improvements of the capital-labour ratio; i.e. the capital supply to labour has rapidly increased. This has resulted in a rapid increase of labour productivity and several sub-sectors of the food industry are currently among the productivity leaders of Estonian industry.

Innovation expenses in food industry as well as overall manufacturing industry have increased significantly (see Table 4.1.3.1 last row). The largest and growing share of innovation expenses involved expenses made on the purchase of machinery and equipment. For comparison: in 2000 57% of innovation expenses in the industry (entire industry) of Finland were made on research and development activities and 18% on the purchase of equipment. In case of Estonia the high share of investments in machinery is primarily related to Estonian access to the EU. According to expert estimates the money was used above all on the most urgent investments and product development, thus leaving few resources for technologies innovation. Contemporary equipment is relatively reliable and an operating period lasting several decades is quite usual. Therefore the share of expenditures especially on product development should increase in the coming years.

Table 4.1.3.1 Breakdown of innovation activities expenses, 2000 and 2004 (%)

	Food industry		*All manufacturing industry*	
	2000	*2004*	*2000*	*2004*
Intramural R&D	8	18	12	14
Extramural R&D	3	1	3	2
Acquisition of machinery	61	79	60	82
Acquisition of external knowledge	2	2	1	2
Market introduction	15	-	4	-
Training	2	-	2	-
Preparation for production	5	-	15	-
All expenses (million EEK)	140	522	1182	2535

The increased competition in food industry forces the enterprises to offer a broader range of products in order to cover various market niches. The competition from import and the purchasing power of consumers have also increased compared with the period four years ago. A remarkable result of this is the increasing selection of goods and services. While the goods selection in several other economic sectors remained the same or even declined, according to the food industry entrepreneurs, it has more than doubled as **a result of innovative activities** (see Table 4.1.3.2). It may be stated that the competitiveness of the food industry enterprises has increased – the market share has increased and broadened, mostly on account of export. The number of enterprises has declined, but they are larger and offer a broader range of products. As for process innovation the reduction of energy and labour expenses per product unit should be pointed out.

Table 4.1.3.2 Effect of innovative activities, innovative enterprises (%), 2002–2004 and 1998–2000

	Food industry		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Increased range on goods and services	21	46	25	38
Increased market or market share	20	36	20	34
Improved quality in goods and services	29	36	29	36
Improved production flexibility	23	17	21	20
Increased productivity	-	22	-	27
Reduced labour costs per produced unit	8	14	10	18
Reduced materials and energy per produced unit	9	16	8	18
Improved environmental impact or health and safety aspects	6	9	8	13
Met regulations and standards	21	26	12	16

The **main cooperation partners** in food industry are the suppliers, relatively close cooperation is also carried out at the business group level, but also with the clients and competitors of the same sector. But the enterprises consider the former two the most valuable cooperation partners. The most valued **sources of information** for food industry enterprises were the suppliers of equipment and materials. Together with investment in equipment the firms received information and training on the handling and operation of the machines. New equipment often presumed the change of organisation of work and the training of workforce. Next as sources of information came the employees and clients of the enterprise. The use of other sources of information was lower. Various fairs could be mentioned, which perform the functions of presenting the firms as well as their products and obtaining new knowledge.

Table 4.1.3.3 Share of enterprises valuing highly the information source type, innovative enterprises (%), 2002–2004 and 1998–2000

	Food industry		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Enterprise	33	23	33	34
Business group	9		11	
Suppliers	28	27	24	23
Clients	21	21	24	25
Competitors	12	6	9	10
Consultations firms	4	7	3	4
Universities	2	4	1	3
R&D institutions	0	2	0	1
Conferences, fairs, exhibitions	12	16	15	15
Journals		9		7
Professional and industrial associations		2	-	2

Traditionally, the greatest obstructing factors to innovation are the financial problems (see Table 4.1.3.4). Compared to other industrial sectors the strong competition of enterprises already established in the market could be mentioned. The shortage of qualified staff has significantly increased, which primarily hints at the need for advanced training and the development of more efficient training systems.

Table 4.1.3.4 Share of factors obstructing innovative activities for enterprises (%), 2002–2004 and 1998–2000

	Food industry		*All manufacturing industry*	
	1998–2000	*2002–2004*	*1998–2000*	*2002–2004*
Excessive economic risk	9		11	
Lack of funds – enterprise	39	39	32	30
Lack of funds – outside		22		20
High innovation costs	28	27	25	20
Lack of competent personal	10	17	11	20
Absence of information on technology	5	7	4	4
Absence of information on market	6	4	5	5
Difficulty in finding cooperation partners		6		8
Markets dominated by established firms		25		16
Uncertain demand		8		10
Lack of necessity due to previous innovations		11		17

As has been clearly shown by M. Porter[54], the development of an economic sector is usually significantly influenced by the related sectors. Investments in food industry have contributed to the development of the related sectors of the food cluster such as the packaging industry. Traditionally the food supply chain of the industrial age has been as follows: agriculture as the supplier of raw material, food industry as the processor of raw material and trade as the distribution network of food products. Significant changes have occurred above all in the distribution network, i.e. grocery stores. A significant concentration or forming of chains has taken place; on the other hand a large amount of additional ready-to-eat or semi-manufactured food products have appeared, which are produced in the stores, etc. The eating habits are also changing and for instance increasing attention is to organic food products. Food producers must consider all that while developing new products and innovating processes.

4.2 Innovation in Estonian services sector

For quite a long time already Estonian economy may be described as services-oriented. The services sector is growing throughout Europe and thus marks the most characteristic feature of post-industrial economy. According to the Eurostat yearbook, 71% of the EU value added was created in the services sector in 2004, while the figure was below 40% as recently as in the 1970s.

The growth of the services sector in Estonia during the period of transition to market economy has been even faster and more significant in the increase of the state's competitiveness than in many developed nations of Western Europe. While the economic structure of Estonia in 1989 was dominated by industry and agriculture, the situation has completely changed within the last 10-15 years – as of now 66.3% of Estonian GDP is provided by the services sector (Table 4.2.1).

Table 4.2.1 Share of various sectors of Estonian economy of GDP in 1989, 1996, 2000 and 2004–2005 (%)

	1989	*1996*	*2000*	*2004*	*2005*	*1989 versus 2005*
Primary sector (agriculture, wood, fishery)	23.7	8.1	6.5	4.8	4.4	–19.3
Secondary sector (manufacturing industry, energy, construction)	46.3	25.0	25.5	28.9	29.3	–17.0
Tertiary sector (services sector)	30.0	66.9	68.0	66.3	66.3	+36.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**0.0**

Source: Statistics Estonia

[54] *For details see: Porter M. E. The Competitive Advantage of Nations. New York: Free Press, 1990.*

The significance of the services sector in the structure of economy increased rapidly especially during the economic transition period and its importance has stabilised by now. Industry has overcome the low point and its significance has started a moderate growth.

The services sector is important in Estonia as serving the home market, especially due to the local increasing purchasing power, as increasing export and thus improving the balance of payments. In the latter case the services related to tourism and transport are especially important.

The development of the services sector has been particularly strongly influenced by two changes. First, the development of information and communication technology (ICT), which has significantly changed the possible characteristics of services and their dependence on location (location of service provider) and time. ICT has opened opportunities for innovations in services and their providing. In case of electronic and cellular services there are few (or none) time and place limits, which grants a thoroughly new quality to these services. While the service provider used to possess the main knowledge of service and the user only some, the present situation with the movement from labour-intensive services to nearly zero labour-intensity services has resulted in the user of the services having to possess significantly greater knowledge as before.

Another important factor is the socio-economic changes in the society, which have brought to the market new services and also changed the ways of providing services. In this respect the changes such as the declining role of the state and the local government sector in providing a number of services, the increasing significance of the elderly population and movement towards the knowledge-intensive economy should be mentioned.

In order to improve the understanding of the services sector developments and innovations we shall briefly discuss what a service is and how services differ from material products. Services were viewed as significant means for boosting the new and existing enterprises' competitiveness already in the past decade, when also the separation of services units from industrial enterprises took place. At present the services sector has turned into the main engine propelling Estonian economy and this holds true regarding the longer perspective as well. Services are characterised by the following: first and foremost services are processes; secondly: services are produced and consumed simultaneously (at least in a majority of cases); thirdly: the consumers participate in the process of providing service; fourthly: the services are characteristically based on relations; fifthly: consumers perceive services primarily as immaterial processes (Grönroos 2001).

Innovative activity in services has clearly intensified in the years 2002–2004 as compared to the previous period (1998–2000) and **51% of services enterprises in the survey sample may be considered innovative** (see table 4.2.1).

Table 4.2.2 Share of innovative enterprises in services sub-sectors (%), 2002–2004 and 1998–2000

	1998–2000 *Share, %*	*2002–2004* *Share, %*	*Change of share*
Services	**32**	**51**	**+19**
Wholesale trade and commission trade	34	63	+29
Land transport	16	26	+11
Water transport	31	56	+26
Air transport	50	29	
Supporting and auxiliary transport activities; travel agencies	28	39	+12
Post and telecommunications	69	63	-6
Financial intermediation, except insurance and pension funding	46	69	+23
Insurance and pension funding, except compulsory social security	73	92	+19
Activities auxiliary to financial intermediation	36	70	+34
Computer and related activities	66	73	+8
Architectural and engineering activities	35	42	+8
Technical testing and analysis	32	41	+10

The importance of innovating enterprises has increased in all areas of services, with the exception of post and telecommunication, but this sector was leading already in the previous period as to the share of innovative enterprises. The number of innovative enterprises has been growing the fastest in wholesale and mediation trade and financial mediation auxiliary activities. Since a clear majority of services enterprises work for the domestic market, it may be presumed that the increase of innovation intensity has been caused by the increasing competition for the domestic consumer with growing purchasing power. Another factor forcing the services firms to more intensive innovation activities is the decline of cheap labour resource (exhaustion of advantage of low labour cost).

Two parallel and apparently related processes have continued: the increase of size of the services enterprises and the increasing interest of foreign investors in the Estonian services market. The share of enterprises with foreign owners in services-related innovation activities is remarkable. These enterprises are as a rule more innovative than the local ones. Innovativeness, however, does not increase in proportion with the growth of foreign share. Enterprises with less than 50-percent foreign ownership were 14.7 percentage points and fully foreign-owned firms 8.4 percentage points more active in innovation than local enterprises. The most innovative were the enterprises with domestic and foreign ownership being balanced. Thus in case of 50-99.9% of foreign ownership innovativeness was 21.5 percent higher than that of fully domestic-owned enterprises. At the same time the small domestic ownership-based computer firms have been more innovative in the Estonian market than firms with foreign share.

While in services on the average the most important **results of innovative activity** were the increase of range of products, the improvement of their quality and the increase of market share[55], as for the other results of innovation activity in innovative services enterprises, the increased flexibility in providing services is considered especially important by post and telecom enterprises, as well as inductance and pension funds. The increase of productivity in providing services was primarily emphasised by transport-related and auxiliary enterprises (incl. travel agencies). The latter also emphasised above average (as result of innovative activities) the reduction of cost of labour per product unit. The electric energy, gas, steam and hot water supply enterprises responded to a greater degree compared to other services enterprises that innovative activities reduced environmental impact and/or improved working conditions and safety, which was the most important outcome for that sub-sector. Another expected outcome was that these enterprises pointed out the reduction of material and/or energy cost per product unit. The most important result for innovative insurance and financial mediation enterprises was the improvement of conforming to the requirements of legal acts.

The main **cooperation partners** for services enterprises are the clients and suppliers of equipment as well as other enterprises of the business group. Cooperation at the business group level is especially emphasised by auxiliary activities of financial mediation. Innovative energy and water supply enterprises value above other sub-sectors their cooperation with suppliers, whereas computer service firms cooperation with their clients. Cooperation with other partners may be considered relatively marginal as to the sub-sectors. While in the services sector on the average the most important **source of information** relied on in innovation activities, was in-house and concern-level information, it was especially emphasised by post, telecom and financial mediation enterprises. The post and telecom enterprises also considered above other sub-sectors the competitors and other enterprises of the same sector valuable sources of information. On the other hand, mediation and wholesale enterprises valued more than others the information received from conferences, fairs and exhibitions. The logical outcome is that computer services firms received more information necessary for innovation from clients than the other sub-sectors.

While in the Estonian business in general (both industry and services) the **hampering factors** of innovative activity were primarily related to the finding of financing sources and skilled staff, the issue of shortage of in-house financing sources among individual sub-sectors of the services sector was primarily raised in innovative energy firms, while land transport enterprises saw the finding of external financing sources as the greatest problem. For the financial mediation and insurance sectors, the finding of financing sources is an insignificant obstacle; the primary problem is finding labour of necessary qualifications. Wholesale and mediation trade, as well as auxiliary activities of transport (incl. travel agencies) were seriously concerned with the domination of enterprises already established in the market. The post and telecom enterprises emphasised more than the others the uncertain demand for innovative products and services.

[55] *The same outcomes were also of primary importance for manufacturing industry.*

4.2.1 Innovation in transport sector

Contemporary transport and logistics is a sufficiently multi-layered sphere of activities with a complicated structure and its simple breakdown into maritime, land, air etc. transport and their separate analysis is not nearly sufficient for coping with tasks like the improvement of competitiveness or the study of innovation opportunities. As different "layers" of the sector we could specify the development and maintenance of infrastructure (ports, railways, etc.), transport based on that infrastructure, storage, loading, expediting (i.e. organisation and linking of transport without owning vehicles or infrastructure), various additional auxiliary services. The boundaries of the aforementioned sub-spheres are vague, for example the Estonian Railway Co. is involved in the administration and development of infrastructure as well as the organisation of transport together with other operators by using that infrastructure (which is not the best option from the viewpoint of fair competition). The extent of expediting by firms owning means of transport and carrying out haulage is different, while expediting firms can own storage facilities and provide storage services or not. Breakdown as to the types of transport (water transport, road transport etc.) does not work well in present times, since a large share of firms link different types of transport. Besides transport and storage, some firms may also be involved in trade, i.e. accept the price risk of goods passing through their terminals, while others refrain from this practice.

To sum up: essentially we are dealing with operating systems, "chains", "corridors" etc. linking up different firms, where the boundaries of spheres of activity of certain type of firms can change (an example from world logistics: shipping firms purchase goods terminals in ports in certain market situations and sell them again in others). There may be wide differences between the attitude towards innovation by firms focussing on various operations and serving as links of logistical chains and the type of innovations that are topical for them (e.g. for port developers innovations in hydraulic engineering technology, for port operators new types of cranes or fuel pumping methods, for road transport firms new trucks, for expeditors IT-systems). What is important is that the entire logistical chain could improve its competitiveness through innovation.

The methodology of the present survey breaks down the transport enterprises into those dealing with land, water and air transport (these types cover goods as well as passenger transport) and enterprises specialised in transport auxiliary services (this group also includes travel agencies). According to this classification the so-called sector transport enterprises groups include both the administrators and developers of infrastructure and transport operators. The enterprises listed as providing transport auxiliary services, however, form a highly heterogeneous group, which includes terminal and storage facility owners, various expeditors and firms specialised in narrower auxiliary services.

As to the number of enterprises the size of these groups varies greatly in Estonia. Numerically dominant are ground transport firms (according to Statistics Estonia data ~1,900 enterprises combining road and rail transport) and enterprises of transport-related auxiliary spheres (slightly less than 1,000 enterprises). The number of enterprises in both above groups has increased between the two surveys. The number of enterprises in the water and air transport sectors is marginal when compared to the above sectors, as the number of enterprises in these reaches ten to twenty rather than hundreds or thousands[56]. The size of enterprises also varies greatly, both regarding the aforementioned sectors (water and air transport are clearly spheres for large enterprises) and within the sectors (for instance, when comparing Estonian Railway Co. with a smaller road transport firm). Therefore it should be noted that the following survey results reflect above all the innovativeness and its individual aspects of the predominant mass of enterprises (but the smaller enterprises dominate here), but not the general innovativeness of the corresponding sub-sectors, where the larger leading enterprises clearly dominate. Since the number of large enterprises in the transport sub-sectors is very small, the separate analysis of the large enterprises' innovativeness is problematic.

When viewing the share of enterprises showing innovated (or having attempted it) products or processes, **the transport sector as a whole should be classified as a low-innovation one** (see Table 4.2.2.1). Most of all this applies to the ground transport sub-sector[57].

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[56] *Due to the small number of enterprises the figures for air transport have been omitted from the following tables.*

[57] *The international comparisons of the CIS survey usually treat the transport sector together with several other sectors of the services sector, therefore it is difficult to provide an international comparison here. According to published materials on individual countries we can argue, however, that transport tends to lag behind in innovation in other countries as well. Yet this should not console us, since Estonia is linked to very serious international business via its transport and logistics sector. The servicing of transit makes this sector more important to us than most other countries and without its high innovativeness it would be hard to rely on retaining our positions in international competition.*

Table 4.2.1.1 Share of innovative enterprises in transport sub-sectors (%), 2002–2004 and 1998–2000

	1998–2000	*2002–2004*
Land transport	15.8	26.4
Supporting and auxiliary transport activities; activities of travel agencies	27.7	38.8
All services sector	**32.4**	**50.7**

Although the number of enterprises having introduced innovations (and attempted it) has increased, the innovation position of transport has not improved, at least when using Estonian services sector as a whole for background. Innovativeness has increased at a faster rate in other sectors of services. The survey results show a leap in the innovativeness of water transport enterprises, but since the number of enterprises participating in the survey was rather small in that sub-sector, the result need not be entirely credible statistically. Transport auxiliary services enterprises have been more innovative than ground transport enterprises concentrating on haulage and infrastructure.

The authors of the present publication believe that at least regarding the group of enterprises engaged in services to transport (logistics and expediting firms, terminals etc.) the actual situation with the technological and innovation level of services spheres is somewhat better than shown by the present survey. As we already explained, this sphere deals with relatively complicated, highly technological and constantly changing and developing systems of activities, where the respondents to questionnaires find it comparatively difficult to decide what in particular should be considered innovation[58]. It is often difficult to single out a clearly definable innovation like a new product or even a clearly new service. The firms concentrate on moving the cargo from point A to point B, while optimising speed and cost and doing it within broadly the same type of activities as performed by other logistics enterprises and the way it has been done before. Yet a closer analysis shows that the operating schemes and means in this activity are developing and changing. For instance, we could mention various innovative solutions in the ICT sphere, which support the providing of services, work planning systems, so-called niche services provided to clients, new warehousing technologies etc.

The need for such innovations often emerges during transition to new types of goods or new markets (e.g. the increasing important of transport related to China for some firms). Participation in international transport systems (a large share of Estonian transport auxiliary activities firms and actual carriers participate in them) requires, besides the increasingly complicated information processing and usage systems, the introduction and development of various sensors and monitoring systems, which mean innovation in the spheres of electronics and instrument manufacture. The above certainly does not imply that everything in the Estonian transport sector innovation is in perfect order, but points out that moving on from already quite a high technological and organisational level could require somewhat more complicated innovations than the results of the survey would show.

Regarding the ratio of innovation expenditures to net sales turnover of innovative enterprises, the corresponding indicator of land transport was 3.3%, most of which (3.1%) was used on the purchase of machinery and equipment as well as soft- and hardware, while the rest was mainly spent on in-house R&D. Innovation expenses per turnover were significantly lower in the transport-related auxiliary activities and travel agencies, altogether 0.9%. Out of this amount, 0.7% was used on purchasing machinery and equipment, while the rest was used to commission outside R&D activities and to train staff.

We shall now discuss the benefits of the innovative enterprises from their activities. In case of transport auxiliary services and ground transport enterprises, the enterprises consider **the most significant outcomes** of innovative activity to be the increase of market share and improvement of quality. In case of ground transport the increase of range of services is a somewhat less important outcome than in the other sub-sectors, the more significant ones include in this case, besides the above, the increase of flexibility and productivity. Water transport enterprises are characterised by unequivocally strong position of goods and services range in the spectrum of outcomes, seconded by market share and flexibility.

Compared to the services sector average we should point out the relatively high position of productivity increase for ground transport enterprises and transport services providers and the high position of reducing labour costs in most of the sub-sectors. This reflects the competitive pressure typical of mass services.

[58] *This claim is based on interviews carried out by EIFS in transport and logistics enterprises within several research programmes.*

Table 4.2.1.2 Innovative activities outcomes (high impact of activity) in transport sub-sectors, innovative enterprises (%), 2004

	Land transport	*Supporting and auxiliary transport activities; activities of travel agencies*	*All services sector*
Increased range on goods and services	22.1	28.3	34.8
Increased market or market share	26.3	32.4	33.9
Improved quality in goods and services	26.2	32.8	33.3
Improved flexibility	26	20.3	26.2
Increased productivity	25.4	25.6	19.6
Reduced labour costs per produced unit	16.9	24.3	12.9
Reduced materials and energy per produced unit	17.7	6.1	6.8
Improved environmental impact or health and safety aspects	13.6	5.9	4.8
Met regulations and standards	23.2	21.3	15.9

The most important **cooperation partners** for the transport sector enterprises are the clients and consumers (especially in case of travel agencies) and suppliers, who are especially vital for land transport enterprises. Most of the **information** necessary for innovation activities is also received from the significant cooperation partners: clients, consumers and suppliers. Necessary information is also received via in-house sources of the enterprise or business group.

It is apparent in case of land transport enterprises that although suppliers are the most valuable cooperation partners in the sub-sector, clients and consumers (26%) are more important sources of innovative information than suppliers. Scientific and consultation information is very rarely used in that sector, but the transport auxiliary services and travel agencies value quite highly innovation information received from public sector research institutions.

Table 4.2.1.3 Significance of information source rated highly, innovative enterprises (%), 2002–2004

	Land transport	*Supporting and auxiliary transport activities; activities of travel agencies*	*All services sector*
Within enterprise or business group	21.4	35.8	34.6
Suppliers	10.9	18.1	21.5
Customers	26.3	29.6	26.9
Competitors	12.4	10.3	12.7
Consultation firms	0	6.1	3.1
Universities	1.1	1.4	3.4
R&D institutions	0	10.8	1.4
Conferences, Fairs, exhibitions	0	3.9	12.5
Journals	0	2.6	3.4
Professional and industrial associations	0	2.6	2.4

Table 4.2.1.4 Significance of factor obstructing innovation rated as high, all enterprises (%), 2002–2004

	Land transport	*Supporting and auxiliary transport activities; activities of travel agencies*	*All services sector*
Lack of funds – enterprise	23.8	18.6	21.4
Lack of funds – outside	23.3	16.1	16
High innovation costs	19.5	16.8	17.7
Lack of competent personal	19.3	8.9	16.9
Absence of information on technology	6.6	6	3.5
Absence of information on market	2.9	5.4	2.6
Difficulty in finding cooperation partners	7.6	10.3	5.5
Markets dominated by established firms	14.7	16.2	15
Uncertain demand	10.8	14.8	9.3
Lack of necessity due to previous innovations	13	10.5	12.2

Similarly to other services enterprises, the **innovation barriers** lists specified by transport enterprises are characterised by references to the shortage of sources of financing or lack of demand for innovations and the low position of absence of technological information in the rating of innovation barriers. Shortage of qualified staff has risen in the list of barriers, in transport as well as services in general.

4.2.2 Innovation in the ICT sector

Estonian ICT sector operates in conditions characterised primarily by rapid development of technology, strengthening competition and, especially recently, the increasing labour shortage. This sphere involves a constantly changing background system and therefore the same indicators for different time periods cannot be compared to each other. For instance, while the purchase of a computer was a highly innovative move for many enterprises only 10-15 years ago, by now we have reached the stage where households have two or even three computers and their absence is exception rather than rule.

Although information technology and telecommunication are global by nature, majority of Estonian ICT sector activities are directed to the domestic market. The activity of telecommunication firms is largely limited to the domestic market as the same concern's enterprises are already active in most of the neighbouring countries and competing with them would not be practical. There is a certain amount of intra-concern transactions, but these are as a rule considered domestic turnover, which cannot be considered export. The same applies to the subsidiaries and offices of international firms whose activities are limited to the domestic market.

Out of the IT sector turnover the share of export is approximately 10%, with a large share being software developers' subcontracts to neighbouring countries. At the same time the influence of Estonian IT firms on foreign markets is significantly higher than revealed by the turnover figures – Skype and Playtech are the best-known examples, but not the only ones. Yet the current export capability of the ICT sector cannot be considered satisfactory, in the longer perspective it should exceed the domestic market's volume. On the other hand, this development will cause tension in the labour market – with the Estonian IT firms starting to work more for the foreign markets, part of the domestic market demand would go unmet due to limited labour resources. Working for foreign markets would also increase the cost of local labour, increasing the need in the Estonian market for importing cheaper labour from Eastern Europe.

Unlike the previous survey, the present one permitted to single out ICT in industry and services. It should be considered that most of the enterprises (71%) are on the services side[59], out of which the greatest share (over 80 services sector ICT enterprises) were computer services firms. Computer services continue to stay among the highly innovative sectors (innovative enterprises 73%), largely thanks to the natural innovativeness of the ICT sector. However, the innovations dynamics among the telecommunication sphere enterprises shows some decline, since the percentage of innovative enterprises has fallen from 69 to 60. This is partly caused by the fact that the higher a sphere of activities has developed, the more critically it rates its own innovativeness – in this light the certain fall of the corresponding indicator of telecommunication firms is not surprising. On the other hand, very few enterprises are active in this sphere; therefore the large changes are not surprising. **The share of innovative enterprises of the entire ICT sector is 72%** (see Table 4.2.2.1).

[59] *This is also the reason why this sub-item was placed under the services sector. Computer services firms and telecommunication are also emphasised in this sub-item.*

Table 4.2.2.1 Share of innovative enterprises in ICT sector (%), 2002–2004 and 1998–2000

	1998–2000	*2002–2004*
ICT in services	-	70.5
Incl.		
Telecommunication	68.9	59.5
Computer and related activities	65.7	73.4
ICT in industries[60]	-	76.2
All ICT sector (except wholesale)	-	72
All services sector	32	51

As for the **ratio of innovation expenditures to net sales turnover by innovative enterprises**, expenses both in case of industry and services amount to 2%, incl. 1.3% spent on R&D activities and the remainder on the purchase of equipment. The ratio of innovation expenditures to net sales turnover is especially high in case of computer services firms: as much as 8%. The expenses break down as follows: 5.4% are used for in-house R&D activities, 1.1% for extramural R&D, 1.4% on the purchase of equipment and 0.1 on the acquisition of information outside the enterprise. As a negative aspect it has to be admitted that according to experts the research and development activities largely consist of development work with a minimum share of research. In case of telecommunication the innovation expenditures per turnover amount to 0.9%, which is more or less equally divided between R&D activities and the purchase of equipment. The percentage seems low at first sight, compared to the computer services firms, but it should be noted that the turnover of telecom firms is significantly higher. On the other hand, we must also consider the fact that more serious investments were made in the telecom firms already years ago and until the next major technological leap relatively modest expenditures are sufficient for developing new services and extending the client base with the same infrastructure.

Obviously, innovation is of vital importance to enterprises in the struggle for market share and competitive advantages. The process was also sped up by the low in between, when the market volume did not increase, but many newcomers entered competition. A significant impact was made by the opening of the telecom market – although the newcomers have failed to redistribute the established market share to a significant degree, it forced the initially existing firms to much greater efforts. The most significant **results of innovative activities** in the innovative ICT enterprises were the increased range of goods and services, expansion of market or increase of market share and the improvement of quality. The latter was especially important for the ICT industrial enterprises, where the increase of productivity was also a rather significant outcome.

[60] *ICT in industry covers sub-sectors of manufacturing industry, which were partly already discussed in the electronics industry sub-chapter. Out of the sectors covered by electronics industry, the ones directly related to ICT have been singled out. These include: production of office equipment + manufacture of computers and other data processing devices + production of insulated wire and cable + production of valves, cathode ray tubes and other electronics components + production of radio and TV transmitters, wire telephone and telegraph equipment + production of radio and TV receivers, audio-video recording or playback equipment or other similar goods + production of measuring, control, testing, navigational and other equipment and devices, except production processes control equipment + manufacture of industrial production processes control devices.*

Table 4.2.2.2 Innovative activities outcomes (high impact of activity), innovative enterprises (%), 2002–2004

	ICT in services	*Telecommunication*	*Computer and related activities*	*ICT in industries*	*All ICT sector (except wholesale)*	*All services sector*
Increased range on goods and services	46.8	46.2	47	37.8	44.3	34.8
Increased market or market share	42.6	69.2	36.9	31.8	39.5	33.9
Improved quality in goods and services	39.9	48.7	38.1	45.4	41.5	33.3
Improved flexibility	23	28.2	21.9	23.8	23.2	26.2
Increased productivity	11.9	7.7	12.8	25	15.6	19.6
Reduced labour costs per produced unit	7.9	15.4	6.3	12.2	9.1	12.9
Reduced materials and energy per produced unit	4.2	0	5.1	3.4	4	6.8
Improved environmental impact or health and safety aspects	1.6	0	2	4.5	2.4	4.8
Met regulations and standards	20.2	26.9	18.8	3.4	15.4	15.9

As for the **cooperation ties** of innovative enterprises in the ICT sector, it should be pointed out that cooperation is slightly more active in the ICT services side. Cooperation at the business group level for the ICT industry and services enterprises is of equal significance. The ICT industrial enterprises value much more highly cooperation with suppliers while the services representatives value cooperation with clients. Cooperation with research institutions may be rated as still relatively weak, but it shows an improving trend, several enterprises (e.g. EMT AS) have begun closer cooperation with universities. The most important **information** for innovation, however, is received within the enterprise and business group – on the one hand, it is a sign of the firms' strength, but on the other hand it may reveal excessive self-confidence and distancing from the demands and requirements of the market.

Table 4.2.2.3 Significance of information source rated high, innovative enterprises (%), 2002–2004

	ICT in services	*Telecommunication*	*Computer and related activities*	*ICT in industries*	*All ICT sector (except wholesale)*	*All services sector*
Within enterprise or business group	56.5	67.9	54	54.7	56	34.6
Suppliers	15.1	7.7	16.6	32.9	20.2	21.5
Customers	39.1	11.5	44.9	35.1	37.9	26.9
Competitors	13.1	11.5	13.4	5.1	10.8	12.7
Consultation firms	0	0	0	9	2.6	3.1
Universities	2.1	0	2.6	4.5	2.8	3.4
R&D institutions	0	0	0	0	0	1.4
Conferences, Fairs, exhibitions	7.5	10.3	6.9	8.1	7.7	12.5
Journals	5.4	0	6.5	4.5	5.1	3.4
Professional and industrial associations	0	0	0	0	0	2.4

Among **obstructive factors** of innovative activities the shortage of qualified staff (especially acute in the ICT industry) has accompanied Estonian ICT sector for nearly 10 years and, considering the population statistics and market development, it will become the primary obstructive factor of development in the nearing years. The same problem will also increasingly haunt the sectors of economy using IT solutions, which lack ICT competence in the selection of solutions supporting economic activities, their integration with existing processes and infrastructure and in administration and development. Another peculiarity of ICT is revealed in the fact that the physical presence of human recourses does not always mean its usability – e.g. all programmers performing long-term orders for foreign market although staying in Estonia, are excluded for that period from the amount of resources available for the Estonian market. The same applies to the opposite example as well – a person

need not be present in Estonia while engaged in ICT-related development work for an Estonian firm, since the individual's physical location is of no importance in the existence of normal data link. The key for relieving the shortage of qualified specialists for Estonia could be found in the repositioning towards the creation of higher added value – if we could develop the competence of top level project management, business processes analysis and technology strategy in Estonia, it would be possible to outsource technical development functions to countries possessing the correspondent resources.

Table 4.2.2.4 Significance of factor obstructing innovation activities was rated as high, all enterprises (%), 2002–2004

	ICT in services	*Telecommunication*	*Computer and related activities*	*ICT in industries*	*All ICT sector (except wholesale)*	*All services sector*
Lack of funds – enterprise	21.8	16.8	23.2	14.1	19.7	21.4
Lack of funds – outside	18.4	28.2	15.8	3.4	14.3	16
High innovation costs	20.6	19.8	20.8	6.7	16.9	17.7
Lack of competent personal	16.7	11.5	18.1	31.5	20.7	16.9
Absence of information on technology	1.1	0	1.4	2.6	1.5	3.5
Absence of information on market	2.3	5.3	1.4	6.4	3.4	2.6
Difficulty in finding cooperation partners	5.3	18.3	1.9	9.6	6.5	5.5
Markets dominated by established firms	9.4	21.4	6.2	10.5	9.7	15
Uncertain demand	9	31.3	3.2	6	8.2	9.3
Lack of necessity due to previous innovations	13.9	24.4	11.1	2.9	10.9	12.2

In case of telecom firms the obstructive factor is the domination of enterprises, which have established themselves in the market. The domination of the old firms, especially in the telecom sector, is caused by a number of factors. On the one hand operating in the ICT sphere requires significant investments in technology and know-how, which makes it difficult for the newcomers to enter the market in a situation where the old operators have already largely met these costs. When viewed from the client's side the balancing of risks is also important – the new and smaller firms as a rule lack the sufficient "layer of fat", which would insure them against the consequences of delayed projects or failures. The negative aspect of the issue is again based on the fact that the established division of the market obstructs to a considerable degree the emergence of new ideas to the market. In case of telecom firms an important factor obstructing innovative activity is the uncertain demand. This is to some extent a marketing issue, since the client as a rule does not need innovation as such, but desires a simple and convenient service, alleviation of existing problems or solutions for improving his competitiveness. A large share of Estonian ICT firms supply to the market what they have in the products and services portfolio instead of what the client actually wants – often because the client himself has no clear idea of what he wants.

It may be stated, however, that the ICT sector is the one, which compared to other sectors is mainly leading its clients to where they would not think of going on their own. An increasing number of various services and solutions are moves to the Internet or a linked to mobile communications and the Estonian ICT sector is highly innovative in that respect. According to experts, however, future progress will be hampered by primarily the shortage of skilled labour and the limited cooperation of firms with research institutions.

4.2.3 Innovation in financial mediation and insurance sector

Financial mediation and insurance services are highly profitable and productive knowledge-intensive services. Financial mediation services are provided primarily by commercial banks, with two large banks in local terms – the Hansabank Group and SEB Eesti Ühispank – cover most of the financial mediation services market share and belong to two large Swedish banking groups (Swedpank and SEB). During the period under observation (2002–2004) the presence of strong foreign owners has helped to accelerate the introduction of innovations and the share of innovative enterprises of the financial mediation sector continues to be very high (69%). It should be noted in that respect that the presenting of percentage in this chapter is of relatively limited adequacy due to the small number of enterprises being studied (the survey sample included in the financial mediations sphere 15, in the insurance and pension funds sphere 12, and in the financial mediation auxiliary activities sphere 23 enterprises).

During 2004 there were the following insurance providers in Estonia: seven indemnity companies, five life insurance companies and insurance providers in the reinsurance sphere the Estonian Traffic Insurance Fund[61]. The sphere of insurance has also made very rapid progress in innovativeness. The access to the services of this sphere is one of the most important premises for the development of any country's economy (and therefore the changes on this sector have great importance to the entire economy). The sector is also important as a depository of a large number of securities[62]. The opening of the insurance market in 2004 brought to Estonia the first cross-border service providers and the first subsidiary. The opportunity of conducting insurance business throughout the European Union insurance market also provides a new challenge and enables the Estonian insurance companies to expand their circle of insurants[63].

The development of the insurance sector has been highly successful as to profitability during the period under observation. Thus the companies operating in the Estonian insurance market collected a total of 3.2 billion kroons worth of premiums in 2004 and their volume increased 20.4% as compared to 2003[64]. The innovativeness of the sector has developed equally to the above and the above 90% share of innovative enterprises makes this the most innovative sector of services in Estonia.

Table 4.2.3.1 Share of innovative enterprises in financial mediation and insurance sector (%), 2002–2004 and 1998–2000

	1998–2000	*2002–2004*
Financial intermediation, except insurance and pension funding	46	69.4
Insurance and pension funding, except compulsory social security	73.1	91.7
Activities auxiliary to financial intermediation	36.4	70.1
All services sector	32	51

Although the significance of innovative enterprises is high in the financial mediation and insurance sector, the same cannot be claimed about the ratio of innovation expenditures to net sales turnover. The innovative enterprises' ratio of innovation expenditures to net sales turnover in financial mediation in 2004 was 1.2% (= average figure for services), while the optimistic aspect is that most of it (1.1%) was spent in R&D activities. But the insurance and pension funds' ratio of innovation expenditures to net sales turnover was only 0.3%, of which most was, however, used on in-house R&D. The ratio of innovation expenditures to net sales turnover was above the medium indicator of services sector in auxiliary activities of financial mediation – 2%, with 0.5% amounting to expenses on in-house R&D, an equal amount on outside R&D, 0.8% on the purchase of necessary equipment, while the rest was spent on acquiring knowledge from outside the enterprise.

The implementation of new technologies has been accompanied by the introduction of new services to the market and renovation of older services. As an example we could mention the option of rapid payment, which enables to perform urgent payments within minutes. The period as a whole is characterised by extensive spreading of e-services and as many as 90% of banking services are accessible over the Internet. Similarly, Estonia has been one of the pioneers in the use of opportunities provided by mobile telephones – Eesti Ühispank and Hansabank in cooperation with the Banks Card Centre (Pankade Kaardikeskus) developed an option of payment for goods and services over mobile telephone. One of the generally visible technological innovations is the availability of automated cash deposit machines. While the automated teller machines (ATM) and payment machines were widespread even before, the spreading of automated cash deposit machines began during the period under observation.

The emergence of these and many other services[65] and spheres of activity[66], or their improvement towards greater user-friendliness, presumed organisational and technological innovation in the enterprises of this sphere. However, the enterprises of this sphere no longer consider the expansion of the range of services and the improvement of their quality the most important results of innovation activities (these outcomes won the most votes in the 1998–2000 survey); instead, according to the estimate of the enterprises in the sector an increasing number of innovation activities have contributed to making the services more flexible. It was also pointed out that innovation activities have very significantly improved the activities complying with the legislation (see Table 4.2.3.2).

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61 *http://www.fi.ee/failid/Kindlustuse_aastaraamat_2004.pdf*

62 *http://lhv.delfi.ee/news/index.cfm?id=1040145&in_window=1*

63 *http://www.fi.ee/failid/Kindlustuse_aastaraamat_2004.pdf*

64 *http://www.salva.ee/downloader.php?fn=est.1.214.pdf#search=%22kindlustussektori%20%C3%BClevaade%22*

65 *E.g. the leasing and factoring activities were characterised by rapid growth. One of the important factors in the growth of leasing and factoring could be the improvement and development of technological solutions, which have turned leasing and factoring more convenient for the clients. The administration of the client's accounts is presently much simpler and the exchange of information takes place automatically.*

66 *E.g. the bank activities expanded with the administration of the pension funds, the II pillar (compulsory pension payments) pension funds were introduced and all major banks began handling them*

Table 4.2.3.2 Impact of innovation activities was rated as high, innovative enterprises 2002–2004 and 1998–2000 (%)

	Increased range on goods and services	*Increased market or market share*	*Improved quality in goods and services*	*Improved flexibility*	*Increased productivity*	*Reduced labour costs per produced unit*	*Reduced materials and energy per produced unit*	*Improved environmental impact or health and safety aspects*	*Met regulations and standards*
2002–2004									
Financial intermediation, except insurance and pension funding	20	16	24	32	16	24	0	12	52
Insurance and pension funding, except compulsory social security	31.8	31.8	18.2	36.4	9.1	9.1	0	0	40.9
Activities auxiliary to financial intermediation	32.4	47.8	39.2	30.7	15.3	15.3	8.5	8.5	40.9
All services sector	34.8	33.9	33.3	26.2	19.6	12.9	6.8	4.8	15.9
1998–2000									
Financial intermediation, except insurance and pension funding	39.1	13	60.9	26.1	34.8	34.8	34.8	8.7	21.8
Insurance and pension funding, except compulsory social security	47.3	36.7	42.1	31.5	0	21.1	10.5	0	10.5
Activities auxiliary to financial intermediation	29.1	0	19.4	19.4	19.4	38.9	19.4	0	19.4

Since a majority of the innovation expenses in the financial mediation and insurance sector are made on in-house research and development activities, it is logical that the most valuable **cooperation partners** are other enterprises of the same business group, while in-house or in-concern sources are considered the most important **information sources**. The previous survey reached the same conclusions. Compared to the previous survey, the significance of suppliers, as well as conference and trade journals as information sources has significantly declined.

Tabel 4.2.3.3 Significance of information source rated as high, innovative enterprises (%), 2002–2004

	Within enterprise or business group	*Suppliers*	*Customers*	*Competitors*	*Consultation firms*	*Universities*	*R&D institutions*	*Conferences, Fairs, exhibitions*	*Journals*	*Professional and industrial associations*
Financial intermediation, except insurance and pension funding	72	36	32	240	0	0	8	0	8	
Insurance and pension funding, except compulsory social security	59.1	0	18.2	18.2	9.1	0	0	0	0	9.1
Activities auxiliary to financial intermediation	39.2	0	8.5	298.5	0	8.5	6.8	0	0	
All services sector	34.6	21.5	26.9	12.7	3.1	3.4	1.4	12.5	3.4	2.4

When observing the **obstacles,** which have influenced the innovation projects of the financial mediation and insurance sectors, finding financing sources (especially outside sources) plays a significantly smaller role compared to the other sub-sectors. It is much more important how to find sufficiently qualified labour, which would be capable of developing something new and also implementing the ideas.

To sum it up, we may state that the financial and insurance sectors are very rapidly developing spheres in Estonia, especially regarding the development of e-solutions. Since most of the systems in use are built on new flexible technologies and the so-called old technologies have not obstructed development (e.g. the cheque system still used in many countries), several highly innovative solutions, even on the global scale, have been developed at

the end of the 1990s and the turn of the millennium and these have been developed further towards greater user-friendliness during the period under observation. Hopefully this development will continue and we shall succeed in selling the locally developed solutions elsewhere. The expectation for new solutions is also encouraged by the fact that the Estonian insurance market is still in the growth stage – according to experts, the Estonian insurance firms collect an average half of per capita premiums compared to other new EU member countries.

4.3 What characterises more innovative and less innovative sectors of economy

The following sub-chapter studies in detail the characteristics of those the sectors of economy whose enterprises have been significantly more active in innovation during the studied period, and those having achieved significantly worse results in this activity compared to others. The following does not characterise the sectors of average innovativeness, which of course does not imply their insignificance in Estonian economy or innovation policy. The premise is to concentrate on the extreme examples, which might point out more clearly the particular features of factors influencing innovation.

Table 4.3.1 Less innovative and very highly innovative sectors of economy (2002–2004)

Less innovative sectors of economy	*Share of innovative enterprises*
Clothes production	(26.4%)
Ground transport	(26.4%)
Electric energy, gas, steam and hot water supply	(27.2%)
Water supply, treatment and distribution	(34.2%)
Metal products, except machinery and equipment	(35.3%)
Examples of average innovative sectors of economy	
Furniture production	(50.5%)
Leather industry	(54%)
Motor vehicles, trailers and semi-trailers production	(54.4%)
Publishing, printing and records reproduction	(56.8%)
Highly innovative sectors of economy	
Medical equipment, optical devices, precision instruments and timepieces production	(67.2%)
Financial mediation, except insurance and pension funds	(69.4%)
Financial mediation auxiliary activities	(70.1%)
Radio, television- and communication equipment production	(72.2%)
Computers and related activities	(73.4%)
Chemicals and chemistry products production	(88.7%)
Insurance and pension funds, except compulsory social insurance	(91.7%)

When attempting to single out the sectors, which are especially notable compared to others for higher or lower innovativeness in terms of the present survey, a list of 5-6 sectors may be compiled on the positive and negative sides. The sectors of industry on the negative side are clothing and metal products manufacture**;** as to services, some sectors related to municipal services and transport. The positive side includes, chemical industry and some more "sophisticated" spheres of equipment and instruments production within manufacturing industry; computer-related activities and financial services within the sphere of services. It is typical of the innovative sectors listed in the table that at least 2/3 of the enterprises have implemented innovations (or at least attempted to do so) during the period under observation, while in case of the less innovative enterprises the percentage barely exceeds one third at best.

When comparing the lists of "active innovators" and "laggards" to the results of the previous survey, we notice the relative stability of both lists. The only significant differences are the auxiliary activities of financial mediation, which have risen from the average innovativeness level to that of highly innovative.

Is the higher innovation intensity related to activities in the export markets? In case of industry, the answer is "mostly yes". Yet this does not mean that all export sectors are rapid innovators. For example, this does not hold true in case of the largely subcontracts-based sewing industry, where the innovation activity clearly remains below average. The services sector concentrates to a great degree on the domestic sector, regardless whether or not the sector is innovative.

Let us first observe the differences between the less and highly innovative sectors as per innovative sub-activities.

Table 4.3.2 Innovative activities in less and highly innovative sectors, 2002–2004

	In-house R&D	*Constant in-house R&D*	*Extramural R&D*	*Machinery and equipment*	*Acquisition of knowledge*	*Training*	*Marketing*	*Preparatory activity*
Less innovative sectors of economy								
Clothes production								
Metal products except machinery and equipment								
Electric energy, gas, steam and hot water supply								
Water supply, treatment and distribution								
Ground transport								
Highly innovative sectors of economy								
Chemicals and chemistry products production								
Radio, television- and communication equipment production								
Medical equipment, optical devices, precision instruments and timepieces production								
Financial mediation, except insurance and pension funds								
Insurance and pension funds, except compulsory social insurance								
Financial mediation auxiliary activities								
Computers and related activities								

Highly common activities, above 50% of surveyed enterprises of the sector

Activities of medium frequency, 20–50% of surveyed enterprises of the sector

Less common activities, less than 20% of enterprises of the corresponding sector

First of all it is obvious that in case of the highly innovative sectors practically all innovative activities are practised significantly more frequently. Secondly, the group of very innovative sectors of economy is characterised by active in-house research and development activity.

The survey shows the close relation between innovation activities and the level of technology intensity. Based on technology intensiveness, the less innovative sectors are low or medium low technology and less knowledge-intensive sectors of economy (see classification in Chapter 3). Highly innovative sectors of economy are predominantly either high- or medium high technology production and knowledge-intensive services. Thus, although sectors classified as generally less technology-intensive can also contain high-technology production and vice versa: sometime slow-technology enterprises may be strong innovators, it is statistically true that high-technology/knowledge-intensive enterprises innovate their products, technologies and processes more frequently. It may be presumed that they are forced to it by the "dense" competitive environment and on the other hand by the opportunity to make great profit from innovation.

Is the high or low innovativeness of the sectors related to the placement of the corresponding sectors in the ranking of innovation expenditures (measures as innovation expenditures per net turnover) (see Appendices 2 and 3)? However, there is no clear relation[67], e.g. high innovation expenditures per turnover characterise innovative

[67] *The absence of relation was also proven by correlation analysis.*

computer-related activities, but also the water supply sector, which is placed in the least active group as to innovation. In the industrial sphere, timber and printing industries are notable for high innovation expenditures per kroon of turnover, but they belong to the medium intensity of innovation activity, although the innovation activity of timber industry has increased and may be viewed as a result of high innovation expenditures. The reason for the weak link between the innovation expenditures and innovation activities is apparently quite simple. The structure of the present innovation expenditures of Estonian enterprises is highly dominated by the cost of purchase of equipment. But the sectors with expensive equipment need not coincide with those forced to rapid innovation by market situation. Therefore, the remaining expenditures on innovation, including on R&D, are of considerable importance for the development of innovations.

It may be noted that in some very highly innovative sub-sectors like the manufacture of radio, TV and communication equipment and devices and computer-related activities the expenditures on R&D activities are higher than on the purchase of machinery. In case of manufacturers of medical equipment, optical devices and precision instruments, they are more or less equal to the expenses made on the purchase of equipment.

Table 4.3.3 Significance of information source rated high (%), 2002–2004

	Intra-enterprise or -concern	*Suppliers of equipment, materials, semi-processed goods and/or software*	*Clients and suppliers*	*Competitors and other enterprises from same sectors of economy*	*Consultation firms , commercial labs, private research institutions*	*Universities and colleges*	*Public sector research institutions*	*Conferences, fairs, exhibitions*	*Science journals, trade and technical publications*	*Trade and industry associations*
Less innovative sectors of economy										
Clothes production										
Metal products except machinery and equipment										
Electric energy, gas, steam and hot water supply										
Water supply, treatment and distribution										
Ground transport										
Highly innovative sectors of economy										
Chemicals and chemistry products production										
Radio, television- and communication equipment production										
Medical equipment, optical devices, precision instruments and timepieces production										
Financial mediation, except insurance and pension funds										
Insurance and pension funds, except compulsory social insurance										
Financial mediation auxiliary activities										
Computers and related activities										

Predominantly consider as important source of information (more than 50% of sector enterprises)

10–50% of sector enterprises consider as important source of information

Less than 10% of sector enterprises consider as important source of information

As for analysing the cooperation patterns of different sectors in innovation, a significant difference between the less innovative and highly innovative enterprises concerns their cooperation ties. Out of the less innovative sectors of economy only an average of 12% of enterprises had cooperation relations, while the indicator among very highly innovative sectors is 40%. As for the sources of information, both the highly innovative and less innovative sectors of economy rated the highest intra-enterprise or business group sources (even though the corresponding percentage differs by a magnitude). This is followed by clients and consumers. In case of the less innovative sectors the suppliers of equipment are of equal significance with the former sources. In case of the highly innovative sectors the suppliers and competitors could be considered slightly less significant compared with the others. There were no highly significant changes in the rating of the significance of information sources compared with the previous survey.

Table 4.3.4 Significance of factor obstructing innovation activity rated high (%), 2002–2004

	Sshortage of in-house financing sources	*Shortage of external financing sources*	*Too high innovation expenses*	*Shortage of qualified staff*	*Lack of technology-related information*	*Lack of information about market*	*Problems with finding cooperation partners for innovation*	*Domination of enterprises established in the market*	*Uncertain demand for innovative goods and services*	*No need due to earlier innovations*
Less innovative sectors of economy										
Clothes production										
Metal products except machinery and equipment										
Electric energy, gas, steam and hot water supply										
Water supply, treatment and distribution										
Ground transport										
Highly innovative sectors of economy										
Chemicals and chemistry products production										
Radio, television- and communication equipment production										
Medical equipment, optical devices, precision instruments and timepieces production										
Financial mediation, except insurance and pension funds										
Insurance and pension funds, except compulsory social insurance										
Financial mediation auxiliary activities										
Computers and related activities										

Over 50% of enterprises in the sector consider significant obstructive factor

20–50% of enterprises in the sector consider significant obstructive factor

Less than 20% of enterprises in the sector consider significant obstructive factor

Which are the results of innovation in various sectors? The most important results of innovation activity are related in the innovative sectors primarily to the improvement of quality, followed by market share and expansion of product range. The same choices prevail in the responses of less innovative sectors of economy. The only difference is that the expansion of the range of products and services was the most emphasised among the innovative sectors, followed equally by market expansion and improvement of quality. According to the previous survey, both the highly and less innovative sectors of economy considered the improvement of quality the most important outcome of innovation activity, followed by, in case of the less innovative, increased flexibility, and in case of highly innovative, the expansion of product range. As a general assessment we may point out that all ratings have significantly increased compared to the previous survey.

Some differences between the high and low innovativeness sectors may be noticed in the assessments of factors obstructing innovation.

Less innovative sectors of economy considered above all financing-related problems (the first three columns) the main factors obstructing innovation. Compared to the less innovative sectors, the innovative (with some exceptions) find financial problems much less serious obstacles. Shortage of qualified labour was pointed out relatively frequently.

To sum up we may say that the groups of low innovativeness and highly innovative enterprises have remained the same in the comparison of the previous and current surveys, while among the latter the indicators of innovativeness have significantly increased. In the less innovative sectors the growth of indicators remains below the average growth rate. The purchase of machinery and equipment is the most widespread innovation activity in the Estonian enterprises, despite their placement in the innovativeness scale. At the same time, the enterprises at the top of the scale are significantly more active in research and development.

5 Conclusions and recommendations

The survey results and the analysis provided above allow making both positive and negative conclusions. The general amount of innovations, which the enterprises have introduced in the 2002–2004 period, has increased in an encouraging manner. This is especially apparent in services. It is also positive that compared to the previous survey, small enterprises have started to implement innovation projects more actively. At the same time the radicalism and complexity of innovations still remains to be desired. There are relatively few innovations that would significantly change the production profile and technological level of enterprises, in other words, innovations that would ensure the survival of the enterprises in the future environment of higher cost and presuming higher level of sophistication. The significance of the sectors based on more sophisticated (high and so-called medium high) technologies in Estonian economy has practically not increased. This means that our economic development continues to depend on predominantly low and medium low technology sectors. One could argue that during the carrying out of the survey our economy was still clearly in the stage of investment-based development and in the best case was only approaching the stage of innovation-based stage of economic development. The innovation expenses of enterprises, especially made on R&D, are still low. The cooperation with universities and research institutions concerns only a very small share of enterprises etc.

Innovation in the enterprises is not sufficiently complex, it is still predominately limited to the purchase of new equipment (and the training of employees for operating it).

This is the background against which we have to judge Estonian innovation policy and find opportunities for its further development.

Estonian measures of innovation policy, both put to practice and being planned, overlap practically 100% with the measures used and considered perspective in the recent period's international (primarily EU) practice. The initial analyses of the implementation of the measures and their success have provided both positive and negative feedback. Aid programmes supporting innovation have taken off as intended, although some of them with delays. The analyses of the implementation of the programmes, which have been carried out so far, claim that the state funds allocated within the programmes have been directed to achieving the necessary goals. The ability of the enterprises to prepare well thought-out projects for applying for innovation support has significantly improved during the past 3-4 years, as well as the procedures of Enterprise Estonia in cooperation with enterprises for the processing and approval of the applications. Yet the number of beneficiaries from the programmes, although it has increased in time, has nevertheless remained unsatisfactory. At least so far there are no clear signs of clear and massive improvement of the innovation situation as a result of the innovation policy measures taken. In fact, it would be too early to expect it in case of some programmes. At present, in 2006, there are clearly no grounds for considering the continuation of some measures taken so far impractical. Lessons learned provide an opportunity to organise their future implementation in a more rational and better targeted manner. It would certainly be practical to revise critically the focuses of the present innovation policy, to determine how much they contribute to the ability of the enterprises to cope with more complex and competitive environment, and if necessary, to adjust these focuses. In addition to the checking of the proportions of the existing measures and their partial readjustment, the implementation of some completely new measures should be possible in the next few years.

In order to "tune" the innovation policy as a whole more efficiently, primarily the following ties and proportions should be critically reviewed:

- Connection between various policies, especially between research policy, education policy and innovation policy. This list could be continued by including regional policy, entrepreneurship policy, foreign investments involvement policy, possibly also the issues of implementing innovative solutions in the environment sphere (environmental technologies), agriculture and other special spheres;
- Relation between the so-called breakthrough directions linked to contemporary high technology and measures representing other sectors and having a potentially extensive circle of consumers;
- Relation between universal measures and innovation policy considering sectoral peculiarities;
- Relation between measures directed at supporting one consumer (enterprise or research institution) and measures aiming at the development and support of networks.

At present the research policy, education policy and innovation policy, despite the efforts made for their integration, still exist as separate fields of policy rather than a joint mechanism for increasing the knowledge-intensity of Estonian economy (and other social affairs). They are competing for resources rather than conducting planned cooperation, hence the periodic fluctuation of the state financial support between different directions (the so-called "fluidity of focuses"), which undermines the consistency of policies and their implementation.

Therefore a mechanism should be created (TAN – Science Development Council – should play an important role in it), which could better coordinate the activities of the three aforementioned policies.

The general goal of Estonian innovation policy is not unequivocally high-tech-centred, but when reviewing which existing measures fit to which categories of enterprises, we find that the measures like the R&D projects financing programme and Spinno are rather "slanted" towards the new high technology sectors. The same may be claimed regarding the recently launched Competence Centres programme and the planned Development Fund's venture investments mechanism. The innovation awareness and innovation audit programme and some other measures cannot balance that slant. Apparently it would not be right to make a sharp turn towards low and medium low-technology sectors, even for the reason that the distribution of relatively small funds between a large number of enterprises need not have any effect. Yet we should consider reducing this disproportion, both by better orientation of the existing measures to the needs of the so-called regular enterprises and by the development of some new measure, which would consider primarily the needs of low and medium low-technology sector enterprises. It could be, e.g., the strengthening of the technology experts in most widespread traditional local sectors that also possess development potential (for example, the forestry and timber complex).

One prospective direction is the implementation of high technology in certain sectors of the traditional production sectors.

Estonian innovation policy measures have so far been so-called universal, i.e. the ones, which should be applicable in all sectors. At the same time the need for state programmes has been declared (programmes oriented to the establishment of certain concrete sectors or clusters) and debates have taken place on the need for so-called industry policy (i.e. specific packets for supporting individual sectors). The issue of whether the sectoral element should or should not be strengthened in the Estonian innovation policy (or economic policy in the broader sense) needs to be debated in the near future. For example Finland has quite extensive experience with such programmes; within these it would be possible to create successful links between activities at the national and international levels.

The final issue concerns whether the goal should be an innovation policy reaching directly (via some types of supports) as many enterprises as possible or whether the state should rather support networks of enterprises or enterprises and research institutions. In the Estonian innovation policy the Competence Centres Programme and Spinno Programme are by their nature network-oriented measures, but it would be necessary to think over whether the support of networks (incl. networks of enterprises) should be considered a higher priority than previously or not.

Proceeding from the results of this survey and outcomes of several discussions with policies development experts, the following proposals can be advanced:

- Since the basic contradiction in the present stage can be seen in the insufficient integration of the three policies: the research, education and innovation policy, this issue should be analysed. Solutions should be found at the government level and orientation to at least the following problems:
  - how to link the interests of the universities better to meeting Estonian labour market needs, especially regarding high-technology and medium-high-technology sectors;
  - how to combine more efficiently the innovation-related interests of the business and research circles (of course, this presumes a broader discussion involving all parties, but the government should perform the mediator role in that process);
  - how to link better the infrastructure investments of research institutions to the innovation and education inputs of universities;
  - how to make the Science Development Council operate productively;
  - to detail the issue of state programmes and in case of necessity their implementation.

- To launch a special direction of activities: development of cooperation with parent firms of high-technology production in order to increase value added and/or attract new transnationals, whose activity could help the Estonian economy to significantly increase its value added (connection to the foreign investments attraction policy);
- To extend the innovation awareness programme, linking it on the one hand to the analysis of successful innovation cases, and on the other hand to the promotion of diagnostics and innovation management instruments suitable for enterprises;
- To approach the Spinno programme from the aspect of sustainability of the structures being created and activities being launched, to develop the basics for the next stage of continuing the programme. The principle on the next stage should be the ensuring of an actually working system of knowledge transfer and cooperation rather than allocating one-time (for a certain period) resources to universities for presenting their potential output, cooperation events with enterprises etc.

- To develop parallel measures for improving the ability of enterprises to communicate with research institutions (incl. supports for temporary or permanent employment of corresponding staff; also linked to the planned mobility programme). This measure is linked to the so-called mobility programme idea, which has already been discussed;
- Proceeding from the innovation potential of various potential beneficiaries and the opportunities of the Estonian innovation policy to define the target groups of innovation policy and accordingly the desirable extent of innovation policy;
- To create and launch as a separate programme a clusters development promotion programme (presuming that it would also concern cross-border cooperation clusters and services clusters);
- To expand the capacity of the so-called technology audit programme and to increase its flexibility, to provide different types of audits/diagnostics to different types of firms in different situations (e.g. preliminary diagnostics of less complicated technology transfer, diagnostics explaining the practicality of carrying out applied research in the firm, etc.).

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Appendix 1 | Share of innovators by activity field (%), 2004 and 2000

Field of activity	*2004*	*2000*
Mining of coal and lignite; extraction of peat	25.7	19.2
Other mining and quarrying	51.8	37.5
Manufacture of food products and beverages	58.6	48.8
Manufacture of textiles	50.1	28
Manufacture of wearing apparel; dressing and dyeing of fur	26.4	20.9
Tanning and dressing of leather	54	42.3
Manufacture of wood and of products of wood	41.5	31.4
Manufacture of paper and paper products; publishing	60.5	60
Publishing, printing and reproduction of recorded media	56.8	47.1
Manufacture of coke, refined petroleum products and nuclear fuel	100	33.3
Manufacture of chemicals and chemical products	88.7	72.4
Manufacture of rubber and plastics products	56.2	40.4
Manufacture of other non-metallic mineral products	63.3	35.7
Manufacture of basic metals	60	24.9
Manufacture of fabricated metal products, except machinery and equipment	35.3	33
Manufacture of machinery and equipment n.e.c.	52.2	47.9
Manufacture of office and computing machinery	100	40
Manufacture of electrical machinery and apparatus n.e.c.	56.2	29.7
Manufacture of radio, television and communication equipment and apparatus	72.2	64.6
Manufacture of medical, precision and optical instruments, watches and clocks	67.2	52.9
Manufacture of motor vehicles, trailers and semi-trailers	54.4	87.5
Manufacture of other transport equipment	48.5	40.8
Manufacture of furniture; manufacturing n.e.c.	50.5	46
Recycling	45.8	100
Electricity, gas, steam and hot water supply	27.2	24.6
Collection, purification and distribution of water	34.2	31.7
Wholesale trade and commission trade	62.9	34.4
Land transport; transport via pipelines	26.4	15.8
Water transport	55.6	30.8
Air transport	28.6	50.1
Supporting and auxiliary transport activities; activities of travel agencies	38.8	27.7
Post and telecommunications	63	69.2
Financial intermediation, except insurance and pension funding	69.4	46
Insurance and pension funding, except compulsory social security	91.7	73.1
Activities auxiliary to financial intermediation	70.1	36.4
Computer and related activities	73.4	65.7
Architectural and engineering activities	41.3	34.8
Technical testing and analysis	44	31.7

Appendix 2 | Ratio of innovation expenses of innovative enterprises to net sales turnover (%), 2004

	Intramural R&D	*Extramural R&D*	*Acquisition of machinery*	*Acquisition of external knowledge*	*Sum per four types*
ALL ENTERPRISES	0.5	0.1	1.8	0.1	2.4
Manufacturing	**0.6**	**0.1**	**3.6**	**0.1**	**4.4**
Mining of coal and lignite; extraction of peat	0.5	0.1	2.8	0	3.4
Other mining and quarrying	0.7	0	9.5	0.1	10.3
Manufacture of food products and beverages	0.7	0	3	0.1	3.9
Manufacture of textiles	0.3	0.3	2.8	0.4	3.8
Manufacture of wearing apparel; dressing and dyeing of fur	0.3	0	2	0	2.2
Tanning and dressing of leather	0	0	1	0	1.1
Manufacture of wood and of products of wood	0.5	0.2	8.7	0.2	9.6
Manufacture of paper and paper products; publishing	0.1	0.3	2.2	0	2.7
Publishing, printing and reproduction of recorded media	0.6	0.2	9.1	0.1	10
Manufacture of coke, refined petroleum products and nuclear fuel	0	0.1	3.9	0.1	4.1
Manufacture of chemicals and chemical products	0.7	0	2.3	0.1	3.2
Manufacture of rubber and plastics products	0.2	0.1	3.2	0	3.5
Manufacture of other non-metallic mineral products	0.2	0.2	3.2	0	3.6
Manufacture of basic metals	0	0	1.8	0	1.8
Manufacture of fabricated metal products, except machinery and equipment	0.7	0.1	2.3	0	3.1
Manufacture of machinery and equipment n.e.c.	0.7	0.2	1.2	0	2.1
Manufacture of office and computing machinery	0.8	0	0.1	0	0.9
Manufacture of electrical machinery and apparatus n.e.c.	0.5	0	5.1	0	5.6
Manufacture of radio, television and communication equipment and apparatus	1.9	0.1	1.2	0	3.2
Manufacture of medical, precision and optical instruments, watches and clocks	0.6	0.1	0.7	0	1.4
Manufacture of motor vehicles, trailers and semi-trailers	1.8	0.1	0.8	0	2.7
Manufacture of other transport equipment	0.5	0	1.9	0	2.4
Manufacture of furniture; manufacturing n.e.c.	0.2	0	2.7	0	2.9
Recycling	0.3	0.1	7.8	0	8.1
Services	**0.5**	**0.1**	**0.6**	**0.1**	**1.2**
Electricity, gas, steam and hot water supply	0.1	0.1	1.4	0	1.6
Collection, purification and distribution of water	0	0	4.4	0.1	4.5
Wholesale trade and commission trade	0.1	0.1	0.4	0.1	0.6
Land transport; transport via pipelines	0.1	0	3.1	0	3.3
Water transport	2.4	0	1	0	3.5
Air transport	0	0	42.5	0	42.5
Supporting and auxiliary transport activities; activities of travel agencies	0	0.1	0.7	0.1	0.9
Post and telecommunications	0.3	0.1	0.7	0	1

Appendix 2. Ratio of innovation expenses of innovative enterprises to net sales turnover (%), 2004

Financial intermediation, except insurance and pension funding	0.9	0.2	0.1	0.1	1.2
Insurance and pension funding, except compulsory social security	0.2	0.1	0.1	0	0.3
Activities auxiliary to financial intermediation	0.5	0.5	0.8	0.2	2
Computer and related activities	5.4	1.1	1.4	0.1	8
Architectural and engineering activities	2.7	0.6	2	0.1	5.3
Technical testing and analysis	3.3	0	3.2	0.4	6.9

Appendix 3 | Ratio of innovation expenditures to net sales turnover, all enterprises (%), 2004

	Intramural R&D	*Extramural R&D*	*Acquisition of machinery*	*Acquisition of external knowledge*	*Sum per four types*
ALL ENTERPRISES	0.3	0.1	1.2	0	1.6
Manufacturing	**0.4**	**0.1**	**2.6**	**0.1**	**3.1**
Mining of coal and lignite; extraction of peat	0.3	0.1	1.4	0	1.7
Other mining and quarrying	0.3	0	3.7	0	4
Manufacture of food products and beverages	0.6	0	2.6	0.1	3.3
Manufacture of textiles	0.1	0.2	1.4	0.2	1.9
Manufacture of wearing apparel; dressing and dyeing of fur	0.1	0	0.9	0	1.1
Tanning and dressing of leather	0	0	0.6	0	0.7
Manufacture of wood and of products of wood	0.3	0.1	5.2	0.1	5.7
Manufacture of paper and paper products; publishing	0	0.1	0.4	0	0.5
Publishing, printing and reproduction of recorded media	0.4	0.1	5.5	0	6.1
Manufacture of coke, refined petroleum products and nuclear fuel	0	0.1	3.9	0.1	4.1
Manufacture of chemicals and chemical products	0.7	0	2.3	0.1	3.1
Manufacture of rubber and plastics products	0.1	0.1	2.2	0	2.4
Manufacture of other non-metallic mineral products	0.2	0.2	2.9	0	3.3
Manufacture of basic metals	0	0	1.7	0	1.7
Manufacture of fabricated metal products, except machinery and equipment	0.3	0	1.1	0	1.5
Manufacture of machinery and equipment n.e.c.	0.5	0.1	0.9	0	1.5
Manufacture of office and computing machinery	0.8	0	0.1	0	0.9
Manufacture of electrical machinery and apparatus n.e.c.	0.3	0	3.5	0	3.8
Manufacture of radio, television and communication equipment and apparatus	1.7	0.1	1.1	0	2.9
Manufacture of medical, precision and optical instruments, watches and clocks	0.5	0.1	0.6	0	1.2
Manufacture of motor vehicles, trailers and semi-trailers	1.5	0.1	0.7	0	2.2
Manufacture of other transport equipment	0.3	0	1.4	0	1.7
Manufacture of furniture; manufacturing n.e.c.	0.1	0	2	0	2.2
Recycling	0.1	0	2.1	0	2.2
Services	**0.3**	**0.1**	**0.4**	**0**	**0.7**
Electricity, gas, steam and hot water supply	0.1	0.1	1	0	1.1
Collection, purification and distribution of water	0	0	3.7	0.1	3.8
Wholesale trade and commission trade	0.1	0	0.2	0	0.3
Land transport; transport via pipelines	0	0	1.4	0	1.5
Water transport	2.2	0	0.9	0	3.1
Air transport	0	0	1.3	0	1.3
Supporting and auxiliary transport activities; activities of travel agencies	0	0	0.3	0	0.4
Post and telecommunications	0.3	0.1	0.6	0	1

Appendix 3. Ratio of innovation expenditures to net sales turnover, all enterprises (%), 2004

Financial intermediation, except insurance and pension funding	0.8	0.2	0.1	0.1	1.2
Insurance and pension funding, except compulsory social security	0.2	0.1	0.1	0	0.3
Activities auxiliary to financial intermediation	0.4	0.5	0.7	0.2	1.7
Computer and related activities	4.3	0.9	1.2	0.1	6.4
Architectural and engineering activities	1.3	0.3	1	0.1	2.6
Technical testing and analysis	1.3	0	1.2	0.1	2.6

Appendix 4 | Rating of encountered factors hampering innovativeness by enterprises (%), 2002–2004

Hampering factor	*Rating of encountered factor*			*Factor was not encountered*
	High	*Medium*	*Low*	
Innovative enterprises				
Lack of funds – enterprise/business group	39.3	40.1	20.6	28.2
Lack of funds – outside	40.5	32.3	27.2	52.5
High innovation costs	36.1	42.1	21.7	41.5
Lack of competent personal	34.0	37.8	28.3	31.8
Absence of information on technology	7.1	39.0	53.9	49.5
Absence of information on market	6.1	42.8	51.1	48.5
Difficulty in finding cooperation partners	12.5	42.1	45.4	53.5
Markets dominated by established firms	28.3	38.1	33.6	42.5
Uncertain demand	19.3	44.4	36.3	45.5
Lack of necessity because of existence of previous innovations	13.8	35.4	50.8	61.1
Non-innovative enterprises				
Lack of funds – enterprise/business group	43.0	39.0	17.9	45.1
Lack of funds – outside	44.0	33.6	22.4	62.3
High innovation costs	46.0	35.6	18.4	62.9
Lack of competent personal	29.8	44.0	26.2	54.2
Absence of information on technology	11.6	41.0	47.4	64.8
Absence of information on market	12.7	40.8	46.5	63.7
Difficulty in finding cooperation partners	23.0	39.6	37.5	66.9
Markets dominated by established firms	30.0	42.9	27.2	54.7
Uncertain demand	21.5	51.8	26.7	61.8
Lack of necessity because of existence of previous innovations	44.0	32.3	23.7	46.3

Appendix 5 | High-technology share of total manufacturing, by country/region (%), 1990–2003

	USA	*EU-15*	*Japan*	*China*	*Asia-8*
1990	12.4	9.1	14.1	7.4	13.0
1991	12.9	9.5	14.6	7.2	13.7
1992	12.3	9.6	14.0	7.0	14.1
1993	12.0	9.9	14.0	8.2	14.9
1994	11.5	9.8	14.5	8.2	15.6
1995	12.2	10.1	14.7	6.8	16.9
1996	13.7	10.4	15.5	8.5	17.0
1997	15.6	10.7	16.1	9.1	18.0
1998	18.3	11.0	16.0	9.7	18.1
1999	21.5	11.5	16.2	11.7	20.5
2000	25.4	12.3	16.3	12.9	22.7
2001	26.8	12.4	15.8	13.6	21.3
2002	28.4	12.1	14.3	15.8	22.1
2003	30.3	12.3	14.9	17.7	22.8

Source: Science and Engineering Indicators 2006

Note: Asia-8 includes South Korea, India, Indonesia, Malaysia, Philippines, Singapore, Taiwan, and Thailand.

Appendix 6 | Existence of cooperation for innovative activity as to partner's country of location and technology level (%), 2002–2004

	No cooperation	*Cooperation existed*	*Estonia*	*Europe*	*USA*	*Other*
High-technology sectors	55.73	44.27	38.98	34.55	9.8	6.36
Medium high-technology sectors	87.71	12.29	9.99	8.53	1	1.91
Medium low-technology sectors	85.13	14.87	12.12	11.24	0.26	1.37
Low-technology sectors	87.71	12.29	9.99	8.53	1	1.91
High-technology services	59.15	40.85	32.31	23.62	9.27	3.94

Appendix 7 | Breakdown of industrial enterprises having implemented innovation as to product and process innovativeness (%), 2002–2004 and 1998–2000

	2002–2004		*1998–2000*	
	Product innovators	*Process innovators*	*Product innovators*	*Process innovators*
Manufacturing	**37.6**	**34.1**	**30.1**	**25.5**
Manufacture of food products and beverages	53.5	38.9	39.7	30.9
Manufacture of textiles	42.2	37.8	25.5	20.6
Manufacture of wearing apparel; dressing and dyeing of fur	23.7	18.2	17.2	12.1
Tanning and dressing of leather	46.9	26.3	42.3	16.5
Manufacture of wood and of products of wood	27.9	31.8	19.6	21.7
Manufacture of paper and paper products; publishing	55.8	32.7	28.3	53.3
Publishing, printing and reproduction of recorded media	34.8	43.3	29	32.6
Manufacture of coke, refined petroleum products and nuclear fuel	100	100	33.3	0
Manufacture of chemicals and chemical products	69.8	58.6	66.5	42.3
Manufacture of rubber and plastics products	41.8	44.9	37.1	24.1
Manufacture of other non-metallic mineral products	51.3	45.5	29.6	31.1
Manufacture of basic metals	40	40	24.9	24.9
Manufacture of fabricated metal products, except machinery and equipment	25.4	22.2	23.2	24.4
Manufacture of machinery and equipment n.e.c.	38.8	33.2	42.3	24.6
Manufacture of office and computing machinery	100	100	40	40
Manufacture of electrical machinery and apparatus n.e.c.	43.2	43.2	29.7	23.3
Manufacture of radio, television and communication equipment and apparatus	43.2	72.2	20.9	59.6
Manufacture of medical, precision and optical instruments, watches and clocks	59.7	59.4	35	45
Manufacture of motor vehicles, trailers and semi-trailers	45.1	39.6	87.5	75
Manufacture of other transport equipment	39.5	27.9	40.8	27.9
Manufacture of furniture; manufacturing n.e.c.	41	31.9	40	22.4
Recycling	45.8	33.3	100	0

Appendix 8 | Questionnaire

A. GENERAL INFORMATION ABOUT THE ENTERPRISE

An enterprise is defined as an integral organisational unit producing goods or services. An enterprise carries out one or more activities at one or more locations. An enterprise may be a sole legal unit or combination of legal units.

A group of enterprises consists of two or more legally defined enterprises under common ownership. Each enterprise in the group may have a different economic activity and serve different markets. The parent enterprise is also part of an enterprise group (see definitions 1 and 3 on page 11).

If your enterprise is part of an enterprise group, please answer all further questions **only for your enterprise**. Do not include results for subsidiaries or parent enterprises (in or outside Estonia).

A 1 **Is the enterprise part of an enterprise group?** *(Tick; see definitions No. 1 and 3 on page 12)*

1 ☐ YES 2 ☐ NO

*If yes, continue with question **A2**, if no, then with **A3**.*

A 2 **Is your enterprise a parent or subsidiary enterprise?** *(Tick; see definitions No. 1 and 3 on page 12)*

1. Parent ☐
2. Subsidiary ☐ → ..... Write the location country of the parent enterprise Coded by Statistical Office ☐☐

A 3 **Did your enterprise have foreign equity in 2004?** *(Tick)*

1 ☐ YES 2 ☐ NO

*If yes, continue with question **A4**, if no, then with **A5**.*

A 4 **What was the share of foreign equity in percentages?** *(Tick the appropriate)*

1 ☐ less 50% 2 ☐ 50%–99% 3 ☐ 100%

A 5 **In which geographic markets did your enterprise sell goods or services during years 2002 to 2004?** *(Tick at all rows)*

1. Local / regional area within Estonia	1 ☐ YES	2 ☐ NO
2. Whole Estonia	1 ☐ YES	2 ☐ NO
3. Other European Union and EFTA member or candidate countries[a]	1 ☐ YES	2 ☐ NO
4. CIS countries[b]	1 ☐ YES	2 ☐ NO
5. Other (not listed above)	1 ☐ YES	2 ☐ NO

A 6 **Which geographic market do you consider most important for your enterprise during years 2002–2004** ☐

(Write the number of the market area from the question A5.)

[a] European Union and EFTA member or candidate countries (excl. Estonia): Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.

[b] CIS countries: Armenia, Azerbaidjan, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Ukraina, Uzbekistan, Belarus, Russia

B. PRODUCT INNOVATION

A product innovation (see annex, definition No. 9 on page 15) is the market introduction of a new or a significantly improved product (that is good or service) with respect to its capabilities (such as improved software, user friendliness, components or sub-systems). The innovation must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises/institutions.
Changes of a solely aesthetical nature (appearance, packaging), and pure resale of innovations wholly produced and developed by other enterprises not adding any surplus value to them, shall not be included under the term of product innovation.

B 1 **Did your enterprise introduce onto the market during the years 2002–2004 …?** *(Tick)*

1. New or significantly improved goods — 1 ☐ YES 2 ☐ NO
2. New or significantly improved services — 1 ☐ YES 2 ☐ NO

*If you answered no to both subquestions of **B1**, continue with question **C1**, if you answered yes to at least one subquestion, then with **B2**.*

B 2 **Who developed these product innovations?**

(Select only one — the most appropriate — and tick.)

1. Mainly your enterprise ☐
2. Mainly the enterprise group where your enterprise belongs to ☐
3. Your enterprise together with other enterprises or institutions ☐
4. Mainly other enterprises or institutions ☐

B 3 **Were any of your goods and service introduced onto the market during the years 2002 to 2004 …?** (*Tick at all rows.*)

1. New to your **market** — 1 ☐ YES 2 ☐ NO
   Your enterprise introduced a new or significantly improved good or service onto your market **before** your competitors (it may already have been available in other markets).
2. Only new to your **enterprise** — 1 ☐ YES 2 ☐ NO
   Your enterprise introduced a new or significantly improved good or service that was already available from your competitors in your market.

B 4 **Using the definitions from question B3, please estimate the percentage of your total turnover (see Annex, definition No. 8 on page 12) in 2004 from following goods and services:**

1. New to your **market** ☐☐☐ %
   New or significantly improved goods and services introduced onto the market during 2002 to 2004 that were new to your market.
   +
2. Only new to your **enterprise** ☐☐☐ %
   New or significantly improved goods and services introduced onto the market during 2002-2004 that were only new to your firm.
   +
3. Unchanged or only marginally modified ☐☐☐ %
   Goods and services that were **unchanged or only marginally modified** during 2002-2004 (include the resale of new goods or services purchased from other enterprises).
   =

Total turnover in 2004 = 100% — 1 0 0 %

C. PROCESS INNOVATION

A process innovation (see Annex, definition No. 6 on page 13) is the implementation of a **new or significantly improved** production process, distribution method, or support activity for your goods or services. The innovation must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises. Exclude purely organisational innovations.

C 1	**During the years 2002–2004, did your enterprise implement …?** (*Tick at all rows.*) 1. **New or significantly improved producing method** (new or significantly improved methods of manufacturing or producing goods or services) 1 ☐ YES 2 ☐ NO 2. **New or significantly improved delivery method** (new or significantly improved logistics, delivery or distribution methods for your input, goods or services) 1 ☐ YES 2 ☐ NO 3. **New or significantly improved supporting activity for your** (such as maintenance systems or operations for purchasing, accounting, or computing) 1 ☐ YES 2 ☐ NO *If you answered no to all subquestions of **C1**, continue with question **D1**, if you answered yes to at least one subquestion, then with **C2**.*
C 2	**Who developed these process innovations?** *(Select only one — the most appropriate — and tick.)* 1. Mainly your enterprise ☐ 2. Mainly enterprise group where your enterprise belongs ☐ 3. Your enterprise together with other enterprises or institutions ☐ 4. Mainly other enterprises or institutions ☐

D. NOT YET COMPLETED OR ABANDONED INNOVATION ACTIVITIES

Innovation activities include the acquisition of machinery, equipment, software, and licenses; engineering and development work, training, marketing and R&D (see definition No. 8 on page 14) when they are **specifically undertaken** to develop and/or implement a product or process innovation.

D 1	**Did your enterprise have any innovation activities to develop product or process innovations that were abandoned during 2002–2004 or still ongoing by the end of 2004?** (*Tick*) 1 ☐ YES 2 ☐ NO

NB! If your enterprise had no innovation activities during years 2002–2004 (you answered no to question D1) and your enterprise during the same period did not introduce onto the market product innovations (you answered no to all options in question B1) or implemented process innovations (you answered no to all options in question C1) continue the filling of questionnaire from question I2 (page 9). If you answered yes to at least one of options in listed questions continue with E1.

E. INNOVATION ACTIVITIES AND EXPENDITURE

E 1

During the years 2002–2004, did your enterprise engage in the following innovation activities? (*Tick at all rows.*)

1. **In-house R&D (see definition No. 8)** 1 ☐ YES 2 ☐ NO

Creative work undertaken **within** your enterprise to increase the stock of knowledge and its use to devise new and significantly improved products (goods/services) or develop new and significantly improved processes (including software development).

If yes, please indicate how your firm performed R&D during 2002-2004 (if no, continue with next activity type):

1 ☐ continuously 2 ☐ occasionally

2. **R&D ordered outside** 1 ☐ YES 2 ☐ NO

Same activities as above, but performed by other companies (including other enterprises within your group) or research institution (private or public) and ordered by your enterprise.

3. **Acquisition of machinery, equipment and software** 1 ☐ YES 2 ☐ NO

Acquisition of advanced machinery, equipment and computer hardware or software to produce new or significantly improved products (goods/services) and processes.

4. **Acquisition of other external knowledge** 1 ☐ YES 2 ☐ NO

Purchase (or licensing) of patents and non-patented inventions, know-how, and other types of knowledge from other enterprises or institutions.

5. **Training** 1 ☐ YES 2 ☐ NO

Training for your personnel (internal as well as external) specifically for the development and/or introduction of new or significantly improved products (goods/services) and processes.

6. **Market introduction of innovations** 1 ☐ YES 2 ☐ NO

Activities for the market introduction of your new or significantly improved products (goods/services), including market research and launch advertising.

7. **Other preparations** 1 ☐ YES 2 ☐ NO

Procedures and technical preparations to implement new or significantly improved products and processes that are not aforementioned

E 2

Please estimate the amount of expenditure (including personnel costs) for each of the following four innovation activities listed in question E1 in <u>2004 only</u>.

(Show the expenditure in all rows in thousands kroons. In case of the lack of expenditure tick the special box.)

1. **In-house R&D (including investments)**

☐☐☐☐☐☐☐☐**0 0 0** kroons No expenditures in 2004 ☐

2. **R&D ordered outside**

☐☐☐☐☐☐☐☐**0 0 0** kroons No expenditures in 2004 ☐

3. **Acquisition of machinery, equipment and software (excluding that for R&D)**

☐☐☐☐☐☐☐☐**0 0 0** kroons No expenditures in 2004 ☐

4. **Acquisition of other external knowledge**

☐☐☐☐☐☐☐☐**0 0 0** kroons No expenditures in 2004 ☐

Total for four listed activities

☐☐☐☐☐☐☐☐**0 0 0** kroons No expenditures in 2004 ☐

F. SUPPORT FROM PUBLIC SECTOR

F 1 **During the years 2002–2004, did your enterprise receive any public financial support for innovation activities from any level of public administration?**
(*Tick at all rows.*)
(Include financial support via tax credits or deductions, grants, subsidised loans, and loan guarantees. Exclude research and other innovation activities conducted entirely for the public sector under contract.)

1. Municipalities — 1 ☐ YES 2 ☐ NO
2. Government (incl. funds financed by government or from ministries; there is shown also the support co-financed by EU Structural Funds) — 1 ☐ YES 2 ☐ NO
3. European Union — 1 ☐ YES 2 ☐ NO

If yes, please indicate if your firm participated in the EU's 5th (1998-2002) or 6th (2003-2006) Framework Programme for Research and Technical Development.

1 ☐ YES 2 ☐ NO

*If you answered no to all subquestions of **F1**, continue with question **G1**, if you answered yes to at least one subquestion, then with **F2**.*

F 2 **During the years 2002–2004, did your enterprise receive any public financial support for the following types of innovation activities and how do you assess the importance of the support if received?**
(Tick those types of innovation activities you received the support for. In case of the lack of support tick special box.)

Activity	Importance of support: high 1	medium 2	low 3	Support not received 9
1. In-house or external R&D	☐	☐	☐	☐
2. Acquisition of other external knowledge for innovation activities	☐	☐	☐	☐
3. Training associated with innovations	☐	☐	☐	☐
4. Market introduction of innovations	☐	☐	☐	☐
5. Co-operation on innovation with other enterprises or institutions	☐	☐	☐	☐

F 3 **Did the following effects occur as a result of the received support from public sector during the years 2002–2004?** (*Tick at all rows.*)

1. Innovation processes speeded up — 1 ☐ YES 2 ☐ NO
2. Innovation expenditure decreased — 1 ☐ YES 2 ☐ NO
3. Quality of innovations improved — 1 ☐ YES 2 ☐ NO
4. Innovation risks diminished — 1 ☐ YES 2 ☐ NO
5. There were other effects on innovation — 1 ☐ YES 2 ☐ NO

G. SOURCES OF INFORMATION AND CO-OPERATION FOR INNOVATION ACTIVITIES

G 1 **During the years 2002–2004, did your enterprise use the following information sources for innovation and how important were the sources if used?**

(Tick all the sources used to get information for new innovation projects or to complete the existing innovation projects indicating the importance of the source. If the source was not used, tick the special box.)

Information source	Importance of source: high 1	medium 2	low 3	Not used 9
1. Within your enterprise or enterprise group	☐	☐	☐	☐
2. Suppliers of equipment, materials, components, or software	☐	☐	☐	☐
3. Clients or customers	☐	☐	☐	☐
4. Competitors or other enterprises in your sector	☐	☐	☐	☐
5. Consultants, commercial labs, or private R&D institutes	☐	☐	☐	☐
6. Universities and other higher education institutions	☐	☐	☐	☐
7. Government or public research institutes	☐	☐	☐	☐
8. Conferences, trade fairs, exhibitions etc.	☐	☐	☐	☐
9. Scientific journals and trade/technical publications	☐	☐	☐	☐
10. Professional and industry associations	☐	☐	☐	☐

G 2 **During the three years 2002–2004, did your enterprise co-operate on innovation activities with other enterprises or institutions?**

(Innovation co-operation is the active participation in common innovation activities with other enterprises and/or universities and research institutions. Both partners do not need to benefit commercially. Exclude pure contracting out of work with no active co-operation.)

1 ☐ YES 2 ☐ NO

*If no, continue with the question **H1**. If yes, tick all possible answers by the type of partners and by their location in the list at the following page (continuation of question **G2**).*

G 2 cont.	Co-operation partner	Estonia	Other Europe [a]	USA	Other countries
	1. Other enterprises within your enterprise group	☐	☐	☐	☐
	2. Suppliers of equipment, materials, components, or software	☐	☐	☐	☐
	3. Clients or customers	☐	☐	☐	☐
	4. Competitors or other enterprises in your sector	☐	☐	☐	☐
	5. Consultants, commercial labs, or private R&D institutes	☐	☐	☐	☐
	6. Universities and other higher education institutions	☐	☐	☐	☐
	7. Government or public research institutes	☐	☐	☐	☐

G 3	**Which type of co-operation partner did you find the most valuable for your innovation activities?**	
	*(Give corresponding number of the co-operation partner from the list at question **G2**.)*	☐

H. EFFECTS OF INNOVATION

H 1 **How important were the following effects of introducing onto the market your product (good/service) innovation or implementing your process innovation during the years 2002 to 2004?**

(Tick the degree of observed effect in all rows. If the innovations were not relevant to the effect, tick in the special box.)

Effect	Degree of observed effect: high 1	medium 2	low 3	Not relevant 9
1. Increased range of goods or services	☐	☐	☐	☐
2. Entered new markets or increased market share	☐	☐	☐	☐
3. Improved quality of goods or services	☐	☐	☐	☐
4. Improved flexibility of production or service provision	☐	☐	☐	☐
5. Increased capacity of production or service provision	☐	☐	☐	☐
6. Reduced labour costs per unit output	☐	☐	☐	☐
7. Reduced materials and energy per unit output	☐	☐	☐	☐
8. Reduced environmental impacts or improved health and safety	☐	☐	☐	☐
9. Met regulatory requirements	☐	☐	☐	☐

[a] European Union and EFTA member or candidate countries (excl. Estonia): Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.

I. FACTORS HAMPERING INNOVATION ACTIVITIES

I 1 **During the years 2002–2004, were any of your innovation activities or projects …** (*Tick at all rows.*)

1. abandoned in the concept stage?	1 ☐ YES	2 ☐ NO
2. abandoned after the activity or project was begun?	1 ☐ YES	2 ☐ NO
3. seriously delayed**?**	1 ☐ YES	2 ☐ NO

NB! QUESTIONS BEGINNING FROM I2 MUST BE ANSWERED BY ALL ENTERPRISES.

I 2 **During the years 2002–2004, how important were the following factors for hampering your innovation activities or projects or influencing a decision not to innovate?**

(Tick the degree of importance of the factor in all rows. If the factor was not experienced tick in special box.)

Factor	Degree of importance: high 1	medium 2	low 3	Factor not experienced 9
1. Lack of funds within your enterprise or group	☐	☐	☐	☐
2. Lack of finance from sources outside your enterprise	☐	☐	☐	☐
3. Innovation costs too high	☐	☐	☐	☐
4. Lack of qualified personnel	☐	☐	☐	☐
5. Lack of information on technology	☐	☐	☐	☐
6. Lack of information on markets	☐	☐	☐	☐
7. Difficulty in finding cooperation partners for innovation	☐	☐	☐	☐
8. Market dominated by established enterprises	☐	☐	☐	☐
9. Uncertain demand for innovative goods or services	☐	☐	☐	☐
10. No need due to prior innovations	☐	☐	☐	☐
11. No need due to no demand for innovations	☐	☐	☐	☐

J. INTELLECTUAL PROPERTY RIGHTS

J 1 **During the years 2002–2004, did your enterprise …?** (*Tick at all rows.*)

1. Apply for a patent	1 ☐ YES	2 ☐ NO
2. Register an industrial design	1 ☐ YES	2 ☐ NO
3. Register a trademark	1 ☐ YES	2 ☐ NO
4. Claim copyright	1 ☐ YES	2 ☐ NO

K. ORGANISATIONAL AND MARKETING INNOVATIONS

An **organisational innovation** is the implementation of new or significant changes in firm structure or management methods that are intended to improve your firm's use of knowledge, the quality of your goods and services, or the efficiency of work flows (see appendix, definition No. 5 on page 12).
A **marketing innovation** is the implementation of new or significantly improved designs or sales methods to increase the appeal of your goods and services or to enter new markets flows (see appendix, definition No. 8 on page 15).

K 1 **During the years 2002–2004, did your enterprise introduce organisational innovations?** (*Tick at all rows.*)

1. New or significantly improved knowledge management systems to make better use of or exchange information, knowledge and skills within your enterprise	1 ☐ YES	2 ☐ NO
2. A major change to the organisation of work within your enterprise (such as changes in the management structure or integrating different departments or activities)	1 ☐ YES	2 ☐ NO
3. New or significant changes in your relations with other firms or public institutions (such as through alliances, partnerships, outsourcing or sub-contracting)	1 ☐ YES	2 ☐ NO

*If you answered no to all subquestions of **K1**, continue with question **K3**, if you answered yes at least to one subquestion, then with **K2**.*

K 2 **How important were the following effects of an organisational innovation introduced during years 2002–2004?**

(Tick the degree of importance of the factor in all rows. If the innovations were not relevant tick in special box.)

Effect	Degree of observed effect: high 1	medium 2	low 3	Not relevant 9
1. Reduced time to respond to customer or supplier needs	☐	☐	☐	☐
2. Improved quality of your goods or services	☐	☐	☐	☐
3. Reduced costs per unit output	☐	☐	☐	☐
4. Improved employee satisfaction and/or reduced rates of employee turnover	☐	☐	☐	☐

K 3 **During the years 2002–2004, did your enterprise introduce marketing innovations?** (*Tick at all rows.*)

1. Significant changes to the design or packaging of a good or service (Exclude routine/ seasonal changes such as clothing fashions)	1 ☐ YES	2 ☐ NO
2. New or significantly changed sales or distribution methods (such as internet sales, franchising, direct sales or distribution licenses.	1 ☐ YES	2 ☐ NO

L. BASIC ECONOMOCAL DATA OF ENTERPRISE

L 1	**What was the total turnover of your enterprise for 2002 and 2004?** *(Including sales to non-residents and taxes except VAT, for insurance services gross premiums written. See definition No. 7 on page 14. Turnover in thousand kroons.)* Total turnover in 2002 ☐☐☐☐☐☐☐☐**0 0 0** kroons Total turnover in 2004 ☐☐☐☐☐☐☐☐**0 0 0** kroons
L 2	**What were sales of your enterprise to non-residents for 2002 and 2004?** *(See definition No. 4 on page 12. Sales in thousand kroons.)* Sales to non-residents in 2002 ☐☐☐☐☐☐☐☐**0 0 0** kroons Sales to non-residents in 2004 ☐☐☐☐☐☐☐☐**0 0 0** kroons
L 3	**What was the number of employees in your enterprise for 2002 and 2004?** *(See definition No. 11 on page 15. Annual average. If not available, number of employees at the end of the year.)* Number of employees for 2002 ☐☐☐☐☐ Number of employees for 2004 ☐☐☐☐☐

REMARKS AND COMMENTS

Persons filling up the questionnaire for further contacting to specify the details			Date	Head of the enterprise (name, signature)
Name				
Phone				
Fax				
E-mail				

Thank you!

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