Innovation in Estonian Enterprises 1998–2000

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Foreword

The development of any efficient policy, action or business plan should be based on a competent study or analysis. Therefore, professional decision-making is impossible without supporting information and neither is it sensible to gather information, which is not necessary or used in the process of decision making.

This publication is based on the results of an extensive innovation survey conducted among more than 4000 enterprises in Estonia. The results of the survey enable us to position the innovativeness of Estonian enterprises in international context, determine their strengths and weaknesses and give an input in the process of forming the innovation policy.

Without close co-operation between different parties, the realisation of this project would not have been possible. Therefore, I appreciate the involvement of all the participating experts and institutions and the contribution of enterprises, which found time to complete the questionnaires.

As a minister responsible for Estonian enterprise and innovation policy, I would like to stress that the information contained in this publication significantly contributes to the evaluation of the competitiveness of Estonian enterprises and, as a result, the entire economy. Furthermore, it enables us to make necessary conclusions and more effective future-oriented decisions. I believe that in addition to significant policy input, the project will also serve as an example to increase the amount of decisions based on detailed analysis.

Sincerely

Liina Tõnisson
Minister of Economic Affairs and Communications

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Project Background and Introduction

In today's increasingly global, increasingly knowledge-based economy, innovation – the capacity to apply new knowledge in order to improve productivity and create new products and services – is more significant than ever. This capacity relies not only on scientific inventiveness and entrepreneurial flair but, critically, on the conditions, which permit, encourage and sustain the innovative creativity, or restrict it.

According to the well-known economist Michael E. Porter the international competitive advantage ultimately results from the effective combination of national circumstances and company strategy. But these are companies, not nations, on the front line of international competition. Nevertheless, characteristics of home nation play a central role in a firm's international success.[1]

The illustration above shows clearly that governmental policies and firm level decisions should be made hand-in-hand in order to secure long-run competitiveness of the Estonian economy, and consequently, continuously increase our social well-being.

Understanding that knowledge, creativity and innovation have a major role in the long-term competitiveness of the Estonian economy has led to a strong governmental will throughout the recent years to improve Estonian innovation policy[2]. As a result of these developments, the Parliament has approved the main innovation policy document "Knowledge-Based Estonia" – The Research and Development Strategy of Estonia for 2002–2006. The wide objectives of the strategy are to update the overall knowledge pool and increase the competitiveness of local enterprises. An additional significant step has been the reorganisation and simplification of our enterprise support system. In the process, Estonian Technology Agency (ESTAG) was established (under the jurisdiction of Enterprise Estonia). Estonian Technology Agency is the main body for innovation policy implementation.

In order to develop appropriate and successful policy measures, the policy-makers should have a deep understanding and clear overview of the activities at individual company level. Since current statistics gives them solely a broad picture of the tendencies of the enterprise sector, more comprehensive surveys must be carried out. Only in this way it is possible to develop personalised support measures, which are addressed to the main weaknesses of certain types of companies or sectors.

Proceeding from the above-mentioned, the Division of Technology and Innovation of the Ministry of Economic Affairs and Communications together with Estonian Technology Agency have decided to carry out a comprehensive innovation survey at enterprise level in Estonia. The idea of the survey was to collect in-depth statistical information about the innovativeness of Estonian enterprises. For example: How innovative are they compared to their EU competitors? What are the main barriers to innovation? Do enterprises co-operate in order to innovate? How are innovativeness, export performance, type of ownership, and economic performance of enterprises related? How well are public support measures for innovation known, how often used etc?

To get internationally comparable results, the survey was carried out in accordance with the EU-developed common methodology – Community Innovation Survey (CIS). The EU Member States conduct the survey once in every four years. Estonia joined the third round of the most comprehensive innovation survey ever made in the world. As a result, we are able to compare the innovativeness of Estonian enterprises and the economy as a whole with almost every other European country.

This publication is the result of slightly more than one year of co-operation between different institutions – Ministry of Economic Affairs and Communications and Estonian Technology Agency as the initiators of the survey, Statistical Office of Estonia as a conductor of the survey, Estonian Institute for Future Studies as an analyst and a producer of the current publication.

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1 *Michael E. Porter – The Competitive Advantage of Nations*

2 *Innovation policy is a set of policy actions to raise the quantity and efficiency of innovative activities, whereby "innovative activities" refers to the creation, adaptation and adoption of new or improved products, processes or services. At the level of firm or the institution these activities are undertaken to introduce new or improved products, processes or services, which in turn will increase productivity, profits and market share, with the ultimate goal to raise their competitiveness in the long run. Source: Building an Innovative Economy in Europe, European Commission 2001*

On behalf of initiators of the survey, we would like to thank all of the participating institutions, experts and contributing enterprises. We do hope that the findings of the survey will give a good input for all key actors in the Estonian economy – enterprises can look for good practices and compare them internationally, policy-makers can identify the main weaknesses of the enterprises in order to develop appropriate measures for improvement, politicians can determine the main obstacles and possibilities for the development of Estonian economy, academicians can have statistics at individual company level in order to analyse and construct scenarios for the development of both enterprise sector and economy as a whole.

Ott Pärna
Division of Technology and Innovation
Ministry of Economic Affairs and Communications
December 2002

Executive Summary

In the economic environment, where we are reaching, i.e. an increasingly global, increasingly knowledge based economy innovation – the capacity to apply new knowledge in order to improve productivity and create new products and services – is more significant than ever. This capacity relies not only on scientific inventiveness and entrepreneurial flair, but critically, on the conditions, which permit, encourage and sustain this innovative creativity, or which restrict it.

Estonia's economy and business have made a very rapid and extensive development since the restoration of independence, but there is still a very long way to go in order to catch up with the more successful and wealthy Western countries. According to the theories of Michael E. Porter, Estonia is still in the "investment-driven stage", which means that the competitive advantage is the cheap production input and the development of firms is largely based on the material (money and equipment) and immaterial (skills, knowledge, experience) capital accompanying the investments. The following, "innovation driven stage", foresees a competitive advantage based on the development of new products/services and processes, which will provide more added value than production based on cheap input. It is difficult to predict, how much time it will take the Estonian enterprises to reach the innovation driven stage. It is also important to point out that this is a matter of decades rather than years, but well-considered action of the enterprises as well as the state will help to significantly speed up this journey. It can be presumed that different sectors will reach this stage at different times, but due to the toughening global competition and the accelerating rise of prices and wages following the incorporation into the EU, the Estonian firms will not be able to retain for long the competitive edge of cheap input. Therefore, the sooner the Estonian entrepreneurs will start to think and act in an innovative way, the higher will be the competitiveness of the entire Estonian economy and the faster the growth of welfare. The mission of the state would be to help the entrepreneurs to choose this path even today.

In order to develop appropriate and successful policy measures policy-makers should have a deep understanding and clear overview about what is going on at individual company level. Therefore the Division of Technology and Innovation at the Ministry of Economic Affairs and Communications together with Estonian Technology Agency have decided to carry out a comprehensive enterprise level innovation survey in Estonia during 1998–2000. The survey was carried out according to the EU *Community Innovation Survey* (CIS) methodology in order to enable to compare the innovativeness of the Estonian entrepreneurs at the international level. Unfortunately, the results of CIS3 on the other countries are not yet available, therefore the comparisons to the EU average has been made to the CIS2 indicators dating back to 1996.

The main sample group of the innovation survey included 3,490 enterprises with more than 10 employees and the small enterprises group 777 enterprises with 2–9 employees. The response percentage was very high – 74% in the main and 65% in the small enterprises survey.

This survey treated innovativeness **as implemented technologically new products, processes or services and significant technological improvements in products, processes or services. It requires an objective improvement in the performance of a product or in the way in which it is produced or delivered. An innovation has been implemented, if it has been introduced on the market – product innovation, or used within a production process – process innovation. The product, service or process should be new (or significantly improved) to the enterprise, but does not necessarily have to be new to the enterprise's market.** The technological innovation could include, but does not presume the basic or even applied researches; the idea for new product, service or process might be taken over or obtained from practical experiences.

Innovative activity in Estonian enterprises

The results of the survey show that the share of innovative enterprises – firms, which had brought a new or significantly improved product or service to the market during the survey period or had innovated or improved their production processes – of all observed Estonian enterprises in the period 1998–2000 reached 36%, which is a relatively good result as compared to the other European countries (EU-15 ~ 45% 1996). We have to take into account here that innovativeness in the Estonian enterprises is generally influenced by the same trends as displayed by the previous EU surveys: the innovative enterprises have a larger number of employees and higher turnover, while the firms with foreign owners/partners and belonging to concerns are more innovative. Although the share of innovators among the services enterprises was lower than among the manufacturing firms (respectively 32% and 39% of the sector's enterprises) it seems that the services enterprises are more

complex innovators, since their participation in various innovative activities was higher than in the manufacturing enterprises. Regionally the more innovative enterprises in Estonia have concentrated in the Tallinn and Tartu regions, where the entrepreneurial and research activities are the most active and where every third enterprise made expenses on innovation, it was followed by Ida-Virumaa with every fourth enterprise, while in the rest of Estonia, only every firth firm confirmed expenses made on innovation.

However, when studying in greater detail how large expenses the enterprises make on the implementation of innovation projects and on which activities they spend money, the results no longer look as optimistic. In 2000, 29% of the studied enterprises made expenses on innovation. In most cases, the expenditures were associated with the acquisition of machinery and equipment as well as the accompanying training. Out of the total turnover of innovative enterprises, total expenses on innovation amount approximately to 2.3% in manufacturing and only to 0.8% in services. The corresponding EU indicators in 1996 were 4% and 3%. Unlike the average indicators of the EU countries, in Estonia the SMEs make in manufacturing relatively more expenses on innovation (half of innovation expenditures in manufacturing have been made by SMEs) than the large enterprises. However, in the services sector the largest expenditures are made by the large enterprises. A significantly greater amount on innovation out of net turnover in Estonia is made by the several smaller services firms – computer services (8% of turnover), engineering and testing services provider firms (14% of turnover), and electronic and optical equipment manufacturers (9% of turnover).

In European Economic Area 69% of innovators in manufacturing and 47% in services conducted R&D on regular or occasional basis. The corresponding indicators in Estonia are 44% and 40% and they are strongly correlated to the size of the enterprise. Intramural R&D expenditures amount to slightly more than one tenth out of total innovation expenditures. As compared to the R&D indicators or the state statistics, this survey gave a several times better result. It can be presumed that the enterprises largely consider any in-house development activity R&D activity. Therefore interpretation should be rather careful. The share of extramural R&D is even smaller than intramural R&D. In more than 2/3 of innovative enterprises, which had made expenditures on R&D, the share remained below 1% of turnover. In 60% of innovative enterprises no expenditures were made at all on R&D.

The low intensity of R&D is also reflected in the enterprises' sales figures. Only one sixth of turnover of Estonian entrepreneurs was amounted by the sale of new or improved products/services and in turn only 6% were also new for the enterprises' market. A majority of turnover is provided by the sale of established products/services. But when observing the share of innovative products/services of the turnover of only innovative enterprises, it amounts to nearly one third, while the share is higher among the small and medium enterprises. Among the large enterprises the expenditures on innovation amounted to a relatively smaller share of turnover than among the SMEs. The large enterprises in general in Estonia are, as to actual innovative activities (expenditures made and share of turnover of new or improved products/services), relatively less innovative than the SMEs, while the previous EU CIS surveys have shown a greater activity of the large enterprises. When adding the fact that the enterprises exporting more than 90% are less innovative than the firms with lower share of export, and the greater exporters are generally the larger firms, it would confirm the survey of Estonian exporters that the Estonian enterprises' present-day competitive advantages are the lower prices thanks to cheaper production input, rather than the new and more expensive products/services, which produce higher value added.

R&D activity in the enterprises is low, which is also one of the reasons for the insignificant amount of patenting. Only 4.2% enterprises had filed patent claims and there were 5.6% obtained patents.[3] Patenting as the protection of the entire innovative activity is more frequent among the large enterprises, firms belonging to concerns and with greater foreign ownership. The use of various protective measures is also significantly more active among the innovative firms than among the non-innovative ones. The most extensively used protective measure is pre-empting the competition by acting more rapidly (1/5 of all enterprises and 41% innovators). The registration of trademarks, secrecy and complexity of design are used in almost 50 percent less cases.

The impact of innovative activity is seen primarily in the improvement of quality of products and services and extending the range. Increase of production flexibility and production capacity are the more significant reasons of process innovation, which in turn refer to the competitive edge expected from rapid action. Considering the highly taxed labour in Estonia it was somewhat surprising that only 10% innovators saw the reduction of labour expense as a significant reason for innovation. Therefore the salaries are still low enough not to cause competitive problems to the entrepreneur. The question arises: how long would it last?

Innovative activity is often accompanied by other changes in the organisation – strategic, management- or marketing-related, structural changes or at least a change of the appearance of the product. The latter is the most

[3] *If the firm belonged to a concern the said patents could belong to the parent organisation.*

frequent change in the enterprises. As a general rule the firms making changes are significantly more innovative (51% to 15%) and vice versa, the innovators make organisational changes 2–3 times more frequently (83%) than the non-innovators. Therefore the progressive enterprises are active in the realisation of various innovations, briefly, they possess a more complex entrepreneurial strategy.

Innovation-related cooperation

Compared to background information from the EU countries, it can be claimed that the Estonian enterprises are in a relatively close innovation cooperation (respectively 1/4 and 1/3 of innovative enterprises). On the other hand, this indicator is only half of the figure in the successful Nordic countries. Keeping in mind the success of the Nordic countries the significance of cooperation was shown by the survey result, according to which export reached 39% of net turnover among the cooperating innovative enterprises, while it remained at the level of 26% among the other firms.

An interesting pattern of cooperation emerges among the services firms: the larger is the enterprise, the more it cooperates with the others concerning processes development (50% of large services firms) and the less in the development of products/services (14% of large firms). Therefore, the larger the enterprise, the more significant it is, in order to remain competitive, to participate in wide services networks, while in order to achieve market advantage, new products/services need to be developed in competition with each other. When observing the development of the large Estonian services enterprises (telecommunication, financial intermediation, transport as well as utilities enterprises), it can be deduced that cooperation is vital for success in at least some activities. Among the industrial enterprises, both products ands processes were developed in cooperation with other firms by 1/5 of innovative firms regardless of the size of the enterprises.

The Estonian enterprises' innovative activities pattern (the implementation of new products, services or in most cases technologies for the firm) is also reflected in the spectrum of the cooperation partners – over 2/3 innovators mentioned cooperation with suppliers and clients-consumers (emphasising the former). At the same time, cooperation with universities and institutes is nearly three times lower than the European average, where every third enterprise cooperated with research institutes. Considering the low R&D activity of the Estonian enterprises this result is rather logical.

There is an even more depressing fact that the research institutes are practically ignored as sources of information. As the only exception, large services enterprises can be pointed out, as at least some of them considered universities as partners. The large services enterprises were in general more active users of various sources of information as compared to the other firms. The most-used information for innovation comes, dependent on the cooperation partners' spectrum, from the suppliers and clients and largely from the internal sources of the firm. Therefore this is the basic model of a product's value chain.

Barriers of innovativeness

Why then is the innovative activity in the Estonian business so little oriented at radical innovations and relatively unilateral, mainly concentrating on the implementation of machines and equipment? Nearly half of the enterprises, which did not implement innovations in 1998–2000 claimed that the earlier innovations meet their requirements and/or that there is no market demand for innovation. On the other hand, 40% of the innovators experienced obstructive factors in the realisation of their innovation projects. The main obstructive factor is allegedly money: innovation requires large expenditures, but there is a shortage of funds. As for the internal problems of the enterprises, the most significant is the shortage of competent personnel, which is another sign of the low ability of the Estonian educational system to provide human resources corresponding to the development level of economy.

Besides, half of the innovative firms experienced in the realisation of their projects as an obstruction the low responsiveness of the consumers to new products and services. But this may mean that the innovation strategy has not been properly thought out. An innovation project has been launched before it is clear, which trends and demands direct the market. Among the positive aspects, the relatively more dynamic organisational structure of the Estonian enterprises can be mentioned, which poses no obstructions to most entrepreneurs in the realisation of their innovation projects. In the EU countries innovation has been frequently obstructed by organisational rigidity. It is possible that a reason is the short age of the Estonian enterprises, which means that organisational rigidity has not yet developed.

Innovative activity in Estonian manufacturing enterprises

The innovativeness of enterprises in manufacturing depends quite strongly on its belonging to a technology group differentiated according to an international classificator (high-tech, medium-high, medium-low, low-tech). The share of innovative firms ranges between 38% in the low-tech branches and 64% in the high-tech branches. Large enterprises innovate significantly more than the others in all technology groups. The high tech technology group is more homogeneous than the other groups as to size, since the small and medium enterprises are also quite innovative there.

The share of high-tech enterprises in the Estonian industry is relatively low. They provide only approximately 3% of overall turnover. The share is somewhat higher as to the new products significant for the market – 10%. But the share of the medium-high group is larger – 16% of overall turnover and 24% of products new for the market.

A large share of Estonian industrial enterprises belong to the group, which is internationally classified as low-tech – meat and dairy processing, woodworking, textiles. The Estonian high tech production is concentrated to a relatively small number of telecommunication and computer producers. Estonia's high tech is predominantly located in Tallinn and Tartu.

While the goal of innovation in the high tech firms is predominantly the improvement of the products quality, in the other technology groups such reasons as to increase production capacity and increase the range of goods have a greater share. The high tech firms, incl. large high tech firms, have only few contacts with universities and research establishments as to cooperation or sources of information.

Innovative activity in Estonian service enterprises

The innovative behaviour of various services branches varies strongly dependent on the sub-sector specific conditions. As viewed against the international background the innovative behaviour of the Estonian services enterprises is actually better than that of the industrial enterprises. As compared to the other sectors there is quite a lot of innovation in the computer firms, telecommunication firms, in most branches connected with financial intermediation, air transport and, of course, firms directly specialised in R&D. As to the international background, the complex of transport branches can be rated as quite innovative, while as to the significance of the innovative firms belong to the small rather than great innovators among the Estonian service sectors.

However, in services the innovations are predominantly new for the enterprise itself, rather than the market (with the exception of firms providing architectural and engineering services and directly R&D-specialised firms). The greatest expenses on innovation are characteristic of the branches of services with a high overall volume of capital (power, gas and hot water suppliers, maritime and air transport, most branches of financial intermediation). At the same time the share of expenditures on innovation to overall turnover is low practically in all services sectors (with the exception of the R&D firms). It cannot be claimed, however, that the services sector has nothing to do with R&D. Intramural research is quite typical, besides the directly specialised R&D firms, to telecom, financial intermediation, computer firms, architectural and engineering firms and firms specialised in technical testing. But this is all done within the limits of relatively small expenses.

As in case of industry, the innovations are generally connected to the acquisition of new machinery. Training is widespread and in some branches also intramural R&D, while the innovation process is relatively rarely associated with marketing.

The services sectors with large share of foreign capital are somewhat more active innovators. This primarily applies to the services branches with large volume of capital like air transport, telecom and insurance funds. At the same time in the branches with lower volume of capital even the "domestically based" sectors may be significant innovators and also be engaged in R&D to certain extent (for example architectural and engineering consultation firms).

Innovation in micro-enterprises

The survey of micro-enterprises (3–9 employees) showed that while they are behind the larger enterprises as to many indicators of innovativeness, they clearly lead the large firms as to such indicators like the share of new products (incl. and especially products new for the market) of their turnover. This shows that a small enterprise, presumably a niche firm, which has managed to bring a new product to the market, can concentrate

its activities to the production of that particular product, which is its comparative advantage to the larger firms with broader nomenclature of products. It is another matter, how much profit could a small firm make out of innovation due to its various restrictions. While the micro-enterprises lag behind the others as to many functions accompanying innovation (training, marketing, outsourcing of R&D), intramural R&D is as widespread in them (naturally, at much lower expenses) as in the larger firms.

The role of the public sector

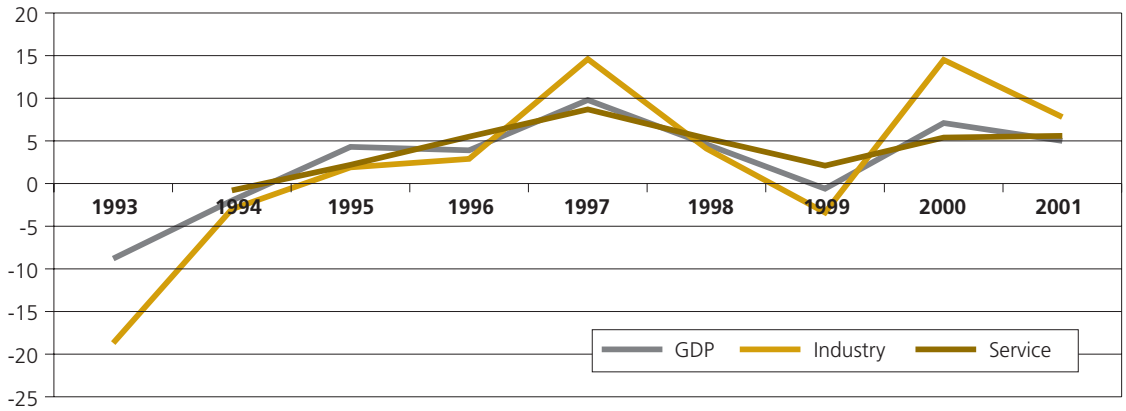
The results of the survey show the very small participation of the public sector in the innovative behaviour of the enterprises. Only 5% of the innovative enterprises has received financial support from the state, while the share of aid recipients is even lower when discussing the local governments or the EU programmes. Considering that the period of the study was also the time of major reorganisation in Estonia's state innovation system, it would not be quite fair to use the results to make definite conclusions about the current system. The results did show that the reorganisations were urgently needed and their further development is highly important. This conclusion was brought along by the fact that most entrepreneurs did not express their opinion at all concerning the state-provided services or distribution of information. Those, who did, considered the provided services mainly unsatisfactory and insufficient, while the same applied to the distribution of information. Therefore the public sector will have to make great effort. Yet its role as the supporter of innovation is highly important, especially considering the realities of the oncoming period, in order to maintain the competitiveness of the Estonian state and its enterprises in the conditions of the European common market and the increasing globalisation.

1 Estonian Economy, Entrepreneurship and Innovation

1.1 Economic environment and development in Estonia

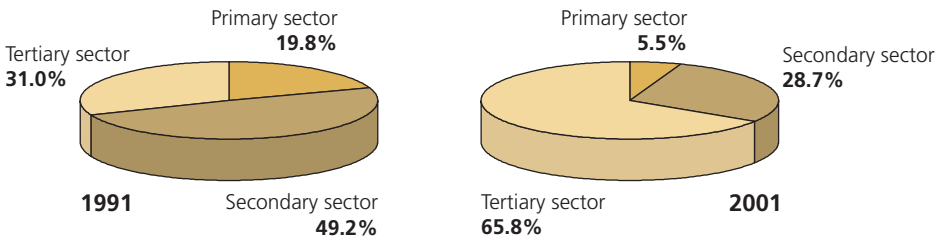
During the 1990s the Estonian economy has experienced revolutionary periods and dramatic changes. Starting the 1990s as still a command economy but already with some transitional phenomena, the Estonian economy went through serious structural changes during the first half of the decade. Thereafter, although being not homogeneous and institutionally weak market economy, followed the first growth period which was finished by the short-term setback in the years 1998–99 as the backwash of Asian and Russian crises. After these events the Estonian economy reached a much more developed and mature stage. The EU accession means new development challenges for Estonian entrepreneurship. Innovative activities have essential role in aligning business development priorities with new opportunities resulting from the EU large internal market and its innovation policy in order to gain and retain international competitiveness at the global marketplace.

Figure 1.1.1 Dynamics of annual growth rates, 1993–2001



The structure of economy changed fundamentally in sectoral, regional and entrepreneurial (forms and size groups) terms, also in geography of foreign economic relations. The share of agricultural and industrial sector decreased substantially, as the service sector that had suffered from serious underdevelopment at Soviet times experienced a period of rapid growth.

Figure 1.1.2 Shares of the main sectors of economy in GDP, (%), 1991 and 2001



During the first period of development the share of trade, tourism related and financial services rose in the service sector. Afterwards also other types of services started to grow. Since the middle of the 1990s the services connected with the transit transport have played important role. Due to the communication sector we can talk about high growth rates. The tourism sector, especially the businesses related to Finnish tourists, was an important part of the Estonian economy through the whole decade.

In manufacturing during the first years of transition the production of food products (except beverages), textile, building materials, and pulp and paper products and also the chemical industry went through a period of deep decline. Compared to abovementioned manufacturing sectors, wood production, sewing, and somewhat surprisingly machinery building, were able to adapt to new conditions more quickly and with better success. Already in 1993 the wood industry started to grow again and with very high growth rates that make this sector the champion one considering the latter periods. Mostly thanks to greenfield foreign direct investments the manufacturing of electronics has shown impressive growth. Newly established electronic enterprises have quickly linked into the highly developed IT cluster of the Nordic countries, however as the producing bases for

the Nordic enterprises. During the mid-1990s the food industry substantially increased its capacities but due to the Russian crises got serious setback and lost its important destination market, at least for a while. Estonian manufacturing in general is mostly export-oriented (exports constitutes about 46% of production in 2000), the structure of Estonian exports is rather diversified.

Entrance to market economy

1988–1990
Starting to move gradually towards market economy and national independence resturation. Beginning of new private entrepreneurship.
1991
Re-establishing Estonian political and economical independence.
1991–1995
The main years of privatisation.
The first half of 1992
The sharp shift to radical liberation of economy and foreign economic relations. This becomes the permanent feature of Estonian economic model afterwards.
Summer of 1992.
Monetary reform. The real beginning of macroeconomic policy.
From the end of 1994
After big recession economy started to rise again.

The regions that initially won most from the new external conditions were capital Tallinn with its surrounding Harju County and Pärnu town as well. The "list of winners" has lengthened gradually but the rural areas in South-Eastern Estonia and the outskirts of Lake Peipsi have remained relatively underdeveloped and industrial North-East having serious restructuring problems.

The private sector in Estonian economy took clearly dominating position since mid-1990s due to the intensive establishment of new enterprises on the one side and due to the massive privatisation on the other. The share of big enterprises (over 500 employees) in employment decreased about from 40% in 1992 to 16% in 1995 (Teder, Terk, 1998). The privatisation of companies was carried out mainly by selling them for money by using the combination of the price, investment retained jobs commitment as the criteria for identifying the best bid in large-scqale privatisation. Application if this model was oriented to the quick generation of core-owners. That contributed the quick recovery of economy. The flows of Western capital came in paralelly through privatisation, greenfield investments and later also through buying by foreigners domestic private companies. Considering the post-socialist countries, Estonia in the field of foreign direct investments *per capita* loses substantially only to Hungary.

In economic foreign relations the quick turn towards West was taken place already in the early years of reforms. In foreign trade as well as in investments Finland and Sweden are clearly holding the first places. Russia's share compared to the mentioned ones is modest.

Since the Estonian economy after the primary restructuration started to grow, the annual average growth rate since 1995 year has been higher than 5% per year. Considering the post-socialist countries, only Poland has been able to show quicker annual economic growth during the mentioned period.

Economy's successful development has been possible due to the relative stability and improving quality of the economic environment. It is characterized by the stable monetary system (Estonian kroon was pegged to DEM

Keywords for development of economy considering latter years

- Harmonization of business environment, related to Estonia joining the EU.
- Progress in institutional development.
- Accelerating internationalisation.
- Fast concentration process.

and thereafter to Euro), decreased inflation, relatively moderate tax burden[4], high level of the openness of Estonian economy, (for a very long time zero tariffs were used in all products' export and import). According to the index of economic freedom calculated internationally by the Heritage Foundation and the Wall Street Journal in 2002 Estonian economy is considered the freest economy compared to the other post-socialist countries and it even outstrips many developed ones having the same 4th rank as Ireland and the Netherlands (O'Driscoll, et al. 2002).

Estonian economy moved towards internationalization very quickly (included companies going under foreign ownership), but the high dependence from fluctuations in World economy as a feature of such a way of development must be mentioned.

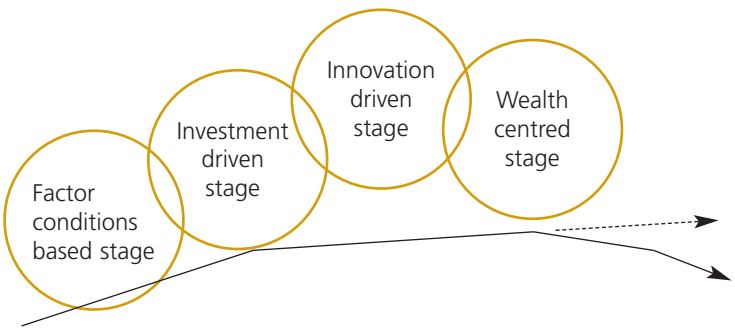
1.2 Estonian entrepreneurship on its way to the new conditions

The structure of Estonian entrepreneurship that changed dramatically in the first half of 1990s considering sectoral terms, forms of ownership and also the proportions of the size groups of companies, started to stabilize in the middle of the decade. Hereafter companies tried to seek for new markets (in addition to the direction of the Nordic countries, also the Russian and Latvian-Lithuanian direction was seen as a possible target). Thanks to the devaluation of currency and to the ability to use partly old infrastructures, Estonia remained a cheap (cheap factors of production) country. In addition, the situation at international monetary markets favored investments.

The economic developments of the 1990s in Estonia as well as in the other post-socialist countries were characterised by a rather rapid productivity growth, but without technology and technological changes playing a central role in it. The increase of productivity was rather boosted by factors like the adoption of elementary skills of production organisation and the use of scale economy (reduction of general expenses by introducing mass production) (Radosevic, 2002; Kalvet, Kattel, 2002). It can be presumed that the ranking of factors of productivity will change in the future.

According to Michel E. Porter's (1985) "competitive advantage development's" four-stage model, in the mid-90s Estonia started to move from the factor condition stage, where existence and price of basic factors are the main source of advantage to the investment driven stage. In connection with inevitable growth of production input prices the innovation centred stage must be the next in the future[5].

Figure 1.2.1 Four stages of competitive advantage development



Factor driven stage – Economy is based on the existence of certain natural resources, which can be exported in a more or less processed form or specific natural conditions (for the growing of certain plans, for tourism), as well as cheap labour. Passive use of technologies available art the international market, usually not particularly sophisticated. In case of need for greater sophistication, a more developed country will create market – key plant. Local firms as a rule have no contact in the international market with end users of production.

4 *Considering single taxes very unique system should be mentioned that concerns corporate taxes: undistributed profit is freed from corporate tax; it belongs under taxation only in the moment when the pay-out of dividends has taken place.*

5 *Placing in the investment driven stage doesn't mean that there can't be any innovative activities. It means that the pattern and scale of the innovation (much less leading edge innovation) is different from the innovation driven stage.*

Investment driven stage – rapid increase of investments in more modern and efficient large-scale production facilities, ability to successfully implement and make properly use of both domestic and foreign, investments, to ensure the necessary labour and other production factors will help on in further development. At the same time the qualification of labour and the quality of infrastructure must increase. Technologies, as well as products will be not only adopted, but also improved. The development level and competition of enterprises will become significant factors. At the same time the cooperation of domestic firms (related and supported industries) has not yet developed, the impact of domestic and home market on economy is low, continuation of successful development will rather presume the need to slow the growth of wages and other production expenses.

Innovation driven stage – Firms not only use and improve technologies and operating methods adopted from outside, but the decisive factor will be the ability to create novel, i.e. principally new products, technologies, methods. Not the economy of expenses (incl. wage expenses) is central, but the increase of productivity based on high qualification and novel solutions. A characteristic feature is the interconnection of related and supported industries, the emergence of so-called deep clusters. Usually, the share of international services besides products will increase in the export of countries in this stage of development. The stimulating impact on economy of the domestic market with its increasing purchasing power will also grow. The economy of the country becomes many-faceted and thanks to the high innovativeness, well adaptable to the changes of the international market situation.

To some extent the situation in Estonian economy was changed by the setbacks of Asian and Russian crises. After the devaluation of rouble, the export to Russia was lost, at least for a while. Emerging markets lost temporarily their attractiveness for the investors. International external demand was withdrawn. Estonia experienced the crash of stock exchange and some bank crises (fortunately not in the biggest banks). Because of these events, many companies that had cultivated expansive growth politics were struggling in difficulties due to overinvestments and resulting liquidity problems. Local owners were forced to sell their companies to foreign owners in order to avoid the worst. (In addition many companies experienced the problems in their capacity in keeping or increasing the rate of their competitors in globalising world and took the same course.) Quite clear ownership structure was formed in Estonia: big enterprises (and leader companies) were dominantly in foreign ownership, SMEs had dominantly domestic owners.

Strategically speaking, this kind of shift in ownership structure was important, but didn't change the companies' behaviour fundamentally. True, that helped companies located in Estonia to join the international chains and clusters more easily; otherwise mainly the logic of factor condition and investment driven stage was continuing. The conditions for getting finances improved, but obtaining labour force with needed qualifications (at the same time the education level of labour was relatively high), sometimes low international competitiveness and not sufficient productivity, remained the main limiting factors. Initially the production factors are relatively cheap but the prises are starting to rise. Joining the EU in near future is accelerating this process; but the Estonian companies still remain to perform "cheap labour and cheap resourced based functions" in international co-operation, mainly subcontracting works or the primary manufacturing stages of raw material. **Estonia as a country joining the EU has no possibility to stay a cheap country performing cheap processes of work. In order to not lose its competitiveness in international markets, Estonia has to move towards the next developing stage, towards the stage of innovation driven economy**.

The European Commission Enterprise Directorate-General has mentioned in the survey of innovation systems' developments in candidate countries: "EU enlargement requires that the economies of the candidate countries evolve and adapt to the pressures and opportunities of increased competition and integration with the technologically more advanced economies of the EU. Innovation has logically a key role to play in these conditions." (European Commission (1), 2001)

1.3 Substance of innovation

1.3.1 Enterprises' capability for innovation

Previous chapters described that the Estonian economy is in the stage driven by investments and therefore the competitive advantages for the companies lie more in cheap labour and raw materials costs[6], and the effectiveness is raised with the approved technology not with the development of new products and services. This trend found confirmation in this innovation survey as **half of the innovating companies did it through machinery and equipment acquisition**. Our situating on this investment driven stage is natural and there is nothing wrong with it, but how long will it take us to reach to the next more wealthy level depends a great deal on our companies' involvement in innovative activities. Prevailing competitive advantages of this stage of development are diminishing, because of the rising prices of labour and local raw materials, the joining with the EU even accelerates this process of price convergence. So the option left is the development of new products, services, processes.

Today where are very few companies in Estonia who are capable of dealing with the development of new products in the firm. The Estonian companies can be classified according to their different levels of capability. A majority of the firms belong to the two lowest steps, which are (a) low-tech and minimum capability SMEs and larger traditional firms, some of them outsourcing testing, measurements and other short-term development work, mostly on an informal basis; (b) subcontractors for foreign firms, whilst this brings in good income in the short-term it is not good longer-term – as costs rise, production will shift elsewhere and unless companies have new, value-added products which will sell internationally they will then be in trouble (De Jager et al, 2002).

Figure 1.3.1 The competence staircase

Research performers	▪ research department or equivalent ▪ able to take long run view of technological capabilities
Technological competence	▪ multiple engineers ▪ some budgetary discretion ▪ able to participate in technology networks
Minimum-capability companies	▪ one engineer ▪ able to adopt/adapt packaged solutions ▪ may need implementation help
Low-technology SMEs	▪ no meaningful technological capability ▪ no perceived need for this ▪ may be no actual need

To climb up on these staircases companies should look over their strategies of action, to analyse their capacity and find the way, how to raise it. It doesn't mean that all the companies should do research in the firm, but they could cooperate in the networks, which include the research and development enterprises.

What is actually expected the companies to involve in to raise their own and whole Estonian competitiveness is described with the following concepts related to research and development (R&D) and innovation processes.

1.3.2 R&D in innovation process

The marketing of the new products and implementation of the more effective technologies depends on how well the science and all system of the research and development activities (R&D) are functioning. This is a whole pervasive cycle through tightly related stages of basic and applied research, marketing and other interim stages ending up with the marketable product/service or implementation of the new technology. Some parts of the R&D process is done in the producing enterprise: it's **intramural R&D**, done by the company's own employees. Great share of the research are done outside the enterprise – **extramural R&D** – by the research institutions, special laboratories, etc. Also such R&D related services like design, testing, patent surveys, market surveys etc could be bought outside the company.

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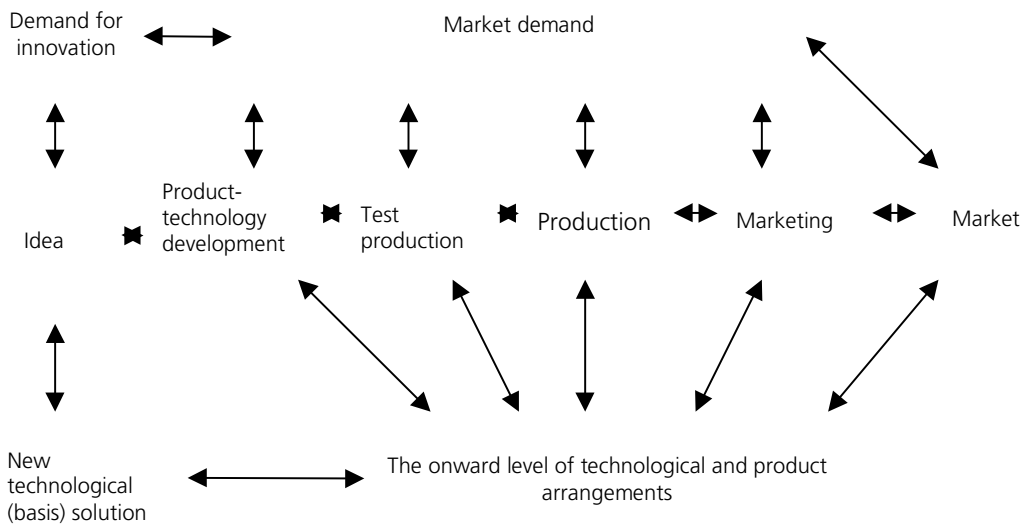
[6] *Survey of Exporters show that ca 54% of them estimated the cheap production input to be their main competitive advantage (Eksportööride uuring 2001, 2002).*

How much of the R&D activities are done in-house and how much are bought outside depends on the company's strategy. An enterprise or a concern which has bet on being first in the market with the new product or service ("the offensive strategy"), but also the enterprise whose survival depends on the market defense against the previously mentioned attackers ("the defensive strategy"), the fundamental research might be expedient, not even mention the applied research, experimental development and design engineering. The company with "imitating strategy" doesn't do the research itself, but it has to be successful in gathering the scientific-technical information and fulfilling the production engineering quality control. Traditional, technologically slowly developing sectors only the production engineering and making small changes in technology would be enough (Freeman, Soete, 1997). The last strategy is characteristic to the companies in the investment driven stage of economy and therefore also to the Estonian enterprises.

Differently act only some spin-off firms which have spun from research institutions, and who have specialized to the research or testing in spite of mass production. There is only small number of such enterprises in Estonia now and the number won't increase substancially in the near future. But there has been seen already some examples of the foreign owned companies whose parent companies abroad have given some of the R&D functions to their local sub-structures in Estonia, for example by founding the engineering centres by them. This example could devolve after some time to the Estonian firms as many other good practices and know-how of the foreign-owned companies have done by now.

Only some decades ago the R&D process was seen linearly – the series of step-by-step following stages, which started with basic research and ended with marketing of the product or service. This linear model is thoroughly changed for today because of the tightening competition, complication of the products and services and globalization of the economy. Now there is an understanding that all the stages of R&D cycle act in the conditions where they are influenced both by the demand-pull and the technology push. So they have to adapt to these two factors and also with the influences coming from the stages back and forward of them. The process is strongly feed-backing and the simplified scheme of it is reflected in the figure. It is so-called **coupling model** (Roswell, 1992).

Figure 1.3.2 Process of research and development



It is very important to notice that the actions described in the boxes in the middle of the scheme do not initiate only on the arisen need and existing technological bases, but also influences them actively: the new products need the new conditions, the new challenges push the whole technological level.

It is clear that without the existence of R&D or in other words "the ideas generating sector", neither innovation nor the related further economic growth are possible in any developed economy. On the other hand, it would be clearly one-sided to presume that it is sufficient to have R&D as a passive "reservoir" and elementary interest of the enterprises towards drawing from it, resulting in an almost automatic introduction of new products and technologies. Actually, success in the practical realisation of innovations depends on a number of factors as well as interconnections between these factors. This system of mutually connected factors forms the given country's or region's innovation capacity. A large number of the innovation capacity elements is located

outside the R&D system or is connected with the latter only indirectly (organization of retraining of labour, existence of individuals with technical education, access to credits etc.). Part of the innovation capacity elements are within the private sector, another part is associated with the level of the country's public services, some are "in between" the private and public sectors. **To conclude, the presence of a well developed innovation capacity will ensure, besides the R&D supply and the enterprises' demand also the absorption and diffusion capacity necessary for the implementation of innovations (Radosevic, 2002)**.

1.3.3 The definition of the innovation

In this survey we don't concentrate to the R&D activities in the enterprises – the key issue is **innovation**. The concentration on innovation draws attention to the application connected questions and to the broader organizational and social context. Innovation in broader sense is the adoption of the new ways of acting by certain social communities, which are suppliers, involved organisations and subunits, groups and persons. **In literature the innovation is usually divided into 3 types: product innovation, process innovation and organizational innovation**. As rule these three parts are not isolated from each other. The innovation process doesn't change only products/services/technology and profits of the parties involved, but also the structure of the parties' relationship, information networks, the networks of common activities, etc. Not considering all this and dealing narrowly with the engineering and/or economic aspects of the development of product/service or technology, it is not possible to succeed. Therefore the survey paid a lot of attention to the different questions of cooperation: from where the information was received; with whom the innovations were developed; what were the effects of innovative activities; how did the public sector support the enterprises; etc.

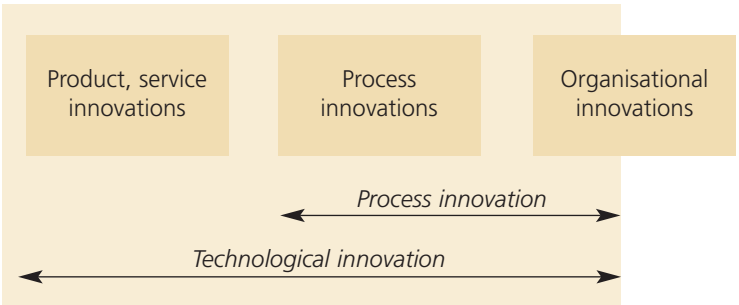
Product innovation – In 2001 United Diaries introduced new line of sour milk drink "HAPS". This product was based on new technology and was also new for the consumers market.

Service innovation – EMT (Estonian Mobile Telephone) introduced in 2000 "the mobile parking system" in Tallinn. This enables to pay for the car parking via mobile phone by using SMS solutions.

Process innovation – The use of CAD/CAM systems in furniture producing has optimised the production processes and raised the quality of the products.

In the survey the term of innovation is more stringent in order to give clearer indicators for analysis. The innovation is treated as **technological innovation**, which involves product and process development and limited share of organizational innovation activities like marketing and training directly related to the implementation of new product, service or process (see Figure 1.3.3).

Figure 1.3.3 Content of the term "technological innovation"



The other important changes in enterprises concerning organizational, structural, managerial, strategic and marketing issues are treated as an independent topics i.e. outside of the key definition of innovation, but these changes play an essential role in raising the innovativeness of the companies and thereby raise their competitiveness.

In the survey we define innovative enterprises (innovators) as the ones who have brought new or improved products/services to the market or have implemented new or perfected processes during the period of 1998–2000. This is the narrow approach to the innovation. The term presumes also the conformation to the market not only the preparation of the product prototype or technology. **On the other side the technological innovation does not presume the basic or even applied researches; the idea for new**

product/service or processes might be taken over or obtained from practical experiences – the important thing is that the new product/service or process is new to the market or to the enterprise itself.

The definitions (see also Appendix 2):

Technological innovation – implemented technologically new products, processes or services and significant technological improvements in products, processes or services. It requires an objective improvement in the performance of a product or in the way in which it is produced or delivered. An innovation has been implemented, if it has been introduced on the market – **product innovation**, or used within a production process – **process innovation**. The product, service or process should be new (or significantly improved) to the enterprise, but does not necessarily have to be new the enterprise's market.

Innovators (innovative enterprises) – enterprises that has introduced new or improved products or services on the market or new or improved processes. Enterprises can have innovation activity without introducing an innovation on the market (it may either have unsuccessful or not yet completed innovation projects).

Research and experimental development (R&D) – creative work undertaken on a systematic basis in order to increase the stock of knowledge, and the use of this stock of knowledge to devise new applications, such as technologically new or improved products and processes. Construction, design and testing of a prototype is often the most important phase of R&D. Software development is included as long as it involves a scientific or technological advance. R&D can be carried out within the enterprise or R&D services can be acquired.

R&D includes basic and applied research and technological development:
Basic research or fundamental research – original work, the aim of which is to obtain new scientific knowledge. It is not mainly directed to a specific practical end or application.
Applied research – original work, whose aim is to acquire new scientific or technical knowledge. It is, however, geared to a specific, practical objective.
Technological development – making use of existing scientific knowledge to produce new or to improve existing materials, devices, products, processes, systems or services, and includes the production of prototypes and pilot plants.

Intramural R&D – research and experimental development is carried out within the enterprise.

Extramural R&D – acquisition of R&D services.

Innovation expenditure intensity – the total innovation expenditure as percentage of turnover.

A new product – a product, which is new to the enterprise and significantly different from previously produced products in terms of purpose, performance, characteristics, theoretical properties or the raw materials and components used in its manufacture. This type of product can be obtained by using completely new technology or existing technology in new ways.

The improved product – an existing product whose performance has been significantly improved. There may be two types of such product: a) a simple product can be improved (better performance, lower costs) by using more efficient components or materials; b) a complex product, comprising various sub-systems, van be improved by making partial changes to one of those sub-systems.

The process innovation – new or significantly improved production methods. Such innovations may stem from changes in equipment or in production organization, or a combination of both. The purpose of the introduction of such methods may be to produce new or improved products, which cannot be obtained through the use of conventional plant or production methods or to improve manufacturing efficiency for existing products.

1.3.4 Innovation policy

It is possible that in post-socialist countries as the reaction to the previous socialist ideology somewhat primitive and market fundamental view is permeated that innovation is the issue of micro-economy: the government should provide the functioning of the market and more-or-less stable macro-economic environment then the market forces (competitiveness) would trigger the innovative behavior of enterprises that they could survive. The life has shown that this way of thinking is valid only in the case of simple innovations, which enterprises are able to prepare and implement without larger groundwork. In more complicated cases the cooperation between different institutions is needed, and the public sector has its role there. Post-socialist countries have also started to compile the national innovation systems and –policies. Whereas the "narrow approach" to the national innovation policy which foresees some intermediation in the aggregating, managing and dividing of the science solutions is not enough. "The broader approach" of the raising of innovatory spirit and development of innovation culture of the whole society is needed. Today the most of the launched public programmes and financial schemes have been targeted to the small group of R&D managing institutions (spin-off firms of universities, new technology-based firms, institutes, etc), but the majority of the enterprises in Estonia belong to the technologically low intensive sectors (food, wood and apparel manufacturing, services) and maintenance of their competitiveness in the future necessitates the severe interfering from the public sector. This survey gives good bases to develop the needed public support programmes.

2 Description and Analysis of Innovation Survey

2.1 General information about the survey

2.1.1 The methodology

The survey conducted in Estonia, by the Statistical Office of Estonia, describing the innovative activities of enterprises is based on the methodology of the EU innovation studies – **Community Innovation Survey**. According to the Community Innovation Survey (CIS) methodology, the survey has been held in the European countries three times after every four years. The latest or CIS3 was held in 1998–2000 and Estonia participated in that as the sole post-socialist country. The results of that survey are reflected in this publication. Comparisons with other countries are here based on the CIS2 results, since the CIS3 data analysis process has not been completed yet.

The population of the survey were economically active enterprises in Estonia in 2000 as defined in the statistical profile of the Statistical Office. If it was for some reason impossible to define an enterprise as a statistical unit, other units like groups of enterprises were used (the respondents included three groups with two enterprises). The sample of survey was formed in compliance with the EUROSTAT methodological recommendations based on the statistical profile of the Statistical Office by two main characteristics – main economic activity and number of employees. Taking into consideration the small size of Estonia, the survey was conducted as **total** survey in the framework of economic activities in the sample.

The enterprises in the sample were distributed to structural subgroups or strata by two basic characteristics. By code of economic activity, the characteristics of belonging into the stratum was NACE two-digit code (excl. code 74 of which two strata 74.2 and 74.3 were formed) and by the number of employees.

The preliminary sample of the basic survey included 3,571 enterprises and the survey on small enterprises included 872 enterprises. The response rate was rather high – 74.3% in the basic survey and 65.1% in the small enterprises' survey. The average response rate of the EU in the previous innovation survey in 1997 was significantly lower – only 57%. **As the Estonian survey was a total survey in the framework of the sample after considering the changes 3,490 enterprises remained in the sample of the basic survey and the number of (micro) enterprises in the small enterprises' survey was 777**.

The questionnaire of the survey coincided with that of EUROSTAT. Some of non-obligatory questions were left out, some questions that arose local interest were added – distribution of market area between the East and the West, evaluation on the innovative services of the state and on information of these services.

In the analysing process the weighed sample was used.

2.1.2 The sample of the study

The sample of the survey comprises mining and quarrying enterprises, manufacturing enterprises and service enterprises with the following economic activities:

Table 2.1.1 Number of enterprises in the survey, 1998–2000

Activity	*Number*	*Share, %*
Mining and quarrying	38	1.1
Manufacturing	**1828**	**52.4**
food products and beverages	235	6.7
textiles, wearing apparel, dressing of leather	319	9.1
wood products, pulp & paper, printing	426	12.2
chemicals, rubber, non-metallic mineral products	166	4.8
basic and fabricated metal products	168	4.8
machinery and equipment	188	5.4
furniture	140	4.0
recycling	3	0.1

Services	**1624**	**46.5**
electricity, gas and water supply	143	4.1
wholesale trade	682	19.5
transport, storage and communication	521	14.9
financial intermediation	60	1.7
computer and related activities, research and development, architectural and engineering activities, technical testing and analysis	218	6.2
Total	**3490**	**100.0**

By number of employees, the CIS3 carried out in Estonia included all enterprises with 10 and more employees in the abovementioned economic activities.

Table 2.1.2 Number of enterprises by size, 1998–2000

Number of employees		*Number*	*Share, %*
Small	10–19	1605	46.0
	20–49	1136	32.6
Medium	50–99	419	12.0
	100–249	212	6.1
Large	250 +	118	3.4
Total		**3490**	**100.0**

We can divide enterprises also by belonging to a concern and by foreign equity. 72% of firms do not belong to a concern, 5,5% are parent enterprises and others are subsidiaries of Estonian parental enterprise on half of the cases and (by decreasing share accordingly) of Finnish, Swedish, Danish, German and USA origin of the mother company. The share of involvement of foreign equity increases with the size from 22% among small firms to 47% among large ones.

Table 2.1.3 Enterprises with foreign equity by size, (%), 1998–2000*

	Without foreign equity	*With foreign equity*	*foreign equity under 50%*	*foreign equity 50–99%*	*foreign equity 100%*
Total	**7.1**	**25.9**	**5.5**	**9.5**	**(10.9)**
Small	77.7	22.3	4.7	8.4	(9.2)
Medium	62.0	38.0	8.9	12.6	(16.5)
Large	53.0	47.0	(7.1)	(19.2)	(20.4)

** The indicators in bracets are based on less than 40 responses.*

The same effect has also the increasing turnover: the larger the company by the number of employees, the bigger the turnover. 77% of large companies had turnover 100 million kroons and more in 2000, among small enterprises the share was only 4%. As the share of the small companies in the sample is the highest half of the enterprises had turnover between one and ten million Estonian kroons.

Table 2.1.4 Turnover and share of exports in turnover by size, (%), 2000

	Net turnover				*Share of exports in turnover*			
	> 1 mill.	*1–10 mill.*	*10–100 mill.*	*100 mill. <*	*> 10%*	*10–50 %*	*50–90 %*	*90% <*
Total	**4.4**	**47.9**	**39.2**	**8.5**	**53.6**	**16.5**	**16.5**	**13.4**
Small	5.5	57.9	32.9	3.6	58.1	15.9	13.8	12.2
Medium	(0.2)	13.2	69.7	17.0	37.2	18.8	26.0	18.0
Large	–	(0.8)	(22.0)	77.1	36.8	15.7	30.6	16.9

The survey on small enterprises covered enterprises with 3–9 employees in the following economic activities (with the exception of "Research and Development" where at the request of the customer also enterprises with 0–2 employees were questioned):

Table 2.1.5 Number of enterprises surveyed in small enterprise study, 1998–2000

Activity	*Number*	*Share, %*
Manufacture of chemicals and chemical products	26	3.3
Manufacture of rubber and plastic products	29	3.7
Manufacture of other non-metallic mineral products	40	5.1
Manufacture of machinery and equipment n.e.c.	75	10.0
Manufacture of electrical machinery and optical instruments	79	10.2
Transport, starage and communication	24	3.1
Financial intermediation, except insurance and pension funding	81	10.4
Computer related activities, research and development, engineering activities, technical testing	423	54.4
Total	**777**	**100.0**

By the size half of the enterprises had 5–9 employees, 47% had 3–4 employees and only 2% have even less people working in the firm.

2.2 Innovators: who they are?

Answering to the abovementioned question we have to follow the definitions. Only after that we may reach to empirical conclusions about the typical profile of the innovators.

According to the definition[7], in the framework of survey the enterprise which in 1998–2000 has brought new or essentially improved products (goods/services) to the market or taken into use new or essentially improved technological processes or supplying or marketing methods is considered an innovative enterprise. In addition to this, innovative is taken also the enterprise where in 1998–2000 the started projects of innovation were not completed yet or they were abandoned without finishing them. Innovators can be divided as product or process innovators, and by the products/services novelty only to the firm himself or also to the market.

Among innovators a group of enterprises can be distinguished which in 2000 had innovative expenditures in order to characterise the present situation of 2000 and the consistency of innovative activities.

On the bases of the empirical study it has been concluded that:
- One-third of enterprises developed new or improved their products or technological processes;
- Estonian enterprises were a bit more product innovative than process innovative;
- Half of innovators develop their innovations themselves and quarter with cooperation with others;
- 14% of all innovators introduced products also new to their markets. Among the product innovators, the share of novel innovators[8] was 52%;
- 16% of enterprises has uncompleted projects and 4% has abandoned their innovation project.

2.2.1 How many firms innovate?

The former studies in European countries have shown the share of innovative enterprises up to half of the population, the manufacturing sector has been more innovative and the service sector about 10 percentage points less innovative (Figure 2.2.1). The structure between manufacturing and services is the same in Estonia, but both sectors are less innovative than the European average shows. **Anyway the Estonian indicators are surprisingly good compared to the EU states CIS2 results from 1996. But it is not enough to compare the indicators, we should also try to look what is behind these numbers** and find out who are the innovators in Estonia and what kind of innovations they carry through.

One must be very careful to compare the different countries, because the countries are situated in the different developmental stages and also they have different culture of entrepreneurship in addition to the variations in the structure of the states' economy.

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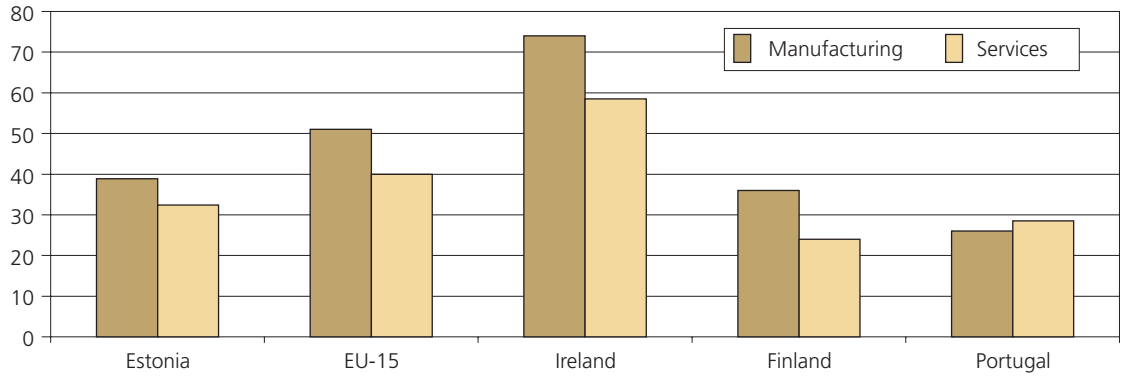
7 *Deffinition of innovation doesn't presume the R&D and most of Estonian companies don't deal with intra- or extramural R&D (see Chapter 2.3). According to Porter the majority of the enterprises start to think about R&D only then the market competition has tightened so much that it's hard to survive without it.*

8 *Novel innovators – the product innovators, whose product was also new to their market.*

Figure 2.2.1 Number of innovative enterprises, (%), Estonia 1998–2000, EU countries 1996



Regarding the question on the low Finnish innovation figures in the CIS2, our interpretation is that they do not properly describe the situation. In the CIS2 we used phrasing technological innovation 'teknologinen innovaatio', which, we think is in the Finnish language too restrictive, producing too low figures. In German or English the word "technological" is perhaps not so strong. In CIS3 we do not have the word technological in the title of the definitions and it seems that our figures will be higher. It remains to be seen, how it will be in comparison with the other countries.
/Ari Leppälahti – Head of the Unit, Statistics Finland/

Additional explanation of cultural differences in understanding the definitions the Finnish study showed, there were a lot of companies doing R&D, but did not claim to have introduced innovations and extremely few which claimed innovations, but had not declared any R&D. In other countries there were a lot more companies claiming innovations without any R&D.
/Jari Romanainen – TEKES/

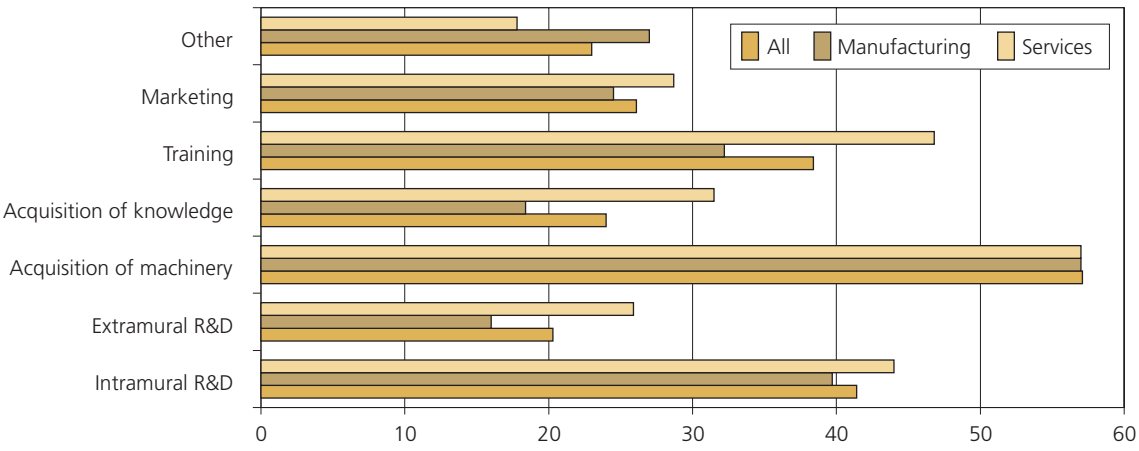
The share of innovative enterprises in total population in Estonia is 36%, but if we observe only enterprises with the innovation expenditures in 2000 the number decreases to 29% (Table 2.2.1.). However one might argue that the expenditures were made also in 1998 and 1999.

Table 2.2.1 Number of innovators (%), 1998–2000

	Manufacturing	*Services*	*All*
Innovators	39	32	36
With innovation expenditure in 2000	30	27	29

From the classification of enterprises by the type of innovative activity (Figure 2.2.2) it is seen that Estonian enterprises have several common features with those for the European Union according to CIS2. Consequently, the share of training in services is significantly bigger than in manufacturing. Purchasing of machinery and equipment is the most essential type of activity. **The greatest difference is that in Estonia service enterprises are more eager to do R&D than manufacturing enterprises, in the EU the situation was the opposite**.

Figure 2.2.2 Innovators by type of innovative activity, (%), 2000

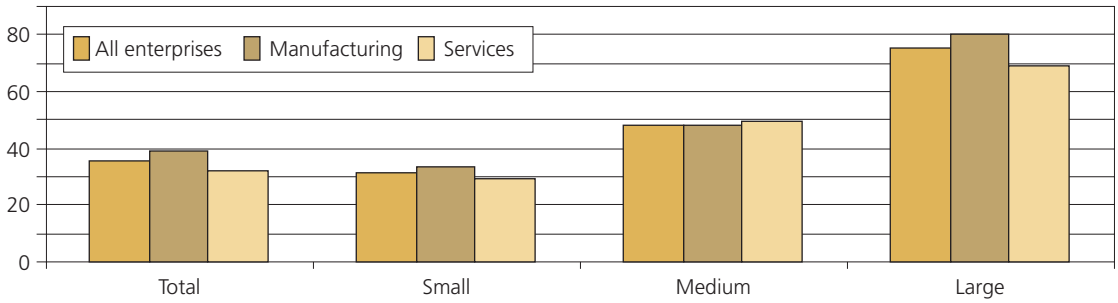


As seen on the figure Estonian services are much more involved in almost all kinds of innovative activities except acquisition of machinery and some other types of actions, but the share of innovators among services was lower than among manufacturing enterprises. **It indicates that in Estonia the service sector is innovating somewhat more complex way than manufacturing sector enterprises**. In the following chapters we see some more indicators to confirm this result.

2.2.2 Typical innovators: who they are?

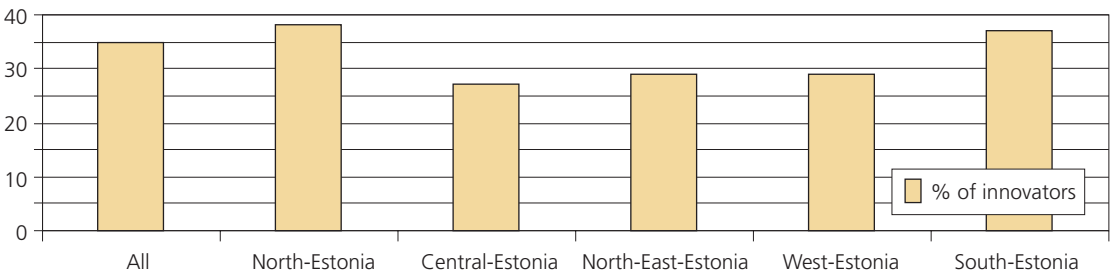
The study results show that the bigger the number of employees or net turnover, the highest is the probability that enterprise is innovative. The same connections were observed in the results of the European Union CIS2 survey for the years 1994–1996. Innovation of enterprises with more than 250 employees is comparable with the corresponding indicator of the EU average four years ago, but in the case of smaller enterprises the corresponding indicator is somewhat lower. In industry as a whole (enterprises with 20 employees and more)[9], in Estonia the innovation was 45%, in the EU – 51%.

Figure 2.2.3 Number of innovators by size, (%), 1998–2000



It is not surprising that the share of innovative enterprises is the largest in Northern Estonia[10] (Figure 2.2.4), first and foremost thanks to Tallinn where in 2000 every third enterprise had innovation expenditure and where about half of innovative enterprises according to the basic survey were located. Almost as active are the enterprises of Southern Estonia, it is mainly thanks to Tartu city, the centre of this region. These two mentioned cities are also the main research centres of Estonia as the main universities situate there, therefore they have the greatest potential for R&D cooperation networks between enterprises and institutions, which are hardly used now as seen from Chapters 2.6 and 2.7. One might mention that the general entrepreneurship intensity indicators[11] of these regions are also substantially higher than in average of Estonia. The level of innovation was lower in Central and Western Estonia where in the year 2000 every fifth enterprise had innovation expenditure. North-Eastern Estonia remained between the two extremes with every forth enterprise's innovation expenditure (see also Chapter 2.3).

Figure 2.2.4 Number of innovators by location, (%), 1998–2000



9 *CIS2 survey involved manufacturing sector enterprises with 20 employees and more.*
10 *See the used regional division of Estonia in Appendix 1.*
11 *Indicators such as the number of enterprises per 1000 inhabitants, new enterprise formation in a year, etc.*

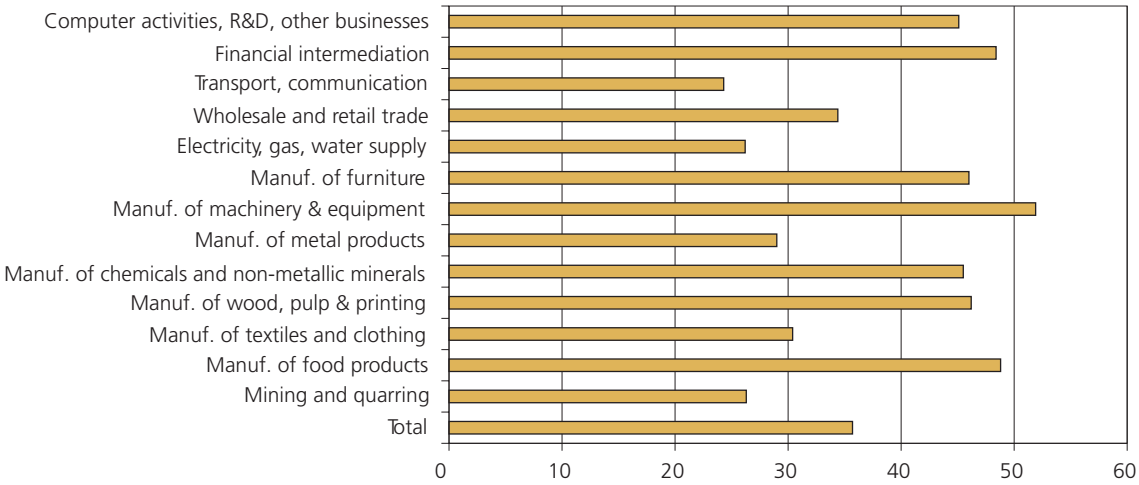
Share of innovators (%), 1998–2000

	Innovators	*With innovation expenditure in 2000*
TOTAL	**35.7**	**28.5**
By economic activity:		
Mining and quarrying	26.3	18.4
Manufacturing	38.9	30.4
Services	32.4	26.6
By number of employees:		
Small 10–19	27.6	21.8
20–49	36.2	28.1
Medium 50–99	45.2	35.7
100–249	54.5	45.2
Large 250+	75.4	68.0
By belonging to a concern:		
Not belonging	29.6	23.0
Belonging	51.4	42.5
parent enterprises	51.8	44.8
subsidiary enterprises	51.2	41.9
By foreign equity:		
No foreign equity	31.9	25.5
With foreign equity	46.7	37.2
till 50%	41.3	34.5
over 50% to 100%	44.5	36.6
100%	51.3	39.1
By most significant market:		
Local in Estonia (within 50 km radius)	27.4	22.5
Local with border territories of neighbouring countries (within 50 km)	31.9	26.6
National (over 50 km radius)	38.6	30.3
International	39.1	31.2
Eastern markets	41.8	38.0
Western markets	38.7	30.2
By turnover:		
below million kroons	20.1	11.1
from million to 10 million kroons	27.5	21.5
from 10 million to 100 million kroons	42.3	33.9
over 100 millon kroons	60.0	52.4
By share of export in turnover:		
below 10%	34.0	26.9
from 10% till below 50%	39.9	33.0
from 50% till below 90%	38.1	30.7
90% and more	34.8	26.5

The most innovative economic sectors in Estonia are financial intermediation, computer and R&D related business from the service side and manufacturing of machinery and equipment, food production, furniture and wood production from the manufacturing side. Financial enterprises in general are active and expansive ones in Estonia and outstanding especially in implementing the new ICT solutions. Also among the machinery produces the biggest innovators are the tele- and communication apparatus developers and producers of the medical-optical instruments. More closer look to the innovation behaviour of different sectors is given in Chapter 3.

It can be observed that enterprises with foreign capital are 1.5 times more innovative than enterprises without it. The enterprises that belong to a concern are almost two times more innovative than those outside the concerns. The first mentioned result is not unique one as several survey conducted in other Central and Eastern European countries have also indicated that the foreign capital is the leading agent of the innovation in post-socialist countries (Radosevic, 1999). The second conclusion is also rather logical: the small enterprises are usually not capable to carry out serious innovations on their own.

Figure 2.2.5 Number of innovators by activity field, (%), 1998–2000



By the type of dominating market, enterprises with domestic and foreign orientation are practically on the same level of innovativeness (accordingly 38.6% of all enterprises and 39.1%), but the share of innovators among the enterprises oriented to the local market (within 50 km radius) is by quarter lower (27.4%). Consequently it can be stated that the demands of Estonian national market are as high as those of international market. **It is surprising that enterprises oriented to the Eastern (Russian and CIS) market are even more innovative than those oriented to the western market (accordingly 41.8% and 38.7%)**. 38% of the enterprises oriented to the eastern market has made innovation expenditures in 2000 and only 30% of the western orientation firms has done the same. The abovementioned empirical results are rather surprising as usually the western markets are presumed more demanding compared to the eastern market. One possible explanation could be that some enterprises working for western oriented exports are based on rather stable products, which do not need frequent changes. And if the innovations are made the innovation costs are carried by the parent companies or clients. In Russian and CIS markets there have been more rapid changes and turbulence in recent years and adaptation to these changes has initiated some types of innovative behaviour. The dominantly export oriented enterprises, but such enterprises are mainly oriented towards the Western market in Estonia, are not as a rule very innovative ones. If the share of export is over 90%, the intensity of innovation is lower than in the enterprises (especially manufacturing) where the share of exports is 10% – 90%.

Table 2.2.2 Number of innovators by share of exports in net turnover, (%), 2000

	< 10 %	*10–50 %*	*50–90 %*	*> 90 %*
All	**34.0**	**39.9**	**38.1**	**34.8**
Manufacturing	34.8	45.2	41.7	37.9
Services	33.4	31.1	29.7	30.0

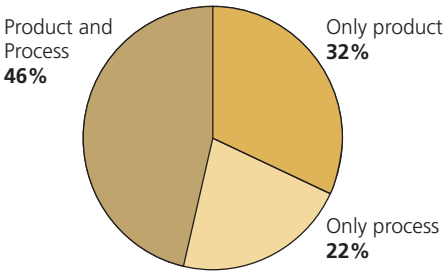
EU average from CIS2 1996 showed that the biggest exporters of manufacturing sector are also the biggest innovators[12], but the service sector behaved in opposite way. Estonian service sector is also more innovative in the home market.

2.2.3 Product or process innovation?

The enterprises could be divided into three groups according to their involvement in technological innovations: (a) only product innovators, (b) only process innovators or (c) product and process innovators. Almost half of the innovative companies do both: develop their products together with processes (Figure 2.2.6).

[12] *According to the results of CIS2 (1996) in the EU-15 countries the share of innovators in manufacturing sector by export intensity: less than 10% – 52%, 10–40% of exports – 58%, over 40% of exports in total turnover – 61% of innovators.*

Figure 2.2.6 Relative distribution of product and/or process innovators, (%), 1998–2000



If we compare the Estonian manufacturing enterprises (20 employees and more) with the ones of CIS2 for Europe, **we'll see that the Estonian producers are more active in the process innovation. The share of enterprises with only process innovations was 20% of all innovators of Estonian manufacturing sector against the 12% of the same indicator of the EU**. 49% of Estonian producers develop their products and processes parallelly. This indicator is 15 percentage points lower than the same number of EU (64%) from 1996. It might be considered that the innovation activities of the enterprises in the Western countries are somewhat more fundamental than in Estonia. Is the reason in smaller capabilities and resources of the Estonian enterprises or in weaker pressure from the business environment – this needs additional studies. The bigger share of process innovators compared to EU could be explained in some extent with the need of the manufacturing enterprises to assign their producing processes with the EU regulation and requirements.

Estonian service enterprises used the combined (product + process) innovation activities more often than manufacturing companies. The latter result is not trivial: this might indicate to **the relatively advanced pattern of the Estonian service sector in general** which is represented by commercial banks and other new services companies which were founded in the 90-ies. Or, in some extent, it may reflect nature of innovation in services where it could be harder to introduce only product without changing process.

Table 2.2.3 Number of product or process innovators (%), 1998–2000

	All innovators	*Product innovators*	*Product innovators only*	*Process innovators*	*Process innovators only*
Total	**36**	**27**	**11**	**23**	**8**
Services	32	23	10	20	8
Manufacturing	39	30	12	26	8

Of the net turnover of product innovation enterprises new or essentially improved products accounted for 26% and new products for market of the enterprise made up 12% (in manufacturing the corresponding figures were 29% and 11%). So the share of novel innovators among the product innovators was 52% (in manufacturing – 46%). In manufacturing the average indicator for European Union according to the CIS2 data was also 48%, but it differed greatly by countries (see also Chapter 2.3).

2.2.4 Innovation developers – enterprises themselve?

There are no big differences between product and process innovations by the breakdown of innovation developers involved: half of innovative enterprises do it themselves, almost a quarter with cooperation with other parties and the rest is on an equal level done by concern or by other enterprises and institutions (Table 2.2.4.). Manufacturing and services differ slightly, in product development service enterprises are more active than manufacturers, in process development the opposite trend can be observed. The breakdown of the involvement of actors in innovation development in general is similar to that of the EU.[13] At the same time **we can't observe in Estonia the trend of EU countries, that process innovation to a larger extent relies more than product innovation on externally developed mechanisms. It holds only for Estonian service sector. The situation in the Estonian manufacturing sector is rather reversed**. Probably the explanation is in the high share of subcontracting works in the manufacturing enterprises as a result of which the new products are probably worked out by the parent company or in co-operation with the clients (see also Chapter 2.6 for cooperation partners).

[13] *Direct comparison with CIS2 results for Europe is difficult as the question about the role of concerns was not included in it.*

Table 2.2.4 Number of enterprises according to who developed the innovation, (%), 1998–2000

	Product development								*Process development*							
	in enterprise		*in concern*		*in co-operation*		*outside*		*in enterprise*		*in concern*		*in co-operation*		*outside*	
Total	**54.4**		**12.8**		**21.9**		**11.0**		**52.6**		**11.1**		**24.2**		**12.0**	
Manufacturing (M)	61.9		11.6		19.0		7.5		57.3		11.3		20.2		11.2	
Services (S)	43.2		14.7		26.2		15.9		46.2		10.5		30.2		13.1	
	M	*S*	*M*	*S*	*M*	*S*	*M*	*S*	*M*	*S*	*M*	*S*	*M*	*S*	*M*	*S*
Small	65	41	7	14	19	25	7	17	61	46	5	10	20	27	12	16
Medium	55	42	18	16	18	30	8	10	51	49	18	12	19	34	9	4
Large	60	71	14	7	18	14	6	7	49	39	23	5	19	50	7	5

In the comparison of industry and services a difference in intensity of cooperation can be noticed. **Services firms develop their innovation projects significantly more frequently in cooperation with other enterprises and/or organisations**. At that the activity of cooperation in services greatly depends on the size of the enterprise: the larger the firm, the less is there cooperation in product/service development and the more in processes development. In industrial firms 1/5 of the enterprises cooperated with the others in the development of processes or products regardless their size. **Therefore the Estonian services firms have better developed cooperation strategies than the industrial enterprises: common processes enable them to reach more efficiently to the markets, where they compete in products and services**.

2.3 Innovation activities and expenditures

The process of innovation encompasses wide range of activities: research and technological development, knowledge creation, diffusion, absorption and use of technology. Complex process of innovation includes learning, developing and marketing of the new products and improving production process. The innovative activities belong to two main groups: creation and maintenance of intangible assets and acquisition and embodying of tangible assets.

Intangible assets
- organisational skills
- human capital
- exploration and creation of markets.

Tangible assets
- fixed capital
- intermediate goods
- technologies

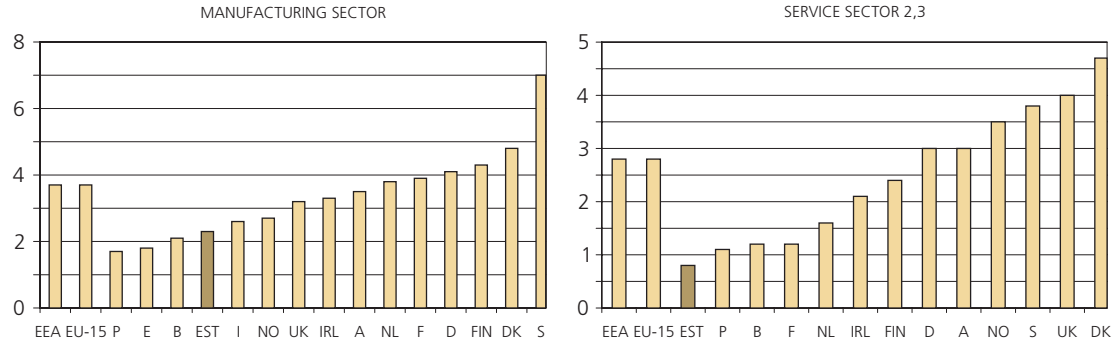
It has been concluded that:
- In 2000 manufacturing enterprises spent 2.3 % of their turnover to innovation, service firms only 0.8%.
- Electrical equipment producers had the highest innovation expenditure intensity in the manufacturing sector, the same stands for engineering and architectural service activities in service sector.
- Acquisition of machinery is the most important single component of innovation.
- 61% of manufacturing and 57% of service innovators have not been engaged in intra-mural R&D activities.
- There is a tendency for large enterprises to be engaged in R&D both in manufacturing and services.

2.3.1 Innovation activities

Innovation is complex process involving both technical and commercial activities. Innovation activities could be carried out within the firm or out-sourced from other institutions. Out-sourcing could involve acquisition of machinery and other goods, services or knowledge. Firm may acquire external technology and R&D in a disembodied or embodied form.

In the current survey, expenditure on technological product, process or service innovation includes all spending related to those scientific, technological, commercial, financial and organisational steps which are intended to, or actually lead to, the implementation of technologically new or improved products, processes or services. In order to analyse the level of innovation expenditure, the **innovation expenditure intensity** is used, i.e. the ratio between total spending on innovation over total turnover.

Figure 2.3.1 Innovation expenditure intensity by country, (%), total population, Estonia 2000, EEA 1996



Source: CIS2, Estonian Statistical Office

In average the innovation expenditures in the EEA manufacturing were 1996 3.7 % of total turnover. Since that period innovation expenditure intensity in neighbouring EU countries: Finland and Sweden has risen. Estonian position in the innovation expenditure intensity figure (Figure 2.3.1) is difficult to compare because Estonian innovation expenditures have risen sharply during the last years, and also the restructuring of national economy has raised foreign investments into machinery and personnel training.

Service branches like banking, insurance, telecommunication and transport have also received quite substantial foreign investments and gap with less innovative European Union members is not very big. Small service firms who are based mainly on local capital are less able to invest into innovation related activities.

Innovation expenditure intensity is clearly related to the structure and composition of industry. Big share of quickly changing engineering industries with good profits permits also to invest into internal research and development, buying of consulting services and acquisition of new machinery. **Biggest difference between Estonia and EU in manufacturing sector is that large enterprises in Estonia are investing relatively less than small and medium sized enterprises into innovative activities**. This could be due to the fact that in the industrial structure of Estonia less innovative sectors like the food, textile, apparel and furniture producers play a big role.

Sweden's innovation and innovation expenditures (see Table 2.3.1) are strongly concentrated to the big manufacturing enterprises. Companies in transport vehicle, pharmaceuticals and telecommunication equipment are world famous. Finland's industrial structure with big telecommunication and machinery producers follows the same composition.

Denmark with widespread networks of small enterprises express the opposite industrial structure. High position in the innovation intensity is achieved with big number of small innovative firms. Small enterprises need also competitive services and Danish small service enterprises are also investing more into innovation than the big service firms.

Table 2.3.1 Innovation expenditure intensity by size, (%), total population[14], Estonia 2000, EEA 1996

	Manufacturing sector				Service sector[15 16]			
	all	*small*	*medium*	*large*	*all*	*small*	*medium*	*large*
EST (2000)	**2.3**	**2.7**	**2.7**	**1.7**	**0.8**	**0.5**	**0.9**	**1.4**
EU-15	3.7	2.5	2.3	4.2	2.8	2.9	2.4	2.8
B	2.1	2.1	1.4	2.3	1.2	0.9	2.7	1.1
DK	4.8	10.4	3.5	4.5	4.7	2.6	1.5	6.3
D	4.1	3.3	2.4	4.4	3	3.1	2.5	3.0
E	1.8	1.0	1.6	2.2	–	–	–	–
F	3.9	1.4	2.2	4.9	1.2	0.8	1.0	1.5
IRL	3.3	2.8	3.2	3.7	2.1	6.0	1.2	2.9
I	2.6	2.4	2.2	3.1	–	–	–	–
NL	3.8	3.0	1.8	4.6	1.6	2.4	2.4	1.3
A	3.5	4.4	3.1	3.5	3	2.8	3.9	2.7
P	1.7	1.8	1.9	1.6	1.1	2.1	1.6	0.7
FIN	4.3	1.6	1.6	5.1	2.4	3.6	3.0	1.8
S	7	2.6	2.7	8.2	3.8	1.1	6.1	5.0
UK	3.2	3.3	2.9	3.2	4	6.9	2.7	3.7
EEA	3.7	2.5	2.3	4.24	2.8	2.9	2.3	2.9
NO	2.7	2.2	2.8	2.8	3.5	2.2	1.2	5.4

When compare the total population to the innovators only (see Table 2.3.2) the innovation intensity is higher. Most striking difference between Estonian and European manufacturing and service sector is that SME-s invest relatively more into innovation than large firms. This means that in case of smaller enterprises innovation is concentrated to small number of highly innovative firms.

Table 2.3.2 Innovation expenditure intensity by size and by country, (%), innovators, Estonia 2000, EEA 1996

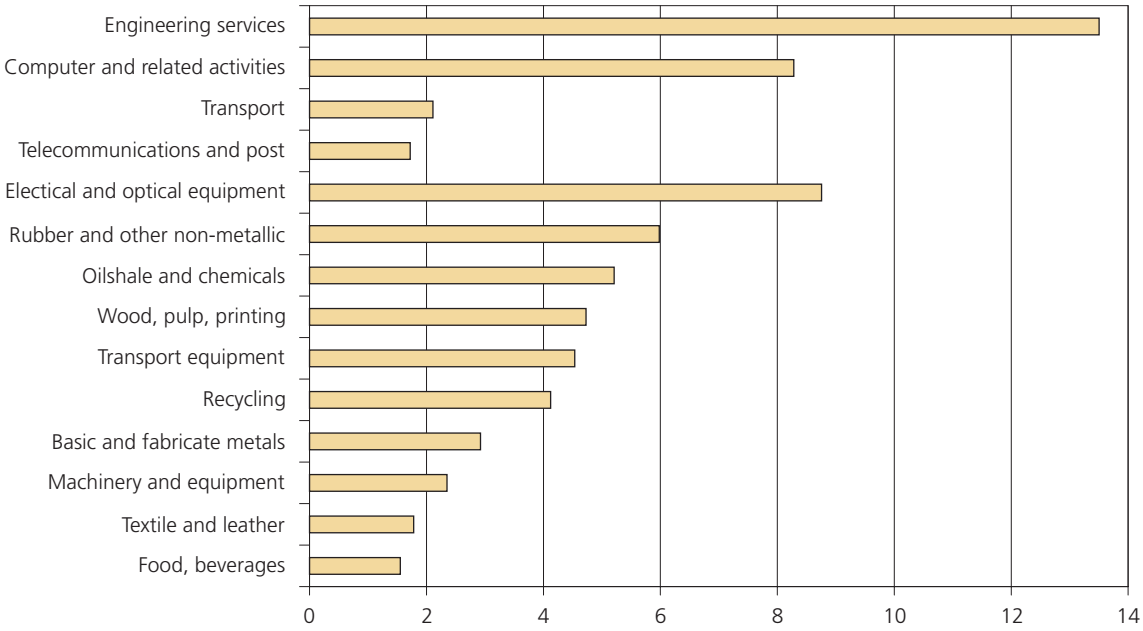
	Manufacturing sector				Service sector			
	all	*small*	*medium*	*large*	*all*	*small*	*medium*	*large*
EST	**3.6**	**5.6**	**4.2**	**2.0**	**1.7**	**1.6**	**1.7**	**1.8**
EU-15	4.5	5.1	3.6	4.7	3.9	10.2	4.5	3.1
B	3.8	5.4	3.7	3.6	2.6	9.2	13.0	1.5
DK	5.4	14.8	4.2	4.7	6.3	5.0	3.6	6.9
D	4.5	5.4	3.2	4.6	4.0	12.0	4.4	3.1
E	2.8	3.7	3.3	2.5	–	–	–	–
F	5.2	3.5	4.0	5.6	2.0	2.6	2.5	1.8
IRL	4.0	3.2	4.4	4.1	2.6	9.2	1.4	3.3
I	3.7	4.8	3.5	3.5	–	–	–	–
NL	4.7	5.2	2.4	5.4	2.1	6.3	4.4	1.6
A	4.1	6.5	4.1	3.9	4.2	4.9	5.5	3.3
P	3.3	3.7	4.5	2.8	1.6	6.5	4.8	0.8
FIN	5.5	4.7	3.4	5.7	3.6	10.6	6.8	2.3
S	8.2	5.8	3.8	9.0	7.4	4.3	10.6	7.2
UK	4.0	6.3	4.2	3.8	6.2	13.8	6.0	5.0
EEA	4.5	5.1	3.6	4.7	4.0	10.2	4.5	3.2
NO	3.8	6.0	4.4	3.2	6.9	9.1	4.9	7.1

The innovation expenditure intensity varies widely across the different economic sectors. Figure 2.3.2 gives details of the innovation expenditure intensity for innovators. The most innovative manufacturing sectors in Estonia were production of electrical equipment with 9% ratio of innovation expenditures to the turnover and the production of building materials and rubber products with 6%.

[14] *Luxembourg is not included.*
[15] *Wholesale sector and financial intermediation not included.*
[16] *Spain and Italy are not included in service sector.*

Figure 2.3.2 Innovation expenditure intensity by economic activity, (%), innovators, 2000

Estonia 2000, EEA 1996

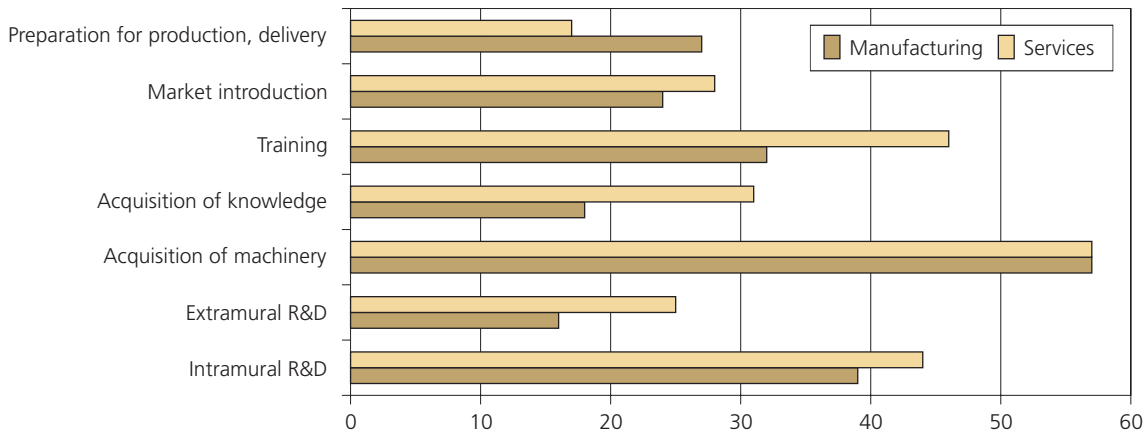


Among service enterprises were most innovative technical testing and engineering services with 14% and computer services with 8%. Both service sectors work mainly with corporate clients offering technical and sophisticated services.

2.3.2 Firms engagement in innovation activities

Intramural research and development is only part of innovation. New information, process technology could be obtained also by buying new machines and equipment. **On the current innovation level an obtaining of new machinery plays crucial role in Estonian innovation. Very often buying of new machinery is accompanied with personnel training of employees who must work on those machines**. Very often company could buy also consulting services related to the acquisition of new machinery and service of that machinery.

Figure 2.3.3 Number of innovators according to the types of innovation activities, (%), 2000



For small enterprises is the technology acquisition even more important than for big ones (see Figure 2.3.4). Small local manufacturing firms could spend smaller amounts of money for outside services like training and product launching. Training activities and acquisition of outside knowledge (consulting) are relatively more conducted by service firms than manufacturing firms (see Figure 2.3.5).

Figure 2.3.4 Number of innovators engaged in different innovation activities by size, (%), manufacturing, 2000

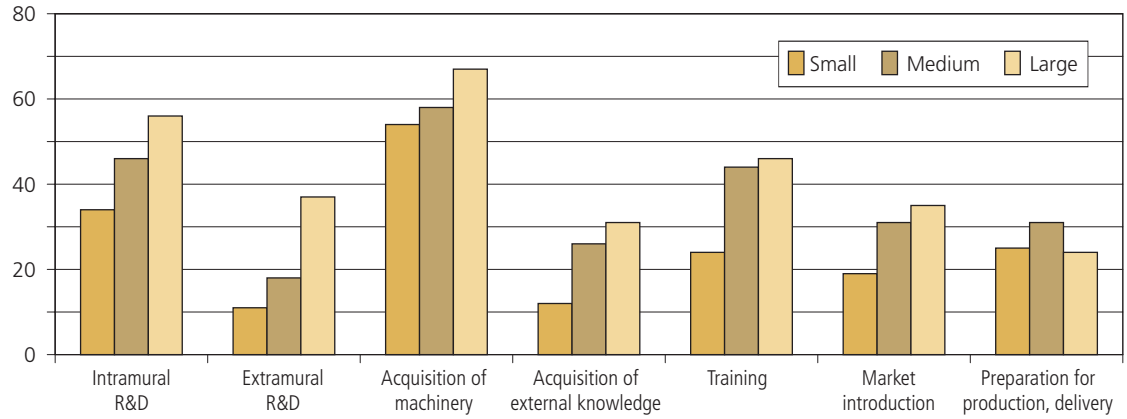
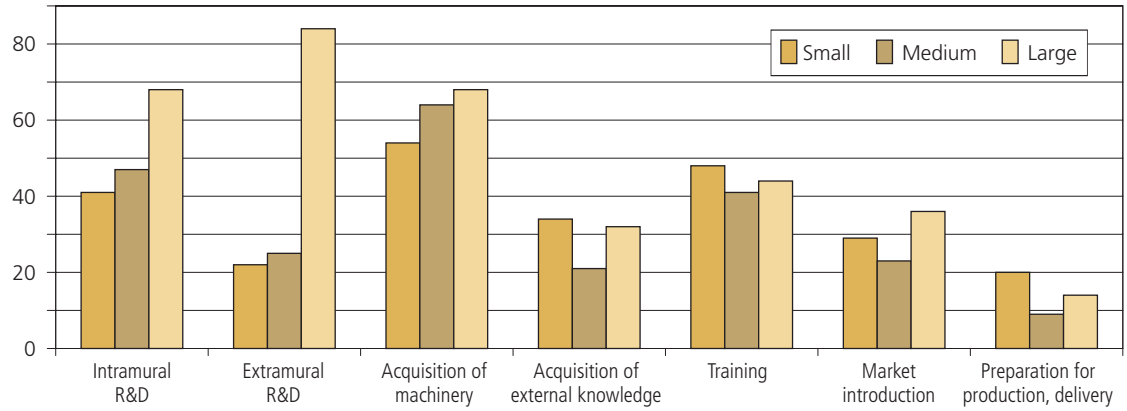


Figure 2.3.5 Number of innovators engaged in different innovation activities by size, (%), service sector, 2000



Innovation expenditures differ between service enterprises by size bands. 84% of large service firms buy extramural R&D compared to 22% of small enterprises. Large service firms conduct also more intramural R&D activities than small and medium sized service firms. Other expenditures are conducted quite equally between service enterprises.

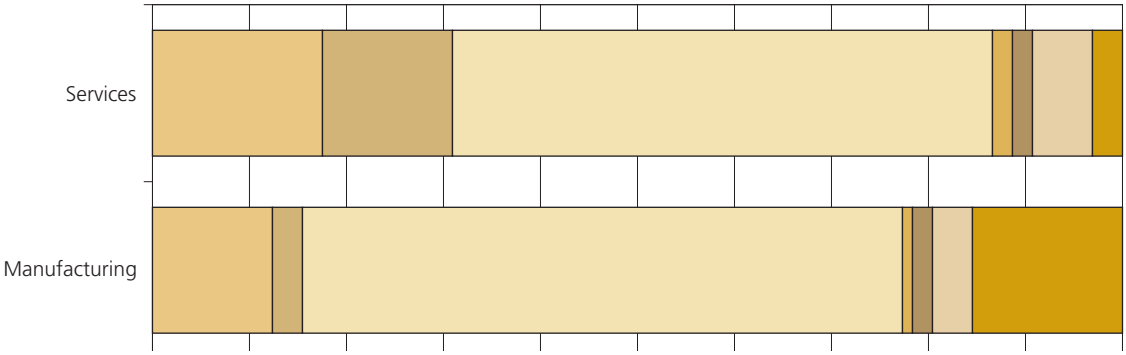
The analyses of the previous CIS surveys in the European Union showed that innovation surveys give for enterprises as concerns the expenditure and personnel of R&D bigger indicators than regular surveys of research and development or financial reports of enterprises. The results of Estonian CIS3 were not an exception as regards the main indicators.

R&D activities, Estonia, 2000	*CIS3*	*R&D survey*	*Difference*
Intramural R&D expenditure (million kroons)	301	130	2.3 times
Extramural R&D expenditure (million kroons)	152	51	3 times
Employees engaged in R&D (persons)	3378	910	3.7 times

2.3.3 Distribution of innovation expenditure

Expenditures on machinery are biggest single most important innovation expenditure in Estonia. Compared to EEA, where intramural R&D is biggest single innovation expenditure, acquisition of new machinery is in Estonia the most important innovation expenditure both for manufacturing and services (see Figure 2.3.6).

Figure 2.3.6 Structure of innovation expenditure, (%), 2000



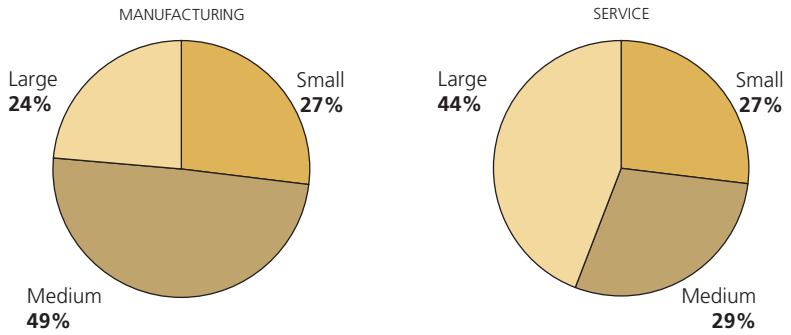
Main innovation activities in Estonia are carried out in capital Tallinn, university-city Tartu and industrial region Ida-Virumaa. Tallinn and Tartu enterprises are investing relatively more to intramural research and development and product launching. Enterprises in other regions spend mainly to the machinery and equipment that is overwhelmingly the biggest innovation expenditure in all locations.

Table 2.3.3 Expenditure on innovation by location, (%), innovators, 2000

Location	*Expenditure on innovation, 2000 (thousand kroons)*	*Ratio of expenditure to turnover, 2000 (%)*	*Share of employees engaged in R&D in total number of employees, 2000 (%)*
Whole Estonia	2161453	1.4	2.96
Tallinn	1083070	1.2	3.71
Harju (with Tallinn)	1283495	1.2	3.65
Hiiu	1112	0.3	1.91
Ida-Viru	334089	2.1	1.98
Jõgeva	10387	1.2	2.30
Järva	24034	1.2	0.76
Lääne	14123	1.2	1.39
Lääne-Viru	68089	1.5	0.87
Põlva	16100	1.4	0.98
Pärnu	44268	0.9	1.01
Rapla	9534	0.8	1.72
Saare	10783	0.9	1.74
Tartu	243926	2.5	5.07
Valga	59975	4.9	1.19
Viljandi	17830	0.5	0.90
Võru	23709	1.4	2.64

As shown on the Figure 2.3.7 the main innovation activities in Estonian manufacturing are carried out in medium sized enterprises (50–249 employees). Medium sized enterprises invest mainly to new machinery, personnel training and intramural R&D activities. Large enterprises invest considerable sums of money for buying external R&D services, consulting and conducting intramural R&D.

Figure 2.3.7 Distribution of innovation expenditure by size, (%), Estonia, 2000

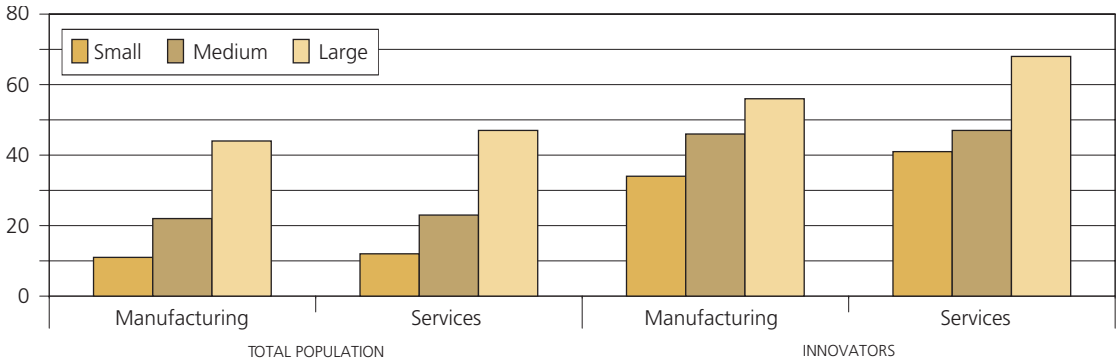


Among innovative service enterprises play an important role the large firms who make 44% of total innovation expenditures. Small enterprises account for 27% of innovation expenditures and medium sized enterprises for 29%. Large service firms belong to the sectors like financial intermediation, telecommunication, but also transport, which all have developed rapidly during last years, largely thanks to the use of ICT opportunities in providing services.

2.3.4 Research and development expenditures

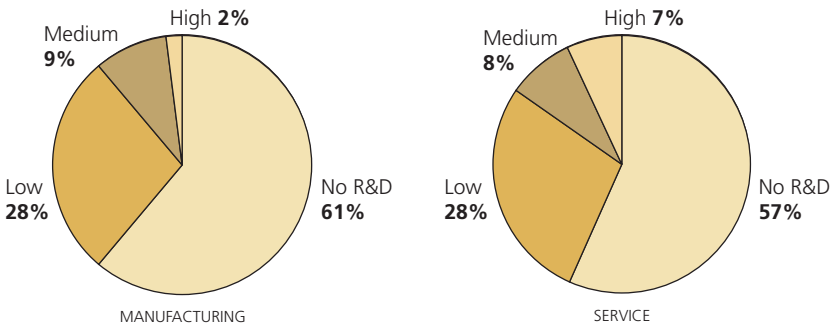
In EEA 69% of innovators in manufacturing and 47% innovators in service conducted R&D in regular or occasional basis. In Estonia 40% of innovative enterprises in manufacturing sector and 44% in service sector have performed R&D activities in the period 1998–2000. Intensity gap between different size class of enterprises was quite substantial. Among total population of manufacturing enterprises 44% of large enterprises conducted R&D activities compared to only 11% of small enterprises. In service sector 47% large enterprises conducted R&D activities and 12% of small enterprises.

Figure 2.3.8 Number of enterprises engaged in intramural R&D, as a share of total population and of innovators, (%), 2000



Among innovators of manufacturing sector 39% of firms are conducting R&D activities (56% in EEA). 2% of enterprises have intensive (over 4% from turnover) R&D activities (Figure 2.3.9). 9% of enterprises spend 1–4% of turnover to R&D and 28% of enterprises less than 1%. Among service sector innovators 7% of enterprises invest more than 4% of turnover to R&D, 8% of enterprises 1–4% and 28% of enterprises less than 1%. 57% of innovators have no R&D activities.

Figure 2.3.9 Distribution of innovators by level of R&D intensity[17], 2000



[17] *Low = expenditures on R&D less than 1% of turnover, medium = expenditures on R&D 1-4% of turnover, high = expenditures on R&D more than 4% of turnover, No R&D = not having any R&D activitites.*

2.4 Commercialisation and protection of innovations

Present chapter introduces main output indicators of innovation activities. The principal indicator in this chapter is the proportion of improved or new products (to the firm) in total sales (innovative products/services). A breakdown by products also new to the enterprise market will be made. These statistics focuses on innovation of products and services. This is due to the fact that product innovation is more easily identified and measured by producers and perceived by customers.

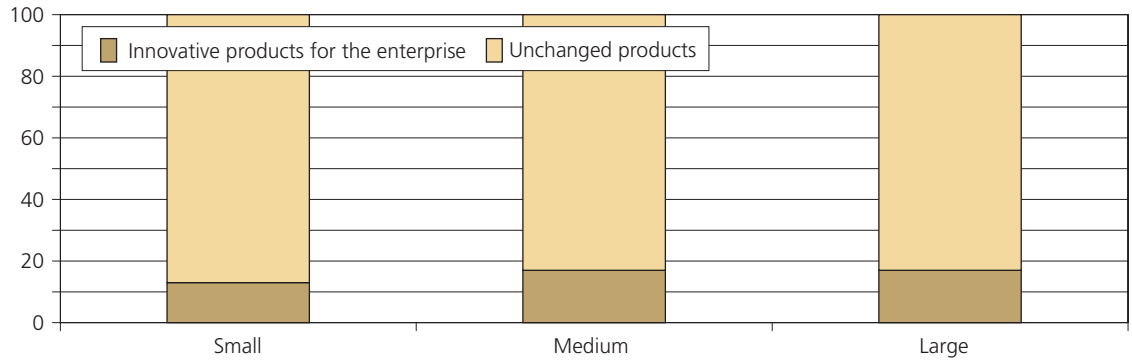
It has been concluded that:
- One sixth of Estonian manufacturing sales is due to new or improved innovative products from the viewpoint of the enterprise. This is two times lower than EU same indicator.
- Innovative products new for market represent 11% of all manufacturing sales.
- Large and medium sized enterprises have been introducing relatively more innovative products than smaller ones. If we compare sales of products new to the market performance differences between small and larger enterprises are relatively non-existing.

2.4.1 Sales: how innovation-based they are?

In 2000, a sixth of sales of Estonian enterprises consisted of products and services new or improved to the enterprise (introduced between 1998 and 2000). Although innovation is an essential precondition for growth and competitiveness in Europe, **Estonian enterprises still realise the overwhelming part of their turnover with products, which have remained unchanged during a three-year period. This indicates the fact that production effectiveness is not based on the uniqueness of the products**.

The proportion of innovative sales (new or improved) products in turnover increases slightly with the size of the enterprise as shown in Figure 2.4.1. The share of new or significantly improved products in the sales of small enterprises was 13%. Medium-sized and large enterprises have the share of innovative products 17%.

Figure 2.4.1 Composition of sales in the manufacturing sector, (%), total population, 2000

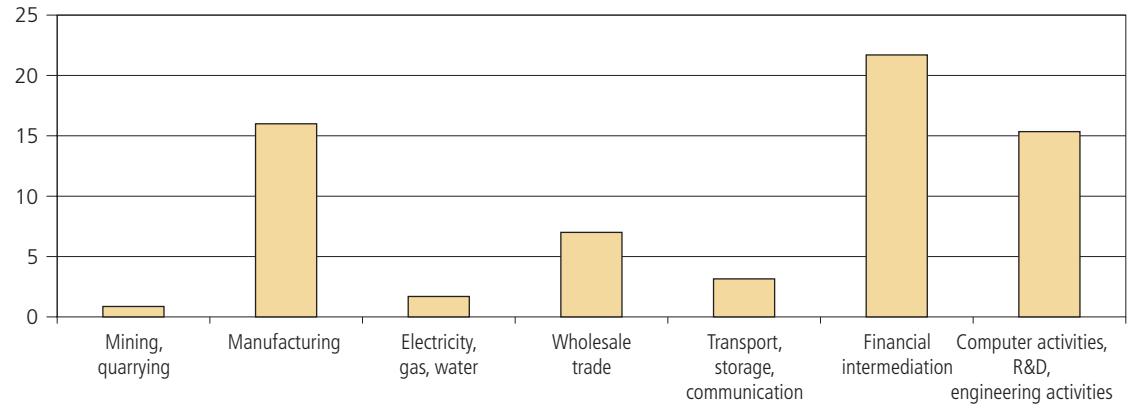


Comparison with the enterprises in European Economic Area (CIS2) **the biggest difference is in the innovative performance of bigger enterprises. In Estonia 17% of sales are constituted on innovative products, in EEA 38% respectively**. In case of smaller enterprises the gap between Estonia and EEA is smaller (Estonia 13%, EEA 15% respectively). We should have in mind also restructuring process in economy and whole society that shows the smaller share of innovative products even more substantially.

Figure 2.4.2 shows that large enterprises account for 32% of total turnover of manufacturing sector sales. Sales of medium sized and small enterprises represent 44% and 24% of turnover. Compared to the sales of innovative products, large enterprises have relatively equal share with 34%. Medium sized enterprises have share of 46% and small enterprises 20%. Current trend is different from Europe where large enterprises account for 71% of total manufacturing sales and 82% turnover of innovative products.

Sales of innovative products in the total turnover account for 16% in Estonia. This is on the same level with Portugal and Belgium, who have relatively least innovative firms and innovative sales in Europe. In the turnover of manufacturing sales of European "champion" Germany's innovative products account 45% of the value.

Figure 2.4.2 The share of innovative products in the total sales by economic activity, (%), 2000



The most innovative sectors of national economy during 1998–2000 were financial services, manufacturing and engineering& computer activities (see also Chapter 3.1 and 3.2). In case of financial services this could be related to the adoption of new information technologies like Internet banking and other Internet services. The computer related services emerge probably because of the big R&D investments and very rapid technology development in the world.

2.4.2 Sales for innovating enterprises

Focusing on innovators only, unchanged products account for more than three quarters of sales of innovators (see Figure 2.4.3). Small innovative enterprises have slightly more innovative products in their portfolio. Big enterprises have also smaller relative expenditures on innovation (see hereinafter). This could mean that Estonia has relatively few big innovative enterprises, who could realize their scale economies for product development. The indicator for large enterprises differs very much if the company has foreign equity or not: **the enterprises with foreign equity more than 50% have 25% innovative products of their sales, but large enterprises without any foreign capital have only 12% innovative product of their sales. Also medium sized enterprises follow the same pattern** – the higher the share of foreign equity in the company the higher is also the share of sales of innovative products. But interesting is that **the small manufacturing enterprises showed opposite design: 1/3 of sales are due to innovative products in companies with no foreign capital, and the same indicator for enterprises based more than 50% on foreign equity was 18%**.

Figure 2.4.3 Composition of sales in manufacturing by size, (%), innovators, 2000

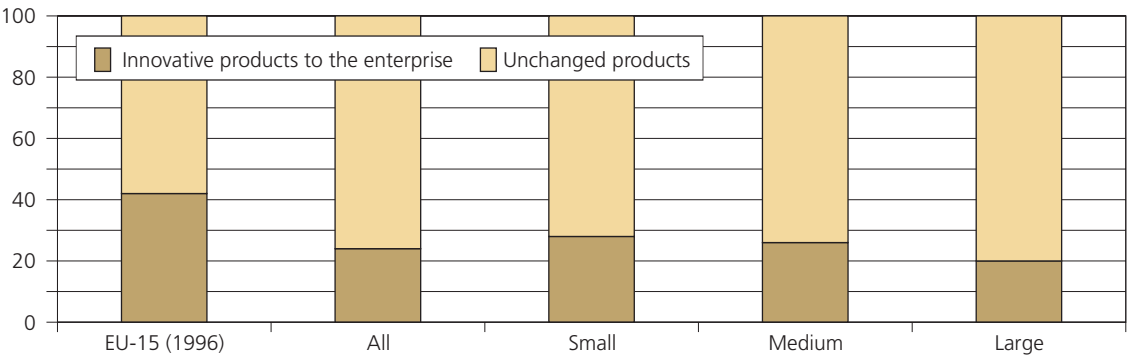
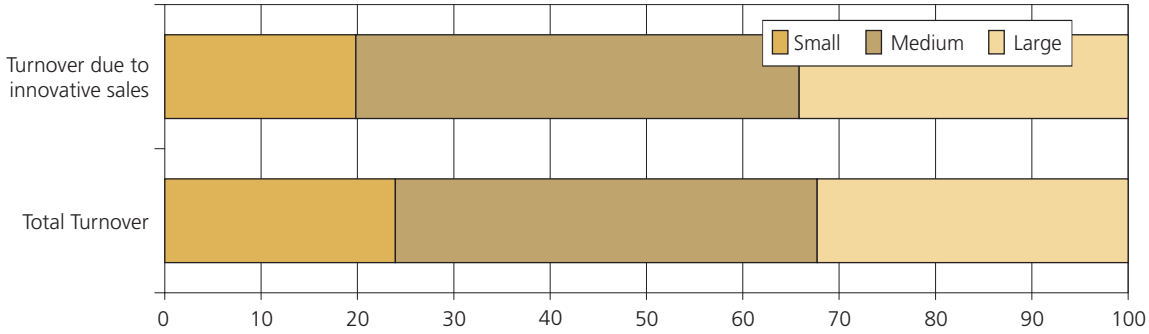


Figure 2.4.4 Comparison of the share of innovative products and total sales by size, (%), manufacturing, 2000

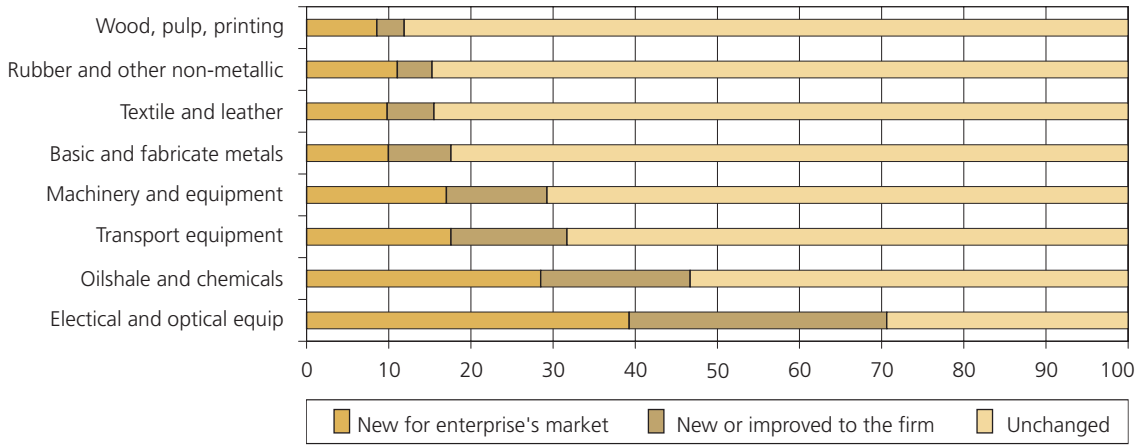


2.4.3 Sales new to the firm or new to the market?

In order to fully describe innovation in Estonian enterprises broader terms of innovations were used. Product innovation that is new for the firm is not always new for the enterprises market. For example in Europe products that are new for market account only one third of products innovative for the producers itself. The remaining two thirds therefore consist of turnover in improved, but already existing, products.

In Estonia innovative products new for the enterprise's market account 6% from the total sales. Remaining 10% are innovative products only for the enterprise. There is no difference in the sales composition between the enterprises with the different size.

Figure 2.4.5 Composition of sales, new to the market/firm and unchanged by economic activity in manufacturing, (%), total population, 2000



In comparison with the EEA countries (CIS2) we must say that **the share of products new to the market in Europe and Estonia is rather similar. What is different is the share of innovations new to the firm. European firms currently improve products and spend considerable resource to make in-house innovations**.

Different industrial sectors vary to big extent by scale of innovations (Figure: 2.4.5). **Most innovative sectors in Estonian industry are production of electrical equipment (office machinery and telecommunication devices), manufacture of chemicals and transport equipment (automobile subcontracting and ship repair)**. In Europe the most innovative sectors between 1994–1996 were: production of transport equipment, production of electrical and optical equipment and production of machinery and other equipment.

2.4.4 Protection of innovations

The questions on protection methods of innovation were asked in the form that allowed to give a positive answer even in the case when the enterprise itself did not deal with protection, but the concern to which it belonged did it. That is the reason why in the analysis it was inevitable to differentiate enterprises by belonging to a concern.

Table 2.4.1 Protection methods by innovativeness, belonging to a concern and foreign equity, (%), 1998–2000

Method of protection	*All enterprises*	*Belonging to a concern*	*Not belonging to a concern*
Patent application	4.2	8.8	2.2
Valid patents	5.6	12.4	2.9
Registration of design patterns	1.7	4.1	0.8
Trademarks	14.5	25.4	10.2
Copyright	3.0	6.3	1.6
Secrecy	12.2	18.9	9.6
Complexity of design	10.2	15.3	8.2
Lead time advantage on competitors	21.9	30.7	18.4

Method of protection	*Innovators*	*Non-innovators*	*With at least 50% foreign equity*
Patent application	9.2	1.2	7.5
Valid patents	11.1	2.5	11.7
Registration of design patterns	4.2	0.3	34.6
Trademarks	26.4	7.9	18.1
Copyright	6.7	0.8	5.6
Secrecy	22.5	6.5	18.2
Complexity of design	21.6	3.8	16.0
Lead time advantage on competitors	40.8	11.4	27.8

Intensity of patent applications was four times higher in enterprises that belong to a concern as compared to those not belonging to concern. The same kind of relation can be observed between innovative and non-innovative enterprises. **Among the protection methods enterprises place first lead time advantage on competitors, followed by registration of trademark**. The intensity of use of these protection methods is also higher in enterprises belonging to a concern or innovative enterprises. In enterprises with at least 50% foreign equity, registration of design patterns was widely used.

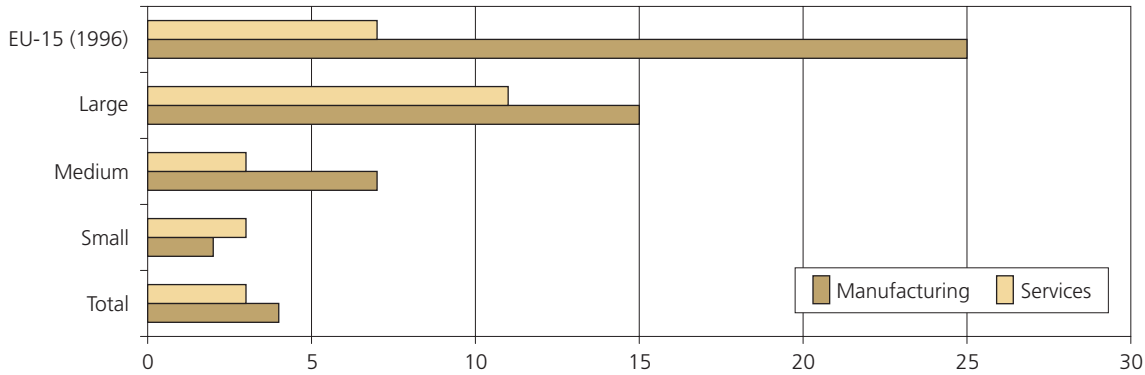
Table 2.4.2 Protection methods by sector and number of employees, (%), 1998–2000

Method of protection	*Manufacturing*	*Services*	*10–49 employees*	*250+ employees*
Patent application	4.3	3.8	3.1	13.7
Valid patents	6.1	5.1	4.8	17.2
Registration of design patterns	2.2	1.2	1.4	6.7
Trademarks	15.0	14.0	11.8	33.1
Copyright	2.8	3.2	2.4	6.1
Secrecy	12.8	11.7	10.7	22.0
Complexity of design	11.8	8.6	9.4	15.2
Lead time advantage on competitors	23.5	20.4	20.3	28.2

Manufacturing enterprises are more active than service enterprises as protection of innovation is concerned. Intensity of innovation protection is dependent on the size of enterprise: as concerns patents and official protection methods, the indicators of enterprises with 250 and more employees are three times higher than those of enterprises with 10–49 employees, in case of business strategy methods the difference is as big as 1.5–2 times.

Although the patents are not the only way to protect the intellectual property and the most of Estonian companies use other strategies to protect their new products/services, **patenting is important measure that shows technological capability of different countries**. As said above only 4% of Estonian manufacturing innovators applied for the patents (see Figure 2.4.6), 3% of innovators in service sector. This figure is low compared to European level (25% in the manufacturing and 7% in the services).

Figure 2.4.6 Number of innovators having applied for at least one patent in the period between 1998–2000 as a share of innovators by size, (%), Estonia 2000



Picture is even getting worse if we look to the data of the Estonian Patent Office (see Table 2.4.3). Number of local applicants is even smaller. Most of the patent applications are filed by foreign subsidiaries and probably based on innovations that have been developed outside of Estonia.

Table 2.4.3 Number of patent applications in Estonia

	Number of applications	*from Estonian appliers*
1992	–	–
1993	–	–
1994	482	16
1995	82	16
1996	213	12
1997	375	15
1998	463	20
1999	619	13
2000	805	12
2001	717	18

Source: Estonian Patent Office

2.5 Impacts of innovation activities

The CIS3 survey methodology classified innovation impacts/ effects into the following 3 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 production capacity

Other effects
- met regulations and standards
- improved environmental impact or health and safety aspects

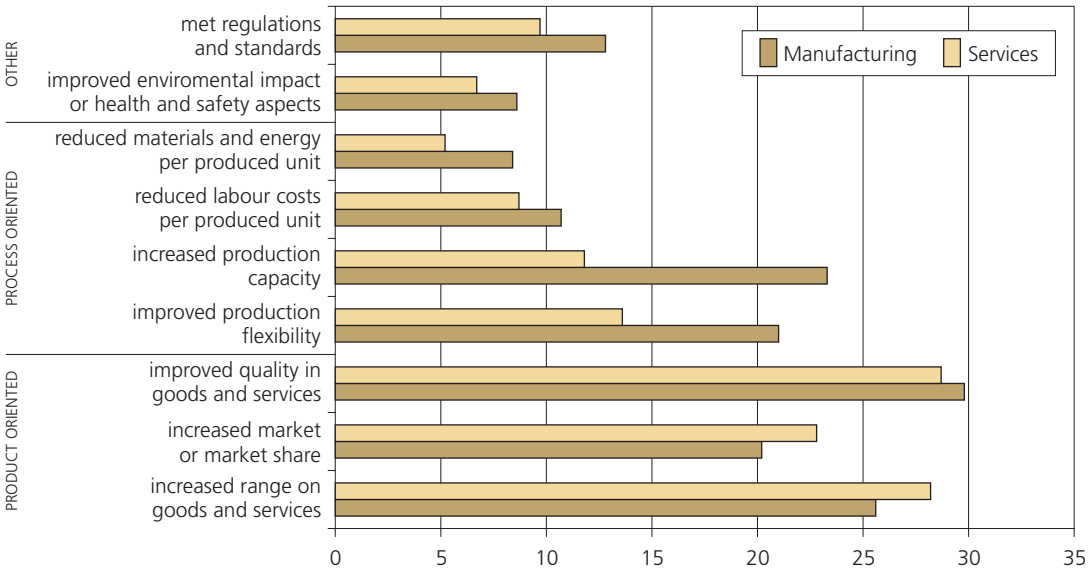
It has been concluded that:
- Enterprises innovate mainly to improve quality in goods and services and increase range of goods and services.
- In average rising of production capacity and flexibility were most important process oriented effects of innovation, but innovation goals and effects varied strongly between different manufacturing and service sectors.
- In general innovation effects to the large enterprises did not differ significantly from SME-s. Large enterprises had more process oriented effects of innovation.

2.5.1 Effects of innovation

Improved quality in goods and services and increased range on goods and services, as shown on Figure 2.5.1 **are most frequently quoted effects of innovation**: 30% of manufacturing and 28% of service enterprises mentioned that during the innovation process quality of their products and services increased. 25% of manufacturing enterprises and 28% of service enterprises mentioned that range of goods and services offered by them increased.

Considering the process-oriented effects, the most important one for the manufacturing were the increasing of production capacity and production flexibility. Reduced labour costs were result of only 10 percent of innovations. This is not in line with Europe, where most important single process-oriented goal was to reduce labour costs. This is motivation for 40% of manufacturing employers. Especially should be mentioned food, textile & apparel and wood, pulp & printing industries, but other manufacturing industries as well – all the labour intensive sectors.

Figure 2.5.1 Number of innovators with very important effects of innovation, (%), 2000



Results of a more legal and regulatory nature were important only for minority of firms in both manufacturing and services. This shows that the Estonian entrepreneurs generally orient well in the business rules established by the state.

Across the different industries the indication of most important effects shows some degree of variability (Table 2.5.1). Increased range of products was important result of innovation for textile and apparel and building materials industry. For shipbuilding and ship-repair industry was increasing range of products relatively less important. Improvement of quality of products was important effect for firms in chemical industry and electrical equipment industry. Improved production flexibility and increased production capacity were important changes for ship-repair and automobile parts producers. All process related results are mentioned strongly by chemical industry firms. Rising of labour productivity and lowering of labour cost was mentioned by small number of manufacturing enterprises.

Table 2.5.1 Number of innovators with very important effects of innovation by economic activity, (%), manufacturing sector, 2000

	Food and beverages	*Textile and leather*	*Rubber and non-metallic*	*Wood, pulp and printing*	*Machinery and equipment*	*Transport equipment*	*Chemicals*	*Electrical and optical equipment**
Increased range on goods and services	21.9	35.0	38.9	22.8	25.2	12.8	28.4	18.1
Increased market or market share	20.2	24.2	26.8	21.7	14.3	21.9	19.5	17.8
Improved quality in goods and services	29.2	25.2	23.8	30.8	24.8	33.5	45.1	39.9
Improved production flexibility	23.2	19.1	23.5	17.8	16.7	52.2	30.5	16.3
Increased production capacity	21.3	22.9	24.7	27.0	17.0	43.2	18.6	20.0
Reduced labour costs per produced unit	8.4	7.1	12.3	12.7	2.7	0.0	20.5	9.5
Reduced materials and energy per produced unit	9.1	6.9	6.0	11.7	11.2	0.0	25.7	2.9
Improved environmental impact or health and safety aspects	6.9	7.6	10.5	8.1	7.4	15.5	25.1	8.4
Met regulations and standards	21.9	4.4	10.7	5.9	11.6	26.4	41.5	14.4

* *without computers and office machinery*

Meeting of the European standards before accession to the EU was important for agro-food, transport and chemical industries. This is in line with changing regulative climate.

Among service enterprises innovative projects had most impact on financial services. Increased range of goods and services was important effect for financial services, telecommunication and computer service enterprises. Process related innovations play minor role in services compared to manufacturing. However financial intermediaries, which pay relatively high salaries, mentioned reduction of labour cost as important result. On the other side transport and trade firms, with average and below average salaries, did not mention reduction of labour cost as important result.

Table 2.5.2 Number of innovators with very important effects of innovation by economic activity, (%), service sector, 2000

	Land and water transport	*Telecommunication and post*	*Financial intermediation (incl. insur. and pension funds)*	*Computer and related activities*	*Wholesale and retail trade*
Increased range on goods and services	10.9	36.8	42.8	30.8	38.7
Increased market or market share	18.3	22.4	23.8	14.1	27.0
Improved quality in goods and services	14.6	26.3	52.4	38.6	27.1
Improved production flexibility	10.5	14.9	28.6	10.5	8.1
Increased production capacity	17.9	8.7	19.0	0.0	7.3
Reduced labour costs per produced unit	5.0	0.0	28.6	7.1	2.1
Reduced materials and energy per produced unit	5.0	0.0	23.8	3.6	2.1
Improved environmental impact or health and safety aspects	13.1	0.0	4.7	0.0	5.5
Met regulations and standards	7.4	0.0	16.7	17.6	8.5

Change in regulative environment is probably not big problem for the service enterprises before the accession to European Union and therefore less effort was dedicated to the innovations in that direction.

2.5.2 Does size influence effects of innovation?

Given the high degree of diversity of the size class structure of the different industrial sectors a breakdown of the indications of effects for small, medium-sized and large firms, to some extent, reflect the underlying sector structure of the three different size classes. Big manufacturing enterprises have experienced more process-oriented effects.

Table 2.5.3 Number of innovators with very important effects of innovation by size, (%), manufacturing, 2000

	Product oriented results			*Process related effects*			*Other effects*		
	increased range on goods and services	*increased market or market share*	*improved quality in goods and services*	*improved production flexibility*	*increased production capacity*	*reduced labour costs per produced unit*	*reduced materials and energy per produced unit*	*improved enviromental impact or health and safety aspects*	*met regulations and standards*
Small	24	18	29	18	20	9	5	7	10
Medium	26	23	32	24	28	12	11	10	16
Large	27	19	26	24	27	12	15	9	15

For service enterprises similar trends could be observed. Most of the effects to the enterprises are quite equal or it is difficult to determine underlying trend. Process related effects are relatively more important for large enterprises than for small ones.

Table 2.5.4 Number of innovators with very important effects of innovation by size, (%), service sector, 2000

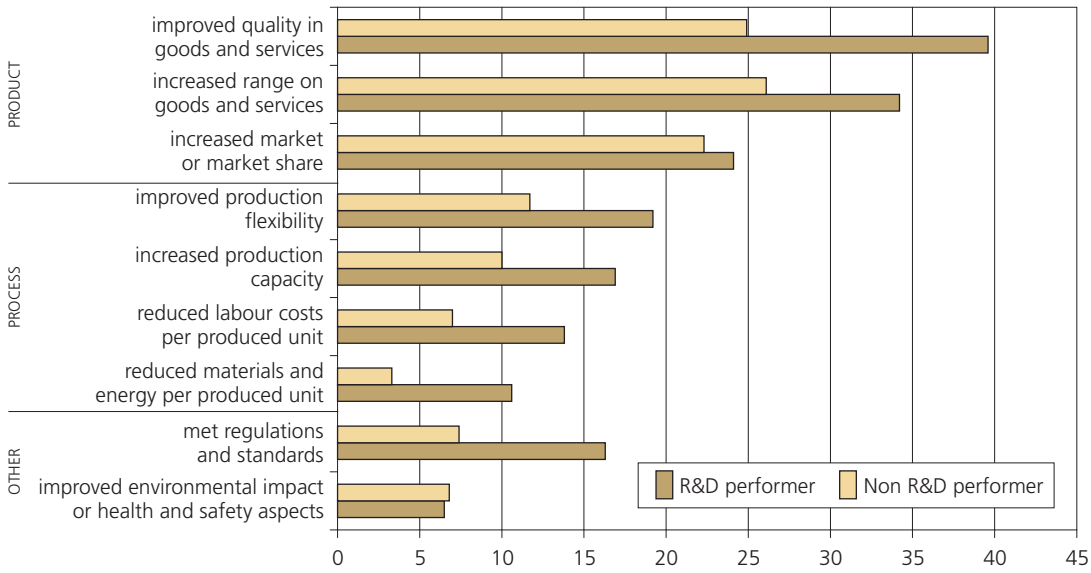
	Product oriented results			*Process related effects*			*Other effects*		
	increased range on goods and services	*increased market or market share*	*improved quality in goods and services*	*improved production flexibility*	*increased production capacity*	*reduced labour costs per produced unit*	*reduced materials and energy per produced unit*	*improved enviromental impact or health and safety aspects*	*met regulations and standards*
Small	29	24	28	13	10	8	4	6	11
Medium	22	18	29	12	13	9	9	8	4
Large	28	6	24	30	22	18	10	4	8

2.5.3 Objectives of innovation among R&D performers

In manufacturing enterprises with R&D have stronger positive effects of innovation activities in all categories. Only exception is labour cost effects. **There is relatively big gap between R&D performers and non-performers in finding new markets and increase of market share, increasing of production capacity and meeting the regulations and standards**.

The picture is quite the same in service sector. In services, enterprises with R&D have also stronger positive effects in all categories. Especially big gap between R&D performers and non-performers could be seen in improvement of quality of goods and services, reduction of labour costs and adaptation of regulations and standards.

Figure 2.5.2 Very important effects of innovation broken down by R&D and non R&D performer, (%), service sector, 2000



2.6 Innovation cooperation

Co-operation with other companies and organizations is one of the key factors for achieving success in activities in general and especially in innovation. The co-operation in innovation processes may consist only of planning and carrying out unsophisticated or more complicated operations, but is still considered as being the "high level co-operation" due to the complications of predicting the possible results and is in this sense comparable to the co-operation in distribution field.

From the surveys that deal with Estonian enterprises' economical behaviour done up to now, cannot be concluded that Estonian enterprises' high ability of co-operation is a plus compared to other countries' enterprises. This became evident for instance from the survey (1997) that embraced Tallinn new economic sector enterprises that co-operation with other enterprises and organizations in order to raise competitiveness is clearly under evaluated activity (Kurik, 1998). If the need for co-operation with the consumers is understood, in other activities (co-operation with competitors, public sector, and universities) usually "single-actor" form is preferred.

The survey studied the enterprises' innovation cooperation as to the types and locations of the following partners:

- Cooperation partner's type:
- Other enterprises within concern
- Suppliers
- Clients and customers
- Competitors
- Consultants
- R&D service enterprises
- Universities
- Public or private non-profit institutes

Cooperation partner's location:

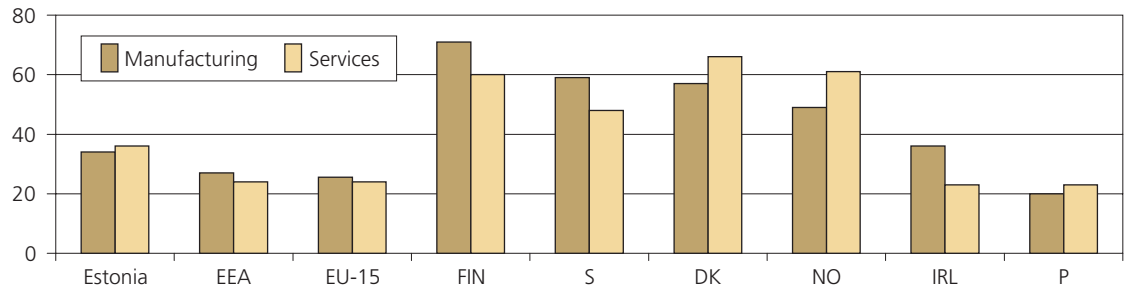
- Estonia
- EU, Island, Norway, Switzerland, Liechtenstein
- EU candidate countries
- USA
- Japan
- Other

It has been concluded that:
- The intensity of innovation co-operation of Estonian enterprises is higher than the EU average, but lower than in Nordic countries;
- The innovation co-operation is more inherent to big enterprises;
- Most of the innovation co-operation is done with providers and consumers-clients, relatively few is taken place with universities, research institutes and other science institutions;
- The co-operation is mainly taken place with partners in the EU countries, much less with Americans and Japanese.

2.6.1 Innovation cooperation between enterprises

According to the mentioned facts the results of the survey concerning innovation co-operation are quite positive. In 1998–2000, one third of innovative enterprises had co-operation agreements with other enterprises and institutions, for manufacturing enterprises the corresponding indicator was 35% and for service enterprises – 37%. The indicator showing intensity of innovation co-operation doesn't reach the Nordic countries' level (Figure 2.6.1), but is significantly higher than according to CIS2 the average of the European Union (25%). This could be that cultural experiences of cooperation patterns vary a lot in different countries.

Figure 2.6.1 Number of innovators with innovation collaboration, (%), Estonia 1998–2000, EEA 1994–1996



As in the European Union, existence of co-operation depends first and foremost on the size of the enterprise, in Estonia it is for enterprises with less than 50 employees 31% and for enterprises with 250 employees and more – 67%. The activity for innovation co-operation is more inherent to big enterprises, unfortunately the reason for that is obviously not bigger willingness to co-operate, but just the fact that big enterprises are more involved in innovation processes. The other indicator in correlation is share of exports in net turnover: if this indicator is below 10%, 32% of enterprises have co-operation, if it is 90% and more, 43% of enterprises have co-operation. Or looking from the other side: the enterprises that have innovation co-operation, the share of exports is 39% in net turnover; the others have only 26%.

In somewhat different situation are enterprises belonging to a concern. Of these 46% had co-operation, of which most – 84% – had co-operation with other enterprises of their concern.

Table 2.6.1 Cooperators' partners in cooperation by type (%), 1998–2000

Type of partner	*Estonia*		*EEA, 1996*	
	M	*S*	*M*	*S*
Other enterprises within concern	44.6	44.9	59	68
Suppliers	76.0	69.5	49	39
Clients or customers	68.9	64.0	48	33
Competitors	38.2	47.2	18	40
Consultants	35.9	39.2	22	30
R&D service enterprises	22.6	35.0		
Universities	25.3	26.2	37	26
Public or private non-profit institutes	12.8	12.6	32	30

High intensity in innovation co-operation with suppliers and clients and consumers is inherent both to Estonian and to the EU countries' enterprises. Different from Estonia, in the European Union the other enterprises of their concern were first in the ranking. Evidently in Estonia the intensity of formation of concerns is not as high

as in European Union (more accurately, the level of the European Union four years ago), despite of the selling and joining of enterprises during the recent years. One other possible reason cannot also be excluded: relations between Estonian enterprises or enterprises that belong to domestic or to international concerns that are located to Estonia and mother companies or "brother-sister companies" is mainly on the level of operationally organizing production, not in the field of innovation. Spontaneously, Estonia's 44.6% is not a low level. **Estonian manufacturing enterprises' low level in the field of intensity of co-operation with universities and non-profit research and development institutions is the fact that should be considered as negative. This kind of poor co-operation could become essential obstacle in introducing radical product and technology innovations**. Other surveys have shown that the main reason why enterprises are so poorly interested in this kind of co-operation is the little interest from the enterprises itself. It is possible that the reorganisation of research institutions (majority of research institutes were joined to universities) that took place in the second half of the 1990s in Estonia has given also some negative impact.

Considering the innovation co-operation between enterprises and consulting firms, it can be said that it is even more dispersed in Estonia than in EU countries on an average.

2.6.2 Location of co-operation partners

The share of co-operation partners located in the European Union was higher in Estonia than in the European Union itself – 59% against 44%. It is of course the effect of the smallness of Estonia, big countries do not have so intensive need for finding partners abroad, but even they are forced to collaborate with foreign companies more and more because of the globalisation and tightening competition. The share of partners located in the USA or Japan was a couple of times bigger in the European Union. As USA and Japan are the leading countries of technology development, therefore poor innovation co-operation between them and Estonian enterprises should be seen as a drawback of Estonian entrepreneurship.

Table 2.6.2 Cooperators' partners in cooperation by location, (%), 1998–2000

Location of the partner in cooperation	*Estonia*		*EU-15*	
	M	*S*	*M*	*S*
National	81.8	88.4	84	74
EU, Island, Norway, Switzerland, Liechtenstein	64.9	50.9	50	37
EU candidate countries	23.7	26.2		
USA	7.5	14.3	25	29
Japan	3.4	1.0	9	12
Other	17.5	18.5	14	22

2.6.3 Importance of the co-operation partners

Quite evident link can be seen: as the enterprises within concern, suppliers and customers are in the first places in the ranking of existence of co-operation partners, opinion on these co-operation partners is preferably high, and in the case of other co-operation partners medium opinion prevails.

Table 2.6.3 Cooperators' opinion on partners in cooperation by type, (%), 1998–2000

Type of partner	*Importance of partner (sum – 100%)*			
	high	*medium*	*low*	*no partner*
Other enterprises within concern	27.8	13.0	3.8	55.4
Suppliers	39.7	27.4	6.2	26.7
Clients or customers	10.1	16.2	15.7	58.0
Competitors	6.5	13.7	17.0	62.8
Consultants	5.9	10.4	11.7	72.0
R&D service enterprises	6.5	12.3	6.8	74.4
Universities	1.1	4.5	7.1	87.3

Suppliers are the most valued cooperation partners, which is entirely logical if we remind that the innovative activities of nearly half of the enterprises concentrate on the purchase of new machinery and equipment. On the other hand equipment suppliers are not necessarily those from whom the enterprises purchase material etc on regular basis. So, the value chain linkages determine the nature of cooperation.

2.7 Sources of information for innovation

Access to information is one of keys to successful innovation. There are national and regional differences in using of different information sources. Innovation can be a product of internal research and development or of market demand. Innovation sources could be both inside the firm and outside of firm. In our survey we used the following types of information sources for innovation:

Internal sources
- Within the enterprise
- Other enterprises within concern

Market information
- Competitors and other firms from the same industry
- Clients or customers
- Consultants
- Suppliers of equipment, materials, components or software

Publicly available information
- Professional conferences, meetings, journals
- Fairs, exhibitions

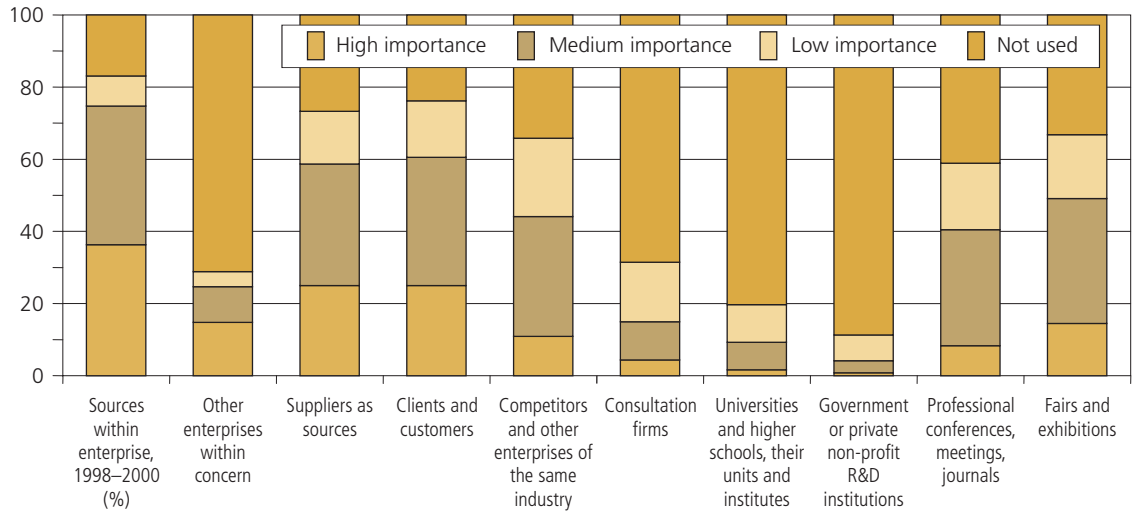
Other
- Public and private non-profit R&D institutions
- Universities and higher schools, their units and institutes

It has been concluded that:
- Information from within enterprises is the main source of information for innovation; every third firm claimed that it was very important source of information used.
- Clients, customers and suppliers ranks highest among the market sources of information.
- Large enterprises, different from EU, are not considering universities as important sources of information.
- Fairs and exhibition are most important publicly available information sources.

2.7.1 Information for innovation

Three most important sources for innovation information were: sources within enterprise, suppliers and customers (see Figure 2.7.1). Enterprises belonging to the concerns also use sources within enterprise group. Competitors and sources of public information (fairs, exhibitions and professional conferences) are used as information sources with medium importance.

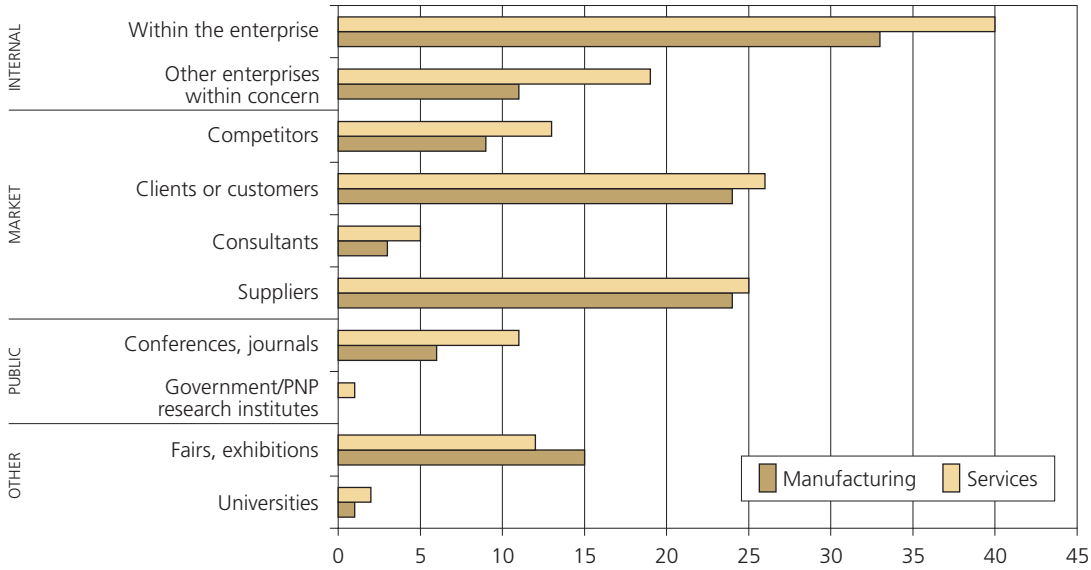
Figure 2.7.1 Information sources by importance, (%), 1998–2000



Education related and public research sources are ranked not used very often. **Less than 2% enterprises used public information sources as important sources of information. This could be due to the fact that enterprises have not used public sources before and rely more on their internal capabilities, suppliers and customers**.

Innovative enterprises in the manufacturing sector are using less internal sources of information as service enterprises (see Figure 2.7.2). Other sources of information are used relatively equally.

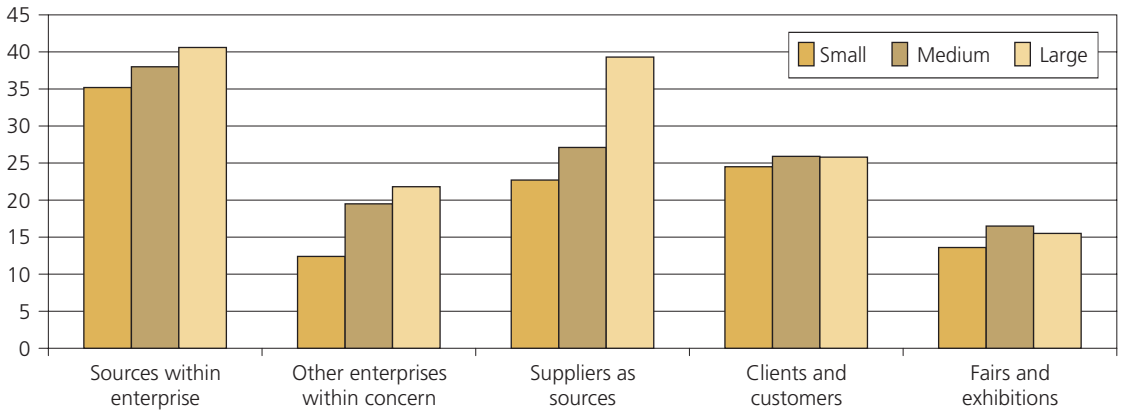
Figure 2.7.2 Number of innovators with very important sources of information for innovation used, (%), 1998–2000



2.7.2 Does size affect information sources?

Survey showed that internal sources of information are most important for enterprises (see Figure 2.7.3). Among large enterprises 41% used internal sources as very important source. Among small enterprises the level was 35%. Second largest source of the innovation information is market information from suppliers of machinery, software and equipment. Also customers and trade fairs are widely used as important source of information.

Figure 2.7.3 Sources of information for innovation by size, (%), 1998–2000



The picture is somehow different if we look separately to manufacturing and services. **Different from EEA (CIS2) in Estonian manufacturing medium sized enterprises use more often market and public information than large enterprises** (see Table 2.7.1). For example customers were used as important source of innovation by 28% of medium sized enterprises and 24% of large enterprises. Fairs and exhibitions were considered as important source of innovation information by 19 % of medium sized enterprises and 15 % of large enterprises. **It could be considered bad signal that large enterprises did not consider universities and institutes as important sources of information**. For example in Finland 7% and Sweden 5% enterprises

considered universities as an important source. **In case of service enterprises the use of innovation information sources was strongly depending of their size. Large service firms used intensively more different information sources.**

Table 2.7.1 Number of innovators with very important sources of information used by size, (%), 2000

	Manufacturing			Service		
	small	*medium*	*large*	*small*	*medium*	*large*
Internal information						
Within enterprise	32	34	36	39	46	48
within concern	8	17	14	17	25	38
Market information						
Competitors	6	15	7	11	14	30
customers	22	28	24	27	21	28
consultancy firms	2	6	9	3	4	24
suppliers	20	30	34	25	21	48
Public information						
Professional conferences, meetings, journals	4	8	9	11	11	18
Fairs and exhibitions	14	19	15	13	9	18
Other						
Government or private non-profit R&D institutions	0	0	0	0	1	4
Universities	1	1	0	2	0	8

2.7.3 Does location affect information sources?

Enterprises in West-Estonia (Hiiu, Saare, Pärnu and Lääne) and South-Estonia (Võru, Valga, Viljandi, Põlva, Tartu and Jõgeva) are using less than average internal sources of information. This could be due to the small R&D capabilities and not belonging to the concerns.

Fairs are relatively more important in Tallinn, Harjumaa and Tartu where exist special premises for fairs and big number of specialized fairs and exhibitions are conducted.

Enterprises in "university towns" Tallinn, Harjumaa and Tartu should quote universities and higher schools more than enterprises in other distant regions, but there is almost no link with universities undependently of the firm's location.

Table 2.7.2 Important sources of information for innovators by location, (%), 2000

	Sources within enterprise	*Other enterprises within concern*	*Competitors of the same industry*	*Clients and customers*	*Consultation firms*	*Suppliers as sources*	*Professional conferences meetings journals*	*Fairs and exhibitions*	*Government or private non-profit R&D institutions*	*Universities and higher schools*
North-Estonia	41	19	10	26	6	26	9	15	1	1
Central-Estonia	32	15	9	18	4	21	6	11	0	1
North-East-Estonia	46	11	12	22	5	31	5	14	1	1
West-Estonia	19	6	6	18	3	21	4	8	0	2
South-Estonia	30	7	13	26	0	22	9	15	0	2

2.7.4 Sources of information for the R&D performers

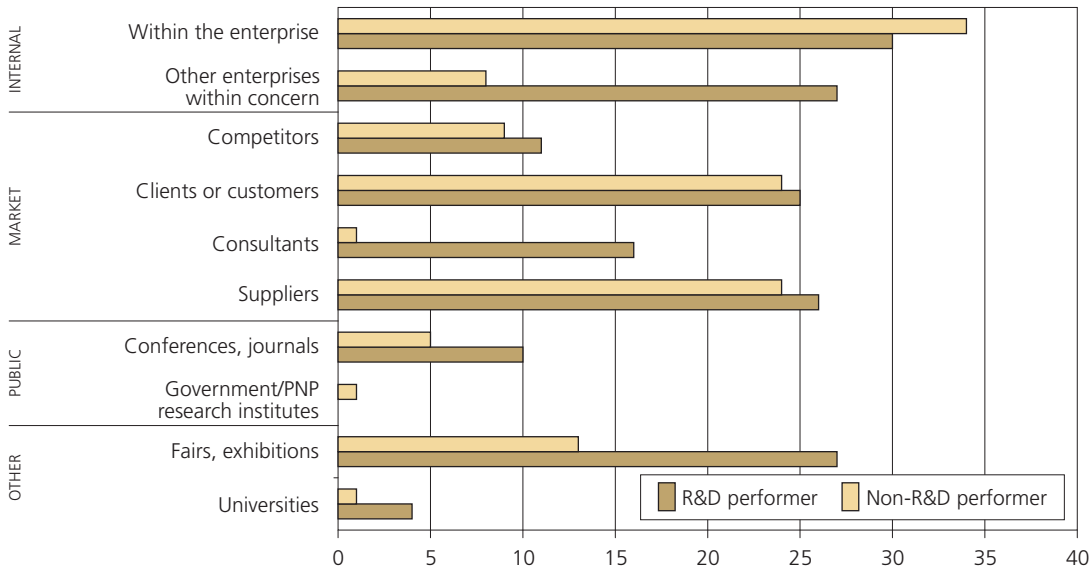
Innovation information could have different sources and also the mechanism for choosing of information sources could be different. Very often it is impossible to come to the real starting point of innovation. Of course in traditional industries feedback from market, customers and suppliers is the main source of signals for change.

Situation is different in the case of new emerging high-tech markets. The knowledge push can come from technology side and it could be the first step towards to a new product or process (CIS2: 70). In such case firms with in-house R&D could be in stronger position.

Manufacturing firms with in-house R&D considered almost all sources of information more important than enterprises without in-house R&D (see Figure 2.7.4). This could be due to the fact that they use those information sources more intensively than firms without in-house R&D.

Firms belonging to concerns are more conducting R&D as firms not belonging. Therefore firms with R&D had also access to the information of other firms in the same concern. 27% of firms with R&D used intensively other enterprises within concern compared to only 8% of enterprises without R&D.

Figure 2.7.4 Very important sources of information for innovation broken by R&D and non-R&D performer, (%), manufacturing, 1998–2000

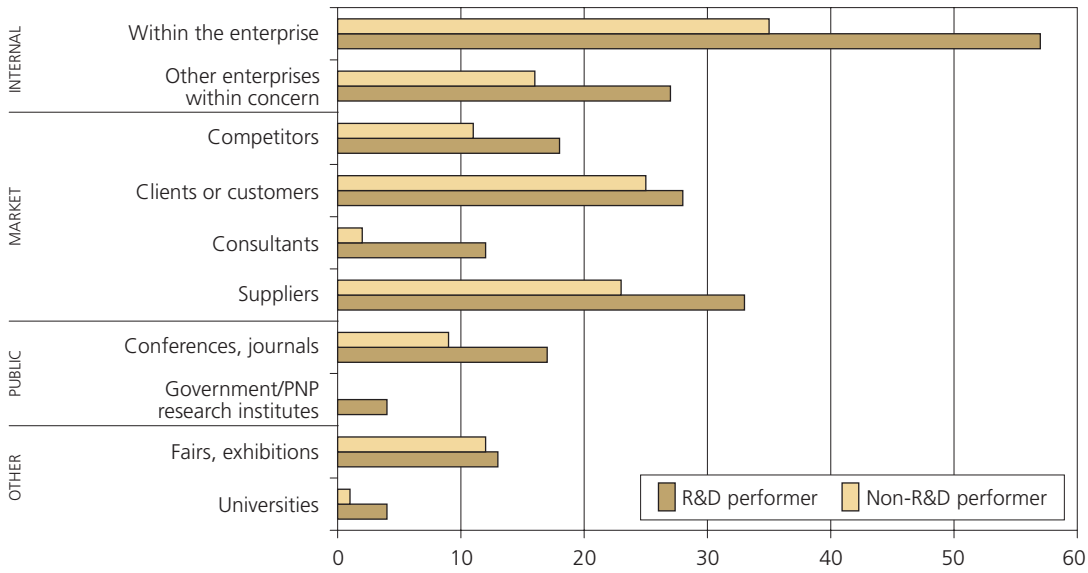


Manufacturing enterprises with in-house R&D were also more active in using of public information sources like fairs, exhibitions, conferences and also consultants.

Compared to EEA (CIS2) Estonian innovators considered almost all sources of information less important than European innovators. This could be due to the fact that information sources are still varying, public sources are under-used (especially universities capabilities) and number of regular long-term customers, who could be also development partners, is smaller than in EEA. This is due to their lower innovation expenditure intensity, and equipment oriented nature of innovation.

Service enterprises with R&D considerably relied more intensively on internal information sources than enterprises with no R&D (see Figure 2.7.5). **R&D performers used internal information for innovation within the enterprise as important source in 58% of firms**. Enterprises with no R&D used internal sources as important in 35% of firms.

Figure 2.7.5 Very important sources of information for innovation broken by R&D and non-R&D performer, (%), service sector, 1998–2000



2.8 Significant changes in enterprises

As we wrote in Chapter 1.3 the broader approach of innovation includes besides developing new or improving the existing products, processes and services, other essential strategic or organizational changes in enterprises. These changes are not classified in this survey as innovative activities, but their progressivism contributes to improving the economic activities.

The covered issues are as following:

- changes in strategy – implementation of new or significantly modified strategies of activity in the enterprise;
- in management – implementation of new, progressive management techniques;
- in structure – renewal or significant change of organisational structure
- in marketing – significant change of the enterprise's marketing strategy or concept;
- and products' aesthetic changes –significant aesthetic, design or other subjective changes of at least one of the products or services of your enterprise.

It has been concluded that:

- The share of innovative enterprises carrying out the organisational changes is two times higher than the one of non-innovators;
- Bigger enterprises and enterprises belonging to a concern are more active in carrying out the changes;
- The third of enterprises have changed their products' appearance and also the third have had structural changes.

2.8.1 Organisational innovation activities

More than half of enterprises have done any significant changes in the enterprise during period 1998–2000. The most often the changes were made in the aesthetic look of products. Also structural changes took place in every third company. 1/4 of enterprises had modified their management or marketing rules or altered the firm's strategy.

Analogically with some other parameters, bigger enterprises or enterprises belonging to a concern are more active in carrying out the changes. Manufacturing and service sector do not differ significantly, services prefer changes in management, strategy and structure, manufacturing enterprises most often change the appearance of their products. The last concept is somewhat ambiguous in services.

Figure 2.8.1 Number of enterprises having significant changes, (%), 1998–2000

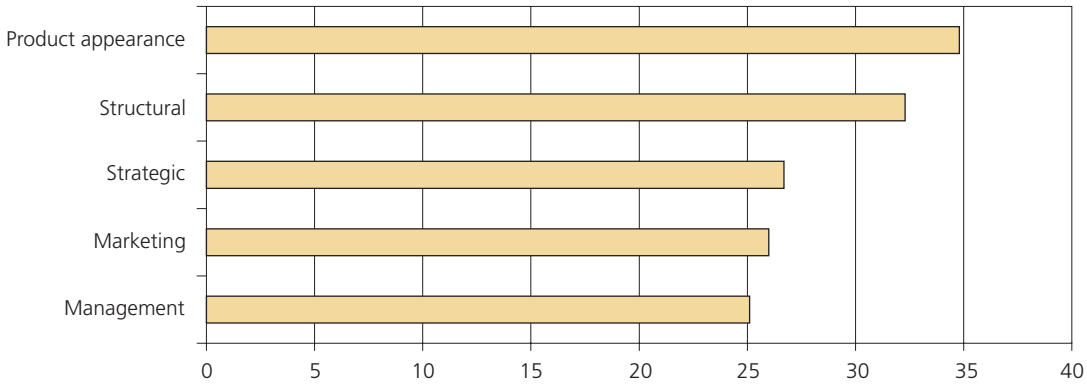


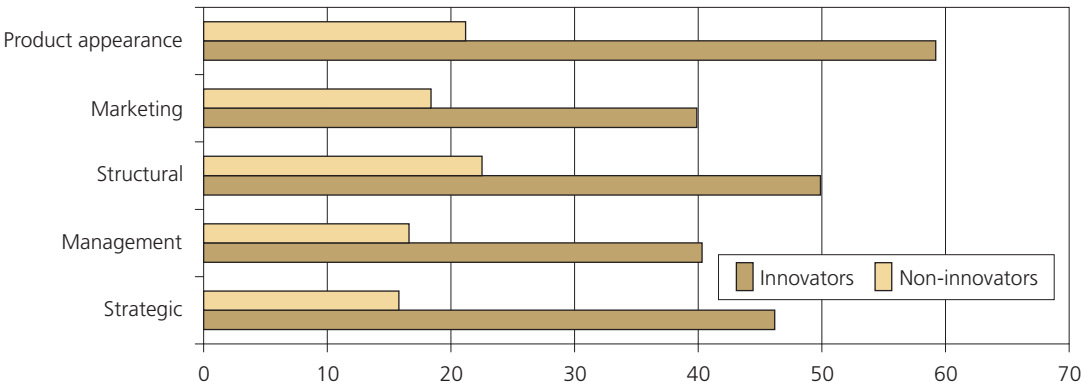
Table 2.8.1 Number of enterprises in manufacturing and services with significant changes by size, (%), 1998–2000

	Manufacturing				Services			
	all	*small*	*medium*	*large*	*all*	*small*	*medium*	*large*
All changes	**60**	**55**	**73**	**78**	**54**	**52**	**65**	**72**
Strategic	25	22	35	39	27	25	40	38
Management	23	19	31	50	27	24	44	50
Organisational	30	23	46	54	34	31	52	63
Marketing	26	24	31	44	24	23	33	38
Product appearance	44	41	53	63	23	23	28	27

2.8.2 Significant changes and/or technological innovation

The difference is most conspicuous in the case of innovative and non-innovative enterprises. **83% of innovators have modified their activities. They are two times more active as a whole and in some fields even three times than non-innovators. It indicates to the complexity of the implementation of new products/services and processes in the firm**. Usually it is hard to carry through one change (innovation or managerial, etc) without any other changes. In innovative firms the changes are more complex and varied, the changes took place in five sixth of the enterprises. Although the volume of the active changers is drastically different the most often done changes consider product appearance or structural changes in both group.

Figure 2.8.2 Number of enterprises carried out significant changes broken by innovators and non-innovators, (%), 1998–2000



If we look also the innovations carried out among the enterprises with and without organisational changes the difference is also huge: **51% of innovators among enterprises with any significant changes and only 15% among the other group. It shows that the forwarded enterprises use every kind of innovative measures**. It might also hint to the fact that the less powerful can afford only very few selected actions to increase or maintain their market position. As the annual turnover of the enterprises' who have carried out any significant changes is three times bigger than of the enterprises who haven't done any modifications. The

other reason not to carry out the changes could be a low knowledge of how to develop the company. The third explanation is that some of the enterprises have already done the needed changes in their companies before the study period. As it reveals from the next chapter 55% of non-innovators were content with their previous innovations.

Anyway we saw before in this study that the innovators were more often bigger in size and also in annual turnover, they are more likely having foreign capital and involvement in concerns. All this has made them more capable to carry out every kind of changes to raise the competitiveness of the company.

2.9 Problems with the implementation of innovation

Several overviews (Hernesniemi, 2000; European Commission (2), 2001) of Estonian innovation system have considered the low innovativeness of the enterprises. The main reasons for this have mentioned to lay in the shortage of finances, but also in the low developmental capacity – the economy has just gone out of the socialist system and only built the market economy, therefore the enterprises are still weak. The lack of managerial skills and little knowledge of the necessity of the innovation are also considered the problem factors. The results of this survey confirm the abovementioned problems.

Hamperig factors are divided into three groups in the survey:

Economic factors
- Excessive economic risk
- High innovation costs
- Lack of finance sources

Internal factors
- Organisational rigidity
- Lack of competent personal
- Absence of information on technology
- Absence of information on market

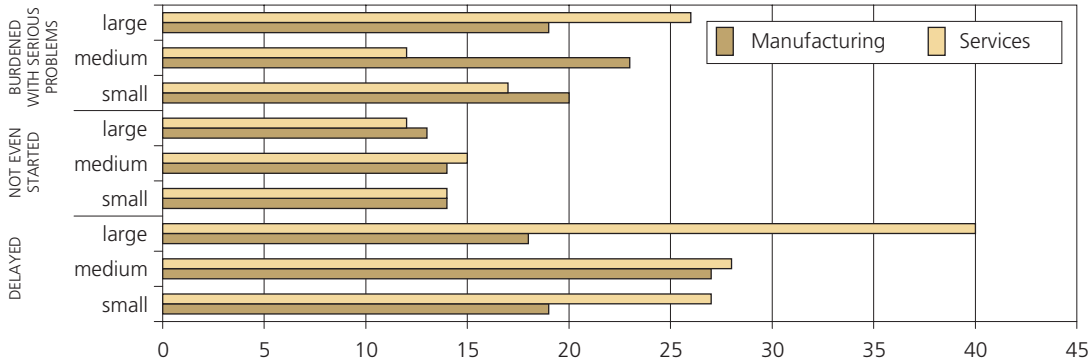
Other factors
- Insufficient flexibility of legislation
- Lack of customer interest

It has been concluded that:
- 40% of innovative enterprises have experienced some problems with their innovation projects;
- 55% of non-innovative enterprises claim that former innovations have been enough and 44% say that market conditions don't require innovations;
- The biggest hampering factors are economic factors: especially the lack of financing sources and high innovation costs;
- The most important internal factor is the shortage of competent personnel;
- and from other factors the low customer interest was revealed.

2.9.1 Innovation projects were delayed, abolished or not even started

In the case of 40% of innovative enterprises all undertakings did not go smoothly, 24% of enterprises delayed some project, 14% did not start the project and in the case of 19% other serious problems came up. The share of enterprises that had difficulties did not depend on foreign equity or share of exports net turnover. **Compared with CIS2 average data of the EU, the situation in Estonia is even better**, in the EU 16% of enterprises abandoned the project and 32% delayed their project. This could be because innovation is more equipment based in Estonia than in EU countries. Hence, fewer things can go wrong unlike in situations when enterprises have strong R&D component in their innovation projects.

Figure 2.9.1 Number of enterprises with problems in their innovation projects, (%), innovators, 1998–2000



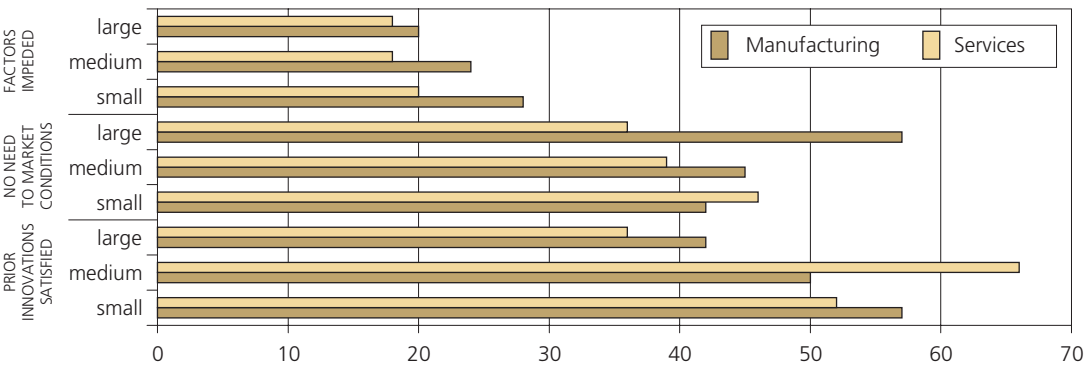
Some differences appear in the comparison of the problems of manufacturing and service enterprises: if service enterprises has been forced to postpone their projects, then manufacturers has experienced severe obstacles more often. It is very hard to trace any trend concerning the problems of the enterprises of different sizes, but according to the data the most problematic firms belong to the large service enterprises. These enterprises, including the banking, telecommunication and transport sector, have been engaged in technologically and organisationally complicated large-scale innovations related to ICT.

2.9.2 Reasons for the missing of innovation activities

The main reason why firms don't carry out any new innovative activities is that they are completely satisfied with the previous ones, 55% of the non-innovative companies claimed that. 44% said that market conditions did not require innovations and only 24% experienced hampering factors.

In majority the smaller the enterprises the more certain they are that they don't need any innovations or the obstacles for innovation are too high. It could be considered that the smaller firms have lesser resources to widen their spectrum of the products/services. **Another interesting category is large manufacturing enterprises who claim that the market doesn't require innovations**. Explanation could be again in the subcontracting character of the larger manufacturing enterprises, which determines the producing of the certain products to the certain clients.

Figure 2.9.2 Number of enterprises by reasons of no need to innovate, (%), non-innovators, 1998–2000



2.9.3 The most common hampering factors

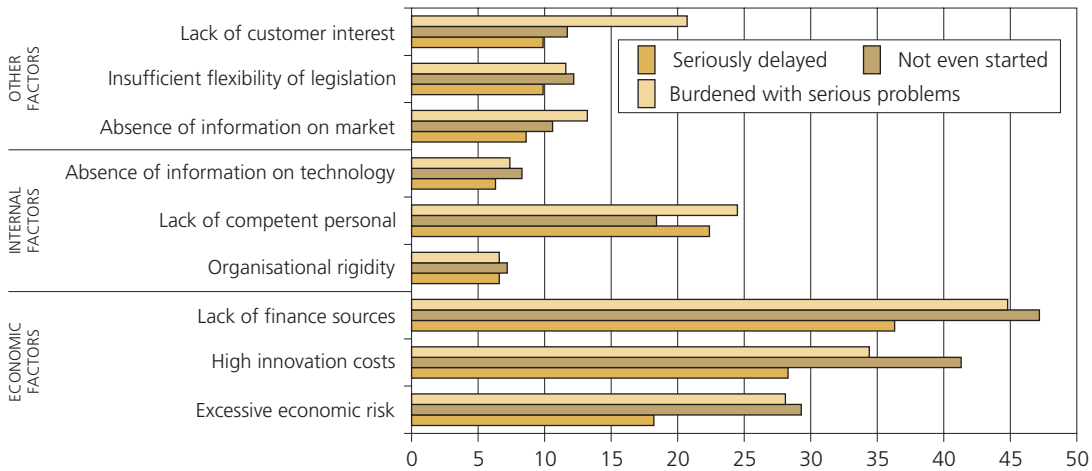
The first and second place in the ranking of factors hampering innovation is shared by the following economic factors: shortage of money – either lack of financial sources or too high innovation costs. Economic factor is in the third place as well – high economic risk, but compared with financial problems the share of this factor is a couple of times lower. Of the factors within the enterprise – lack of competent personnel and of other factors – lack of customer's need/receptivity were considered equal to economic risk.

Table 2.9.1 Hampering factors, (%), innovators, 1998–2000

		Estimation to the factors (total = 100%)			
		high	*medium*	*low*	*not important*
Economic factors	excessive economic risk	11.2	19.9	17.1	51.8
	high innovation costs	22.6	24.0	11.6	41.8
	lack of finance sources	28.8	19.1	12.9	39.3
Internal factors	organisational rigidity	3.3	11.6	19.0	66.1
	lack of competent personal	10.3	22.2	17.4	50.1
	absence of information on technology	3.8	17.9	22.1	56.2
	absence of information on market	4.9	20.1	20.2	54.8
Other factors	insufficient flexibility of legislation	6.5	14.5	15.7	63.3
	lack of customer interest	10.0	23.1	17.5	49.4

As we hinted above the innovative projects were not started or delayed above all because of the economic factors. Another item to make problems of implementation of the innovations was seen in the lack of the competence personnel. Also marketing of the new products or services could end with serious problems for innovative enterprises. **This evidence indicates that many companies do not have strategy, which integrates screening of long-term technological and market trends with co-ordinated new product development and marketing processes**.

Figure 2.9.3 Hampering factors with high importance by innovators with problems in their innovation projects, (%), 1998–2000



European CIS2 survey for EEA from 1996 resulted also in the consideration that the most important obstacles for innovation come from the economic factors. But the impact of the shortage of qualified workers and also organisational rigidities are much more important in the case of delayed projects. The Estonian entrepreneurs perceived the latter obstructing factor the least relevant. Organisational rigidities might have not been identified as a highly relevant issue because the circumstances that enterprises in Estonia are still in the growth process, and as to the subcontracting firms there is a need to adapt the client demands very quickly. It may also reflect less complicated nature of innovations, which have been implemented.

Table 2.9.2 Ranking of the barriers to innovation, Estonia 1998–2000, EEA 1996

	Seriously delayed				*Not even started*				*Burdened with serious problems*			
	manufacturing		*services*		*manufacturing.*		*services*		*manufacturing.*		*services*	
	EEA	*EST*	*EEA*	*EST*	*EEA*	*EST*	*EEA*	*EST*	*EEA*	*EST*	*EEA*	*EST*
Economic factors												
economic risks	5	3	6	4	2	3	1	4	1	4	1	5
innovation costs	3	2	4	1	1	1	3	2	2	2	2	2
sources of finance	4	1	3	1	3	1	1	1	4	1	3	1
Internal factors												
organisational rigidities	2	9	1	8	7	9	9	8	5	9	5	9
lack of competent personal	1	3	2	3	6	4	6	3	5	3	6	3
information on technology	5	5	7	7	4	4	5	7	8	6	7	6
information on markets	8	7	9	6	7	7	6	5	7	6	9	7
Other factors												
regulations & standards	7	8	5	9	5	8	4	9	8	8	8	8
customer responsiveness	9	5	7	4	7	4	8	5	3	4	4	3

Ranking by the mean estimations. 1=the most relevant, 9=the least relevant

2.9.4 What affects the problems' spectrum?

There are no essential differences by enterprises' group of different characteristics. Still, **innovative enterprises due to their experience give somewhat higher opinion to all factors (except lack of financial sources) than non-innovative enterprises, this applies mainly to competence of personnel**. Comparison of service and manufacturing enterprises shows that lack of financial sources and competence of personnel are greater problems in services than in manufacturing.

Observing large enterprises (with 250 or more employees) or enterprises with foreign equity, it can be noted that they have less financial problems than the average, the same principle applies to the enterprises working mainly for exports[18]. The larger firms have the wider range of available own resources, but they also have more credibility with the bankers and therefore their possibilities for bank loans are much higher than of the smaller firms.

Table 2.9.3 Hampering factor was considered of high importance, (%), innovators, 1998–2000

		Manufacturing			*Services*		
		small	*medium*	*large*	*small*	*medium*	*large*
Economic factors	excessive economic risk	11	12	15	10	10	11
	high innovation costs	25	26	18	20	19	18
	lack of finance sources	34	30	19	25	16	19
Internal factors	organisational rigidity	2	5	6	3	3	2
	lack of competent personal	11	13	4	8	11	9
	absence of information on technology	4	3	10	3	1	5
	absence of information on market	5	5	8	3	4	2
Other factors	insufficient flexibility of legislation	6	5	2	7	6	5
	lack of customer interest	9	8	10	10	11	5

Comparing the average rankings of the innovators and non-innovators to the hampering factors, there are no important differences in the succession: first two are the lack of finance sources and high innovation costs, followed by shortage of qualified personnel and customer responsiveness. Differences come from the relevance of the factors, where the innovators give much higher assessments than the non-innovators. The known regularity should be considered: the estimations are stronger if the problems of innovation activities are experienced on one's own company than only in theory.

[18] *Hereby it is important to remember that the share of innovators was lower among the enterprises working mainly for exports than among enterprises with lower exports share in their net turnover (see chapter 2.2).*

2.10 Innovation support from public sector

The public R&D expenditures amount to 0.62% of GDP and private R&D expenditures amount to 1.14% of GDP in EU countries (Innovation …, 2001). The total expenditures on R&D were 0.7% of GDP in 2000 and the public sector's share was 74%. The Knowledge-based Estonia – the R&D strategy for 2000–2006 foresees the increase in the finances for R&D up to 1.5% of GDP by year 2006 and reduce the public share to the 70% (Teadmistepõhine …, 2002). It is very hard to interpret the data on this question as the national innovation system has put through radical changes during 1999–2001. The main innovation supportive organisation Innovation Foundation was reorganised into Estonian Technology Agency under the umbrella organisation Estonian Business Support Foundation "Enterprise Estonia". Also many other business support structures like export and investment support measures were gathered under Enterprise Estonia. Today the structure of national innovation system is almost in its place, but it is still in continual development concerning the different services provided by public sector. The data of the Estonian CIS3 survey show that the changes in public sector services were inevitable.

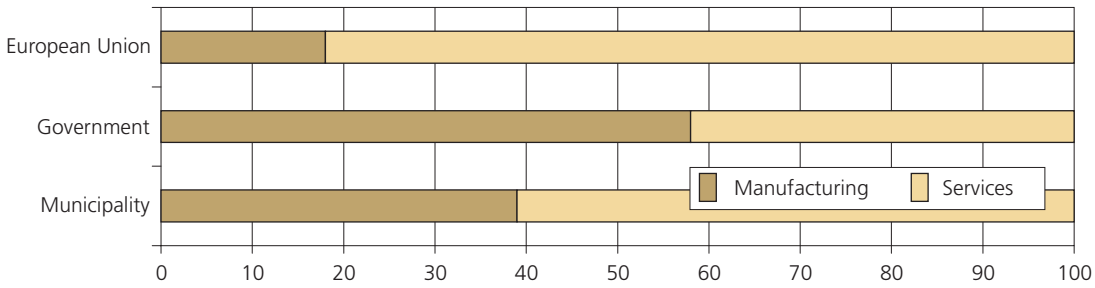
It has been concluded that:
- Very few enterprises have got innovation support from public sector;
- Majority of enterprises didn't take up their positions towards the services and disseminated information of the public sector;
- The innovative enterprises were more critical than the non-innovators about the public sector supporting activities.

2.10.1 The share of public sector funding of innovation in enterprises

The share of supported innovators from public authorities is very small – less than 100 firms reported the financial support from public sector. The biggest supporter has been the government with 4.9% of supported innovators. Municipalities have given financial support to 1.1% of innovators and European Union to 1.6%, among this EU's RTD Framework Programmes has financed 0.9% of innovative enterprises.

Figure 2.10.1 shows that in Estonia's case municipalities and the EU prefer to give financial support to service enterprises, the government is rather neutral supporter in this respect. As the number of supported enterprises is very small the preferences by number of employees and enterprise's location cannot be pointed out. The only fact that could be observed is that at least half of the supportees have been the Tallinn enterprises.

Figure 2.10.1 Division of innovation support by public supporters, (%), 1998–2000



2.10.2 Estimations to the public sector's services

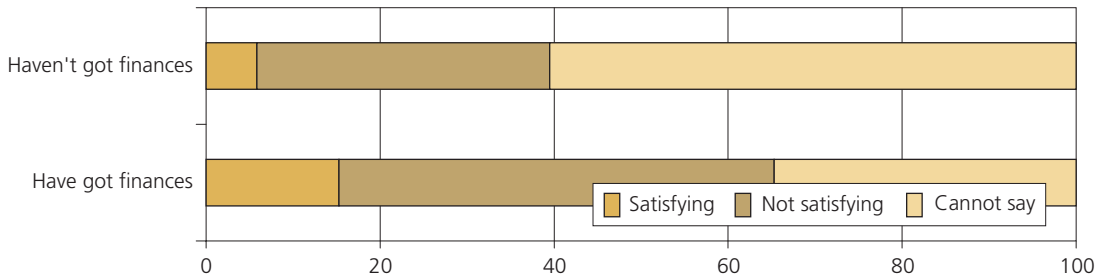
Although the majority of enterprises did not express their opinion, answering: "cannot say", it is clear that enterprises were not satisfied with the public sector services and information on these services (votes – 4:1 to the disadvantage of public sector). It is remarkable that the opinion of innovative enterprises is more negative than that of non-innovative enterprises. The reason might be the personal experience of innovative enterprises.

Table 2.10.1 Opinion on public sector's innovation supporting services, (%), 1998–2000

	Public sector services				*Information on services*			
	satisfying	*not satisfying*	*sufficient*	*not sufficient*	*satisfying*	*not satisfying*	*sufficient*	*not sufficient*
All enterprises	7.2	28.0	5.8	27.5	9.2	31.4	7.5	31.6
Innovators	6.1	36.0	4.4	36.5	8.9	39.8	7.1	41.0

It is also interesting to treat separately the following two groups of innovators: the ones who have got financial support from public sector and the ones who have not. The share of enterprises considering the public sector services satisfying is higher among the innovators who have got financial support, but also about half of them found these services dissatisfying.

Figure 2.10.2 Satisfaction with public sector services, (%), innovators, 1998–2000



About 80 enterprises added commentaries to their opinion. Most common of these were:

- more money to support innovative activities;
- more seminars and trainings;
- support for participation in fairs and expositions by exempting from charge for participation;
- incompetence of the authorities;
- establishment of techno-parks;
- more information in Russian (enterprises in North-Eastern Estonia);
- more opportunities and supporting instruments to municipalities.

3 Innovation in Economic Sectors of Estonia

3.1 Innovation in Estonian manufacturing sector

Innovation in Europe is frequently assessed in a context of level of technology. In Europe, and also in the world, high-tech firms are associated with technological innovation. High-technology fields are very often rapidly growing and with good profit margins. High-tech firms have also influence to the surrounding industrial environment due to the spill-over effect of technical information. Spill-over effect and using of technological information by other firms helps to create jobs and growth also in the other sectors.

Manufacturing industries classified according to technological sector[19]:
High-tech *Aerospace*, computers, office machinery, electronic-communications, pharmaceuticals
Medium-high tech *Scientific instruments*, motor vehicles, electrical machinery, chemicals, other transport equipment, non-electrical machinery
Medium-low tech Rubber and plastic products, shipbuilding, other manufacturing, non-ferrous metals, fabricated metal products, petroleum refining, ferrous metals
Low-tech Paper printing, textiles and clothing, food, beverages and tobacco, wood and furniture

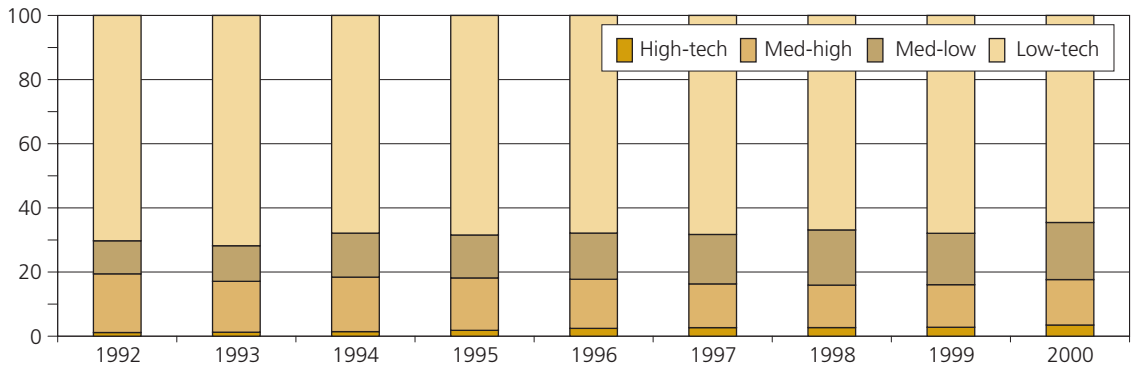
Technology intensity is calculated by the share of spending to the research and development. Belonging to the group of high-technology enterprises means that enterprise operates in the industrial sector that spends big amounts to the research and development. This does not show that enterprise itself spends relatively high share to the research and development. An enterprise in the high-technology sector could be non-innovative and vice versa: highly innovative enterprises could belong to the non-innovative low-technology sector.

It has been concluded that:
- The share of innovative firms ranges between 38% in the low-tech branches of manufacturing and 64% in the high-tech branches.
- High-tech enterprises in Estonia represent less than 3% of the total turnover of manufacturing enterprises, but they produce almost 10% of turnover from products new to the market.
- Using universities and institutes as information sources is extremely low among manufacturing.
- High-tech firms faced more obstacles on the way to innovation than low-tech firms.

3.1.1 Distribution of enterprises by technological sector[20]

In a breakdown of enterprises according to the level of technology 3% of enterprises are classified as being "high-technology" in Estonia (CIS3). Those enterprises produce 3.4% of industrial production (see Figure 3.1.1). Share of high-technology sectors[21] has grown from 1.1% in 1992 to 3.4% in 2000.

Figure 3.1.1 Distribution of industrial production by technology sector, 1992–2000



Source: Statistical Yearbook of Estonia 2002. Statistical Office of Estonia

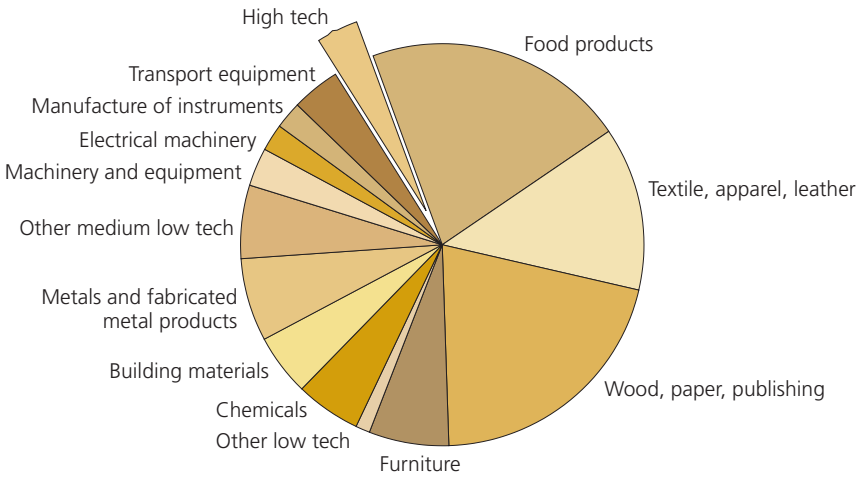
[19] *OECD, Revision of the high-technology sector and product classification, STI Working Papers, 1997/2 by OECD in CIS2 survey.*
[20] *Sample group of CIS3 and yearly industrial statistics differ but not significantly for current study.*
[21] *Not taking into account the change of OECD classificator of technologies.*

High-tech sector in Estonia consists of manufacture of communication equipment and manufacture of office machinery. Describing the industrial structure of Estonia we must admit the dominance of the low-tech industrial branches. For example in EU-15 (CIS2) had 43% of production in low-tech industries, 30% in medium-low-tech industries, 24% in medium high-tech and 3% in high-tech industries.

Estonian high tech sector and notably the production of telecommunication equipment production have grown substantially faster than other industries.

Big share of Estonian industry is concentrated in the traditional: food processing, textile and apparel and wood processing with furniture production. Food processing and wood processing based on local natural resources and textile production based on relatively cheaper labour found more easily export markets after the re-establishing of independence in 1991.

Figure 3.1.2 Composition of industrial production, (%), 2000



Source of data: Statistical Yearbook of Estonia 2002. Statistical Office of Estonia

Other industrial sectors in Estonia are quite fragmented and sometimes also dominated by one big single enterprise.

Number of industrial employees[22] has declined during the 1990-s. Reasons for that are fast growth of service sector, automation of industrial processes, rise of efficiency and concentration of several industries. Number of employees in high-technology has grown in the same time when number of employees in the other sectors have declined.

3.1.2 Level of technology by size class

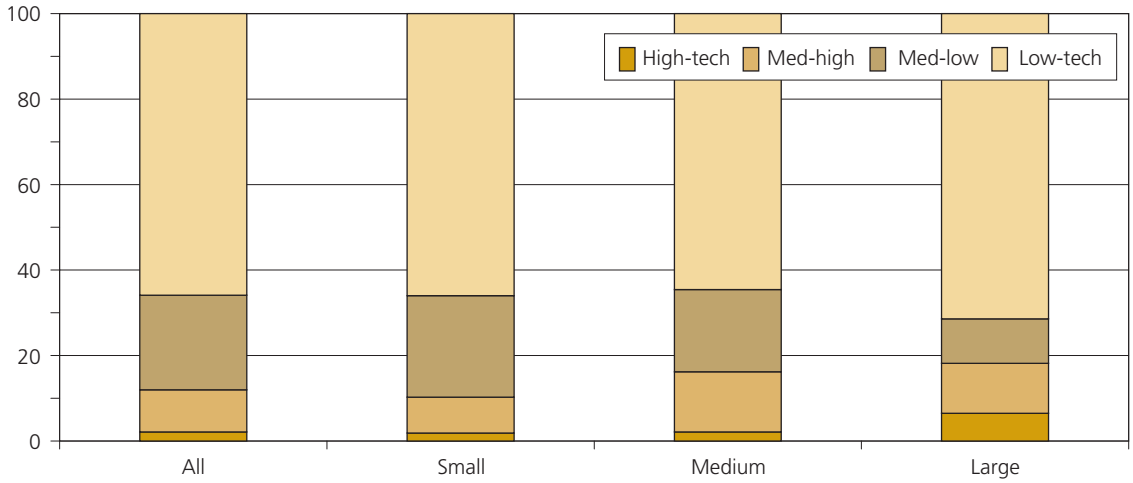
Estonian high-tech production is concentrated to relatively small number of telecommunication equipment and computer producers (see Figure 3.1.3).

A viable and relatively technology intensive part of industry is medium sized enterprises. Among them are very many firms in machine and equipment building, electrical machinery, building materials and chemicals.

High-tech enterprises in Estonia are concentrated in Tallinn and Tartu[23]. Medium-high technology enterprises in building material, chemicals and metal product sectors are mainly located in Tallinn, Tallinn area and North-East of Estonia. Low-tech enterprises in wood processing and food processing are located all over Estonia.

[22] *Computed to the full working day. There is also big number of part-time employees.*
[23] *West Estonia and North-Estonia have quite small number of enterprises in survey.*

Figure 3.1.3 Distribution of enterprises by size and technology sector, (%), 2000



3.1.3 Innovators by technological sector

In the Table 3.1.1 is seen that the manufacturing branches with greater share of foreign capital are quite successful innovators as compared to the others, but this seems to apply particularly to the capital-intensive branches. The other branches without large share of foreign capital, which are dominated by sectors of intensive use of local raw materials, are average innovators.

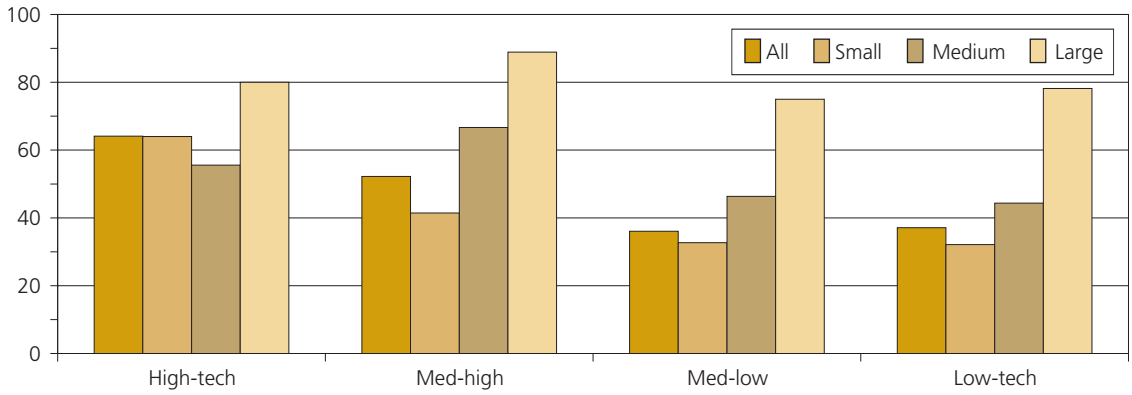
Table 3.1.1 Breakdown of sub-sectors by innovation intensity and the share of foreign capital, 1998–2000

		Share of foreign capital in the sectors' firms	
		Less than 30%	*30-45%*
Innovativeness in the sector (% of total enterprises in the sector)	*Less than 30%*		Manuf. of textiles and wearing apparel
	30–49%	Manuf. of food products Manuf. of wood products Manuf. of pulp, paper products Manuf. of oil-shale products	Manuf. of leather products Manuf. of rubber and plastic products Manuf. of machinery and equipment Manuf. of electrical apparatus Manuf. of other non-metallic mineral products Manuf. of basic metal products Manufacturing n.e.c.
	More than 50%		Manuf. of chemicals Manuf. of transport equipment

In general the share of innovating firms is higher, the higher the branch's level of technology. As shown in the Figure 3.1.4 the share of innovating firms ranges between 38% in the low-tech branches of manufacturing and 64% in the high-tech branches.

A breakdown by size class shows that share of innovators raises among SME-s according to the technology intensity. However it should be mentioned that the share of innovators among low-tech, medium-low tech and medium-high-tech in small- and medium sized enterprises do not differ considerably.

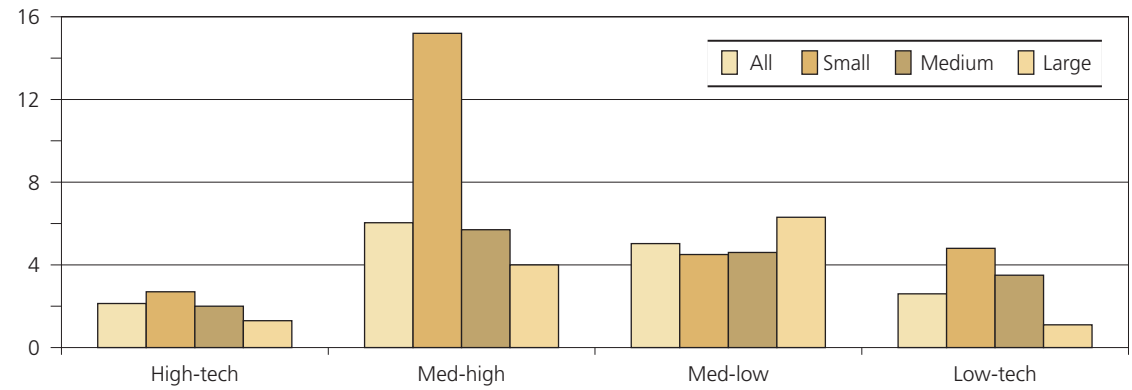
Figure 3.1.4 Number of innovators by technology sector and size, (%), 1998–2000



3.1.4 Expenditure on innovation by technological sector

There is difficult to see any trend on innovation expenditures in Estonia. Relatively did medium-high technology and medium-low technology enterprises invest more into innovation than small number of high-tech enterprises and big number of low-technology enterprises (see Figure 3.1.5). SME-s did invest relatively more into innovation than medium sized and large enterprises. This trend was strongly visible in the case of medium-high technology enterprises.

Figure 3.1.5 Innovation expenditure intensity by size and technology sector, (%), innovators, 2000



Structure of innovation expenditures is quite different from European Union, where innovation expenditures of high-technology firms are approximately 3 times higher than innovation expenditures of other firms (CIS2).

A breakdown of innovation expenditure by level of technology shows that enterprises in the high technology and medium-high technology invest relatively more into intramural R&D than low-technology enterprises. High technology enterprises are also active outsourcers of research and development services.

In case of the low-technology and medium-low technology enterprises acquisition of machinery and equipment are most important single innovation expenditure. There are no differences across technology groups in terms of innovation expenditure intensity, but there is difference in the degree of embodiment of innovation.

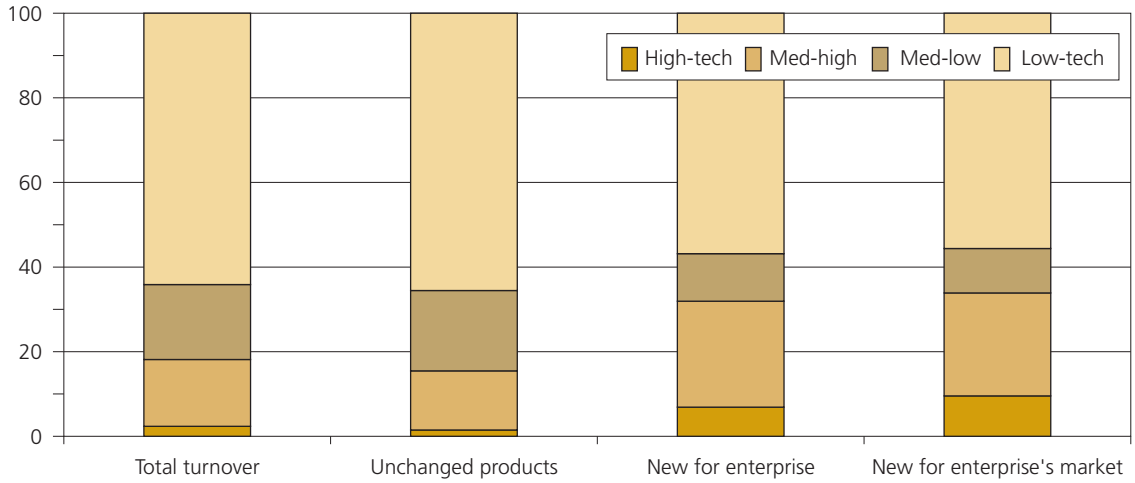
Table 3.1.2 Distribution of innovation expenditure by technology sector, (%), 2000

	Intramural R&D	*Extramural R&D*	*Machinery and equipment*	*Knowledge*	*Training*	*Marketing*	*Other*	*All*
Low-tech	6.3	4.1	76.0	2.3	1.3	6.6	3.4	100
Med-low	17.8	2.9	75.9	1	0.7	0.6	1.4	100
Med-high	17.4	1.5	27.6	1.4	5.4	3.5	43.4	100
High-tech	29.4	10.7	48.6	0.5	1.2	8.5	1.5	100

3.1.5 Output of innovation by technological sector

High-technology enterprises represent in the CIS3 survey (see Figure 3.1.6) less than 3% of the total turnover of manufacturing enterprises. **Despite their small share in the industrial production those enterprises produce almost 10% of turnover from products new to the market. Enterprises in the medium-high technology sector produce 16% of total turnover of industry and 24% of products new to the market. This trend shows important influence of the high-technology and medium-high technology enterprises to the industry in total.**

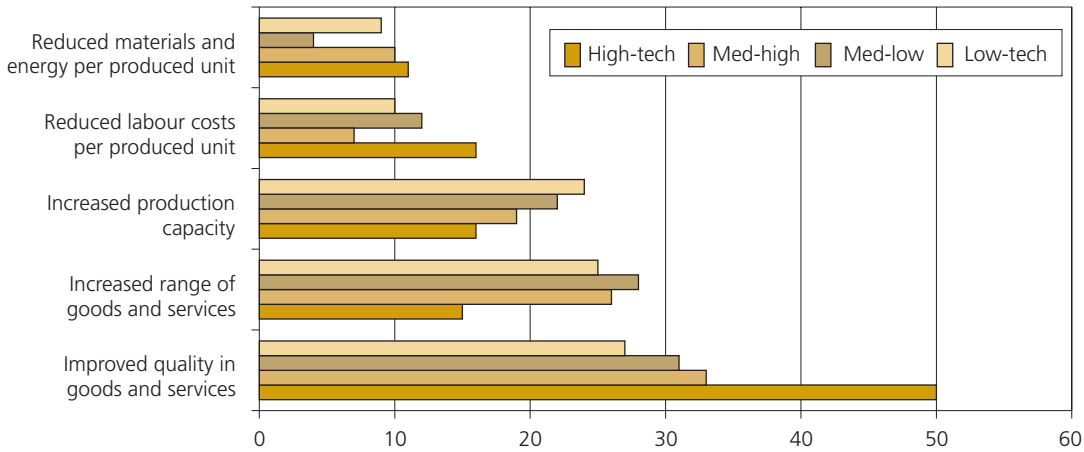
Figure 3.1.6 Breakdown of turnover according to technology sector, (%), 2000



3.1.6 Effects of innovation by technological sector

High-technology enterprises are more product development oriented and therefore high technology enterprises have experienced more product development effects than enterprises in low-technology sector (see Figure 3.1.7).

Figure 3.1.7 Number of innovators according to very important objectives of innovation by technology sector, (%), 1998–2000



Low-technology enterprises have also product improvement effects but to the lesser extent. Process improvement related effects have been distributed equally between enterprises in high-tech and low-tech.

3.1.7 Innovation cooperation by technological sector

Data on cooperation for innovation purposes reveal several significant differences between firms with different levels of technology. Innovators in high-technology sector are more likely to establish co-operation links with other enterprises than enterprises in medium-low technology sector and low-technology sector (see Figure 3.1.8). On average, 52% of high-tech innovators have innovation collaboration against 43% for medium-high tech, 30% for medium low and 31% for low tech. Large technology intensive enterprises are more likely to establish cooperation links than small and medium-sized enterprises.

Figure 3.1.8 Number of innovators with innovation cooperation by size and technology sector, (%), 1998–2000

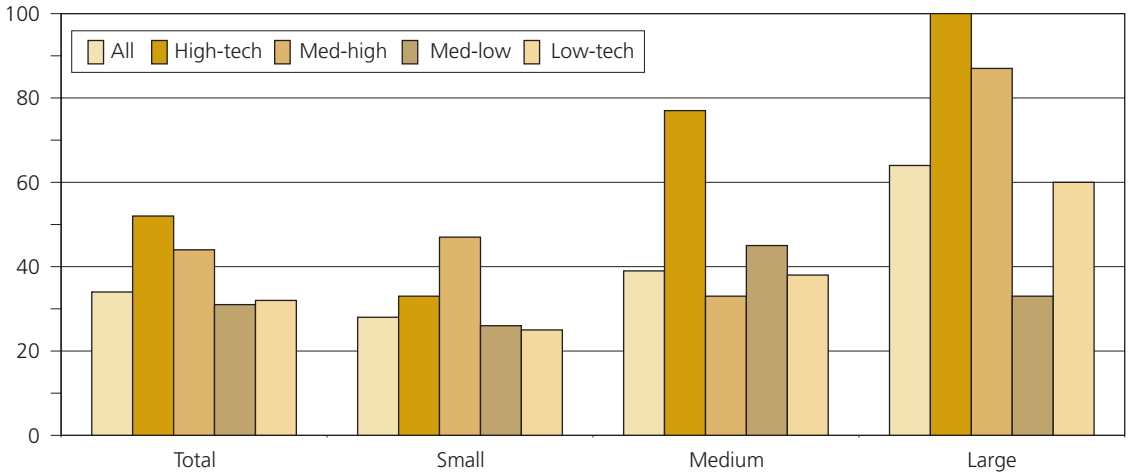


Table 3.1.2 shows that suppliers of equipment and clients are two most important groups for innovation cooperation. Almost all enterprises belonging to the bigger group appointed other enterprises within the same group as important innovation partners. Different from EU, where clients are relatively important for high-tech enterprises and relatively unimportant cooperation partner for low-tech enterprises, low-tech enterprises use clients as innovation partners in 41% of cases compared to 25% in high tech enterprises.

In the second cooperation group are consultant and competitors with few percents. Last group of cooperation partners contains public institutions, universities and private R&D labs with whom cooperation is quite exceptional.

Table 3.1.3 Number of innovators with innovation cooperation by nature of partnership and by technology sector, (%), 1998–2000

	Low-tech	*Med-low*	*Med-high*	*High-tech*
Other enterprises within concern	31	24	24	17
Suppliers of equipment, materials	44	26	31	38
Clients or customers	41	28	39	25
Competitors and other firms from the same industry	9.9	5.3	2.4	0.0
Consultants	2.7	2.7	2.4	9.5
Enterprises offering R&D services	1.9	2.7	0.0	0.0
Universities and higher schools, their units and institutes	2.6	5.2	9.2	0.0
Public and private non-profit R&D institutions	0.1	0.3	0.4	19

The vast majority of cooperation partners are other enterprises in Estonia. As seen from table 3.1.3 high-technology enterprises tend to have far more distant partners than other enterprises.

Table 3.1.4 Number of innovators with innovation cooperation by geographical location of the partner and by technology sector, (%), 1998–2000

	Low-tech	*Med-low*	*Med-high*	*High-tech*
National	80	89	81	72
EU and EFTA	65	66	58	78
EU candidate countries	18	31	34	21
US	4.3	0.8	13.7	29
Japan	4.3	2.8	2.4	0.0
Other countries	10	21	30	38

3.1.8 Sources of information[24] by technology sector

Main information sources for innovations lay inside the enterprise itself. **It should be noted with surprise that high technology enterprises did not quote universities as important sources of information**.

Table 3.1.5 Sources of information by technology sector, (%), 1998–2000

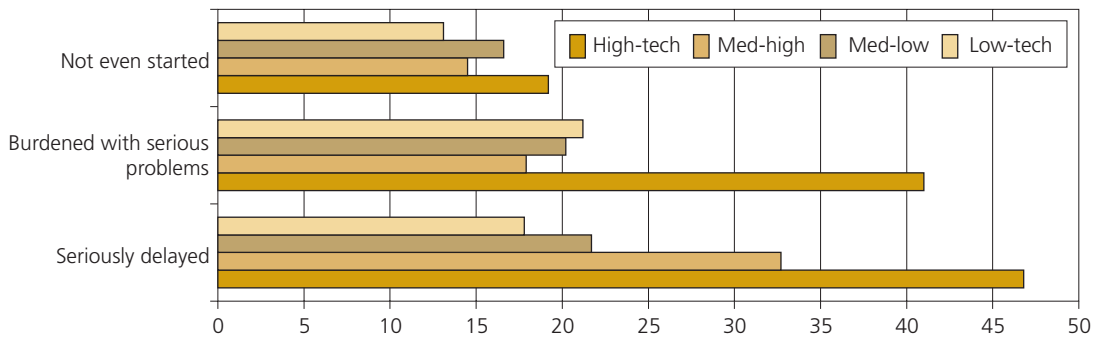
	Within enterprise	*Other enterprises within concern*	*Suppliers of equipment, materials, components or software*	*Clients or customers*	*Competitors and other firms from the same industry*	*Con-sultants*	*Universities and higher schools; their units and institutes*	*Public and private non-profit R&D institutions*	*Conferences, meetings, journals*	*Fairs, exhi-bitions*
Total	12.9	4.4	9.6	9.3	3.6	1.5	0.4	0.3	2.3	6.3
High-tech	30.6	3.2	14.0	24.2	4.1	3.2	0.0	2.6	2.6	14.2
Med-high	19.1	6.8	10.7	20.2	7.2	3.8	1.9	0.7	3.4	12.4
Med-low	11.2	3.6	10.2	6.6	2.7	1.6	0.6	0.3	0.6	6.7
Low-tech	11.9	4.4	9.1	8.2	3.3	1.1	0.2	0.1	2.8	5.1

Clients and customers are very important sources of innovation information for high-tech and medium-high-tech enterprises. This shows that **development of high-tech and medium-high-tech product needs more inter-firm communication and co-operative development**.

3.1.9 Hampering factors by technology sector

High-tech firms are facing more obstacles on the way to innovation than low-tech firms (see Figure 3.1.9). This could be due to the fact that high-tech firms are more innovative and therefore probability of facing different obstacles is bigger.

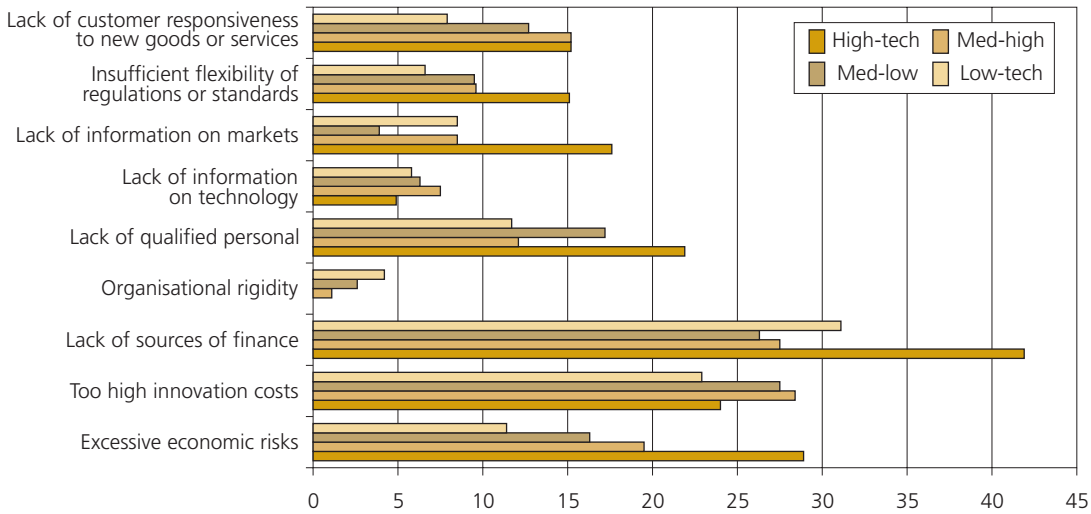
Figure 3.1.9 Percent of innovators facing barriers to innovation by technology sector, (%), 1998–2000



[24] *Number of enterprises in high technology sector was very small (22 enterprises).*

According to technological intensity most critical firms facing the obstacles are high-tech and medium-high tech firms. Least important obstacle for innovation is organizational rigidity (see also Chapter 2.9). Importance of organizational rigidity as hampering factor is growing by decrease of technological intensity. It shows the nature of high tech in Estonia which is still production oriented.

Figure 3.1.10 Number of innovators facing barriers to innovation according to hampering factors, (%), 1998–2000



Most of the low-tech firms are traditional enterprises in meat and dairy processing, woodworking and textile sector. Very often those enterprises have bigger and more hierarchical structures compared to SME-s in high-tech sector. Due to the novelty and small size economic factors, as lack of capital and economic risks are main hampering factors of innovation for high-tech companies.

3.2 Innovation in service sector

3.2.1 Service sector in Estonia

Services amount to 2/3 of Estonia's GDP (see Figure 1.1.2). The share went up rapidly in the beginning of the 1990s and then stabilised around 1994 a. Due to the large share of the sector it is clear that the innovative behaviour of its enterprises and a comprehension of the factors causing it are vitally important issues. It should be considered here that to discuss the service sector as a whole is an extremely high abstraction. This sector is very extensive and extremely heterogeneous, its individual components operate in highly varying conditions of economy, the division of the enterprises in size groups differs widely in the various sub-sectors, etc.

The success of functioning of the economy largely depends on how well the channels of its financing function: the banking sector, the brokerage of international flows of capital, the securities market, leasing. As recently as in the beginning of the 1990s there was no financial market in Estonia even remotely reminding the modern one. Commercial banks, leasing and insurance firms, investment funds and other enterprises operating in that sphere according to the market economy principles are thus a relatively young part of Estonia's business, yet they have already passed several rather different stages in their development, for example, banking crisis, the boom and decline of stock market and investment funds. The whole banking and financial sector amounted to 3.8% of Estonian GDP in 2000 (according to Statistical Office of Estonia).

Transport is another important services sector in Estonia, not just as one branch of infrastructure among others, without which no normal economic and social development can be possible. It also provides a very significant part of Estonia's export of services, but the latter is a macro-economically extremely important balancer of Estonian current account and the balance of payments. The characteristic features of the Estonian transport sector are 1) the large share of servicing the international transit of goods, 2) the role of passenger transport as a component of the development of tourism.

The dependence of Estonian economy on the transit of goods has sometimes been discussed as excessive. Calculations show that the cluster of transport-related spheres amounts to a total of nearly 10% of GDP, which is not as high as the media have sometimes shown, but nevertheless is a quite respectable share.

The transport sector enterprises in Estonia operate in an environment of rather intensive competition, both domestic and foreign. The cheap cost of labour and other production input, as a rule, are not a decisive competitiveness factor in this sphere, what matters is the efficiency of organisation of transport and services. The above also determines the great importance of innovation as a premise for continued successful development in this sector. This is particularly valid in the services to the flow of transit, where various transport corridors are in a brutal international competition. Innovation does not mean here only new transport technologies in the narrow sense, but also the use of new logistical and distribution schemes and computerisation of control and organisation of the entire movement of goods.

3.2.2 Service enterprises in the survey

The representation of enterprises of various sub-sectors of services in the sample of this research[25] is widely different, primarily dependent to the number of enterprises in the corresponding sub-sector. In other words, whether or not there is a large number of small enterprises in the sub-branch. A classical branch of small enterprises is trade, which clearly dominates in our sample of services enterprises. The sample also contains a relatively large number of road transport enterprises, as well as the branch of supportive services to transport. At the same time, the number of studied enterprises in the transport sectors like air and water transport is very small. The number of enterprises is also relatively low (between 10 and 25 per sub-branch) in the financial services sub-branches.

As compared to other branches of economy, financial services (more precisely two sub-sectors of three in this sector) is among the best in Estonia regarding most of the innovation indicators. The sub-sectors of the transport sectors, with the exception of air transport, represented in the sample by a rather small number of enterprises, are placed towards the bottom of the innovativeness ranking. But it should be kept in mind here that neither is transport among the greatest innovators in the other countries (In the EU there were a total of 24% of enterprises considered innovative as compared to, 54% in the financial services sector). The innovativeness of Estonia's transport, with the possible exception of road transport, does not look all that bad against this background.

3.2.3 Innovation intensity in service enterprises

As the above explained, the Estonian enterprises are quite innovative against the international background, regarding both product and process innovation. It should be kept in mind, however, that in some cases the representatives of the service enterprises might have interpreted the term "product innovation" in a somewhat different manner (service as a product).

Table 3.2.1 Number of innovators in service sector, 1998–2000

	Share of innovators, %	*Number of innovators*
Electricity, gas, steam and hot water supply	24	24
Collection, purification and distribution of water	31	9
Wholesale trade and commission trade, except of motor vehicles and motorcycles	34	148
Land transport	15	36
Water transport	30	3
Air transport	50	2
Supporting and auxiliary transport activities; activities of travel agencies	27	40
Post and telecommunications	69	15
Financial intermediation	46	8
Insurance and pension funding, except compulsory social security	73	9
Activities auxiliary to financial intermediation	36	5
Computer and related activities	65	29
Research and development	85	4
Architectural and engineering activities and related technical consultancy	34	38
Technical testing and analysis	31	7

[25] *This study does not cover such sub-branches of the services sector like hotel and restaurant services.*

As is seen in Table 3.2.2., the services branches with greater share of foreign capital are quite successful innovators as compared to the others, but this seems to apply particularly to the capital-intensive branches. In other cases, the branches without large share of foreign capital may be successful (architectural and engineering services) or at least average innovators.

Table 3.2.2 Breakdown of service sub-sectors by innovation intensity and the share of foreign capital, 1998–2000

		Share of foreign capital in the sectors' firms		
		Less than 30%	*30-45%*	*More than 50%*
Innovativeness in the sector (% of total enterprises in the sector)	*Less than 30%*	Land transport	Supporting and auxiliary transport activities; activities of travel agencies	
	30–49%	Electricity, gas, steam and hot water supply Collection, purification and distribution of water Water transport Technical testing and analysis	Wholesale trade and commission trade Activities auxiliary to financial intermediation	Financial intermediation
	More than 50%	Architectural and engineering activities and related technical consultancy	Computer and related activities Research and development	Air transport Post and telecommunications Insurance and pension funding

Let us further observe the tendencies to product and process innovation of the various services branches under study.

Table 3.2.3 Breakdown of service sub-sectors by product and process development intensiveness, 1998–2000

		Product development activities		
		Low	*Medium*	*High*
Process development activities	*High*	Electricity, gas, steam and water supply	Air transport Architect and engineering activities	Financial intermediation Insurance and pension funding Technical testing and analysis
	Medium		Land transport Auxiliary transport services incl. travel agencies activities Activities auxiliary to financial intermediation	Wholesale and commission trade Water transport Post and telecommunications Research and development
	Low			Computer and related activities

As for combined product and process management, two financial mediation sub-sectors and firms specialised on technical testing should be pointed out (Table 3.2.3). The power, gas and hot water suppliers, as well as water supply and treatment firms are active innovators of process rather than of product. The situation is exactly the opposite with the computer firms – they are among the first as to product innovation, but are rather among the last in process innovation as compared to the other sectors. (Although 44% of them innovated their processes in 1998–2000, it is one of the lowest figures against the highly process innovative Estonian background). The firms engaged in trade are, according to the study, among the average as to product innovation, but here we obviously face the problem of how to define the term "new product" when discussing trade.

We can observe a somewhat more critical image when viewing product innovation regarding novelty for the market rather than for the enterprise itself and proceed from the share of turnover of the products, rather than their mere existence. The share of turnover of products new for the market reaches in the studied services sectors from 40% among the directly R&D-oriented firms to 20% among architectural and engineering (consultation) firms. This percentage exceeds 10% in the other sub-sectors at best, but in most cases remains below it.

Greater expenditures on innovation are made by the power, gas and hot water suppliers, water and air transport firms, financial intermediation firms (with the exception of companies engaged in auxiliary activities in that sphere) and, naturally, companies directly specialised in R&D than the others. This indicator has a quite strong connection, estimated in absolute sums, to the overall volume of capital of the sub-sectors, with the exception of the R&D firms, whose overall volume of capital is not very high in Estonia.

But when observing the expenditure on innovation ratio to turnover indicators and total R&D turnover, we can see that significant share of these expenditures can be mentioned only in case of the firms directly specialised in R&D (roughly 60% of the expenditures, according to their estimates, can be interpreted as innovative and slightly over half of that as R&D expenditures, predominantly intramural R&D). A relatively high percentage of innovation expenditures (16% of turnover), rather than a percentage of R&D expenditures can be mentioned in case of firms selling the technical testing services. In case of firms providing computer-related services, the innovation expenditures roughly amount to eight percent, including R&D expenditures six percent of turnover, while in case of the other sub-sectors, approximately one-percent expenditures can be mentioned at best.

A slightly more optimistic picture is provided when observing the indicators' "engagement in R&D" (the firms' own estimate). In practically 100% of cases it can be viewed as a continuously occurring process in case of directly R&D-specialised firms, which is self-evident; but in more than 50% of cases also among firms providing computer-related services, most firms of the financial intermediation and telecommunications sectors. A continuous connection with R&D has been relatively frequently mentioned also in case of water supply and water treatment, architectural and engineering (consultation) firms and firms specialised in technical testing.

When observing the innovation activities of service firms on its different sectors, we can see that the most popular method, as is common among Estonian enterprises in general, is innovation via acquisition of machinery and equipment (Table 3.2.4). As to that indicator there are no major differences between the various services areas and it is slightly less significant only among the firms providing computer services. Training is also quite important in the various branches of services. Intramural research is typical of the telecommunication firms, computer services firms, all firms in the financial intermediation sectors, testing firms and naturally the firms directly specialised in R&D, while extramural research characterises some financial intermediation sectors, power, gas and hot water suppliers, air transport, as well as the firms directly specialised on R&D. The question on the ability to buy extramural research is partly answered by a comparison with the statistic of merging with concerns: it can be presumed that the parent firm provides it free of charge in some cases.

Table 3.2.4 Spread of different innovative activities in services, 1998–2000

	Intra-mural R&D	*Extra-mural R&D*	*Acqui-sition of machinery*	*Acqui-sition of knowledge*	*Training*	*Market-ing*	*Other*
Electricity, gas, steam and hot water supply			X				
Collection, purification and distribution of water			X				
Wholesale trade and commission trade, except of motor vehicles and motorcycles			X				
Land transport			X				
Water transport			X				
Air transport			X		X		
Supporting and auxiliary transport activities; activities of travel agencies					X		
Post and telecommunications	X						
Financial intermediation		X	X		X		
Insurance and pension funding, except compulsory social security					X		
Activities auxiliary to financial intermediation	X		X				
Computer and related activities	X						
Research and development	X		X				
Architectural and engineering activities and related technical consultancy			X				
Technical testing and analysis			X				

≥ 50% of innovative enterprises have used it
20–49% of innovative enterprises have used it
X – the most often used activity in the sector

Using as basis a 50% statistical threshold, we can point out on the one hand a group of innovators narrowly concentrated on the purchase of equipment (electricity, gas, steam and hot water supply; collection, purification and distribution of water; wholesale trade; land transport) and a similar group, where new equipment is accompanied by training (water and air transport). The former could be seen as opposite of so-called complex innovators – financial intermediation, insurance, computer related service firms, R&D firms, architecture and engineering bureaus. By using somewhat relaxed criteria one could also fit the power, gas and heating supply firms in that group. It is interesting that marketing is a relatively ignored function in this group. In some cases the "small country phenomenon" may be the reason: there are few firms in the field, the more serious actors are all known and, for example, in case of innovations realised together with the clients, marketing cannot be differentiated as a separate function.

It is noticeable that intramural R&D, although the expenses on it are relatively low, (see also Chapter 2.3) is nevertheless spread in a rather large number of sub-branches to certain extent. Extramural R&D, as well as acquisition of knowledge seem to be more typical of the sub-branches with greater share of foreign capital.

The importance of marketing as a partial activity of innovation varies strongly in different sectors of services: it is not significant in the sectors, where the market is practically assured (e.g. water supply and treatment), but is important in some sub-sectors of financial intermediation, trade, as well as firms selling R&D.

3.2.4 Partners for cooperation in services

Cooperation arrangements differ greatly in the sub-sectors of services: it is typical of the firms active in financial intermediation, air transport, testing and R&D, as well as power, gas and hot water suppliers. As is typical of Estonian firms in general, the main partners of such agreements and cooperation are the suppliers and clients. The most widespread is a strong innovation cooperation with suppliers among the power, gas and hot water supply firms, water supply and treatment services, air transport firms, strong innovation cooperation with clients in trading firms, road and rail transport firms, post and R&D firms. Innovation cooperation with research institutes, universities and other research establishments can be mentioned primarily in connection with air transport, water supply and treatment firms, architectural and engineering (consultation) firms and R&D firms.

Table 3.2.5 Spread of important information sources in services, 1998–2000

	Within enterprise	*Within concern*	*Suppliers*	*Clients*	*Competitors*	*Universities, R&D institutions*	*Conferences, journals*	*Fairs, exhibitions*
Electricity, gas, steam and hot water supply			X					
Collection, purification and distribution of water			X		X			
Wholesale trade and commission trade			X	X				
Land transport				X				
Air transport								
Water transport								
Supporting and auxiliary transport activities; activities of travel agencies		X		X				
Post and telecommunications		X		X				
Financial intermediation			X					
Insurance and pension funding, except compulsory social security			X	X				
Activities auxiliary to financial intermediation		X						
Computer and related activities				X				
Research and development				X			X	
Architectural and engineering activities and related technical consultancy			X					
Technical testing and analysis		X	X					

≥ 50% of innovative enterprises have mentioned it
30–49% of innovative enterprises have mentioned it
10–29% of innovative enterprises have mentioned it
X – the most important external information source

As can be seen from Table 3.2.5, also in services the sources of information are dominated, besides the in-house sources, primarily by suppliers and clients. Universities and research institutes are of low importance as sources of information.

3.2.5 Innovation in services associates with …

Is the innovative activity in the services sectors associated with indicators like export, investments-to-turnover ratio and the share of employees with higher education in the firms? One would have to state that it is hard to point out common associations as the services sub-sectors are different and act differently. For example, while in the architectural and engineering (consulting) offices, as well as in firms specialised directly in R&D the exporters are indeed significantly more active innovators than the non-exporters, then in most transport sectors, somewhat amazingly, the non-exporters are actually more active innovators (it is true that in transport, most of the studied firms are dealing with foreign markets, making non-exporters somewhat peripheral and uncharacteristic). Financial intermediators as a group in Estonia almost do not export their services, while their innovative activity is impressive, (at least now).

Investment ratio to turnover in most sub-sectors of services seems to be an activity (indicator) favouring innovation (e.g. in financial services, post and telecommunications, R&D firms), but this does not apply to all sub-sectors of services (e.g. transport).

The firms with higher share of university graduates are greater innovators only in some sub-sectors of services and the difference in innovation activity is not significant even there. At the same time, for example in the transport sectors the innovativeness is greater in the firms with a lower share of university graduates. This result is somewhat paradoxical. The further research must show is the formal education level of the employees in Estonian services already as high that its "low level" does not obstruct innovation, or are there some other explanations (for example, that service enterprises, in which the process innovation is the priority type of innovative activity, have usually more staff without university degree).

4 Innovation in Micro-enterprises

We are now going to compare the main indicators of micro enterprises and enterprises which belonged to the basic survey. The objects of comparison are enterprises with 3–9 employees (759 enterprises) and enterprises of the same economic activities from the basic survey[26] (see Appendix 1). As concerns the enterprises with 0–2 employees with the main economic activity of research and development, the detailed analysis is not possible due to their small number (18 in the sample, 8 respondents) for the principle of confidentiality. Besides, only 3 enterprises out of 8 respondents proved to be innovative, for this reason the specification of their main economic activity is doubtful.

Table 4.1.1 Comparison of main innovation indicators in micro-enterprises and basic survey, (%), 1998–2000

Indicator	*Enterprises with 3-9 employees of micro-enterprises survey*	*Enterprises with more than 9 employees of the same activities*[27]
Innovators	31.8	47.1
Product innovators	23.4	36.9
Product innovation developers:		
Enterprise itself	63.9	59.8
Concern	5.2	11.8
In co-operation	22.6	20.1
Others	8.3	8.3
Share of new products for enterprise in turnover	42.0	21.8
Share of new products for market in turnover	38.8	9.9
Novel innovators	13.5	21.9
Process innovators	19.2	31.8
Process innovation developers:		
Enterprise itself	42.6	54.3
Concern	3.1	11.1
In co-operation	26.1	23.2
Others	28.1	11.5
Non-completed innovations	16.6	26.2
Abandoned innovations	3.9	7.5

Table 4.1.2 shows that **micro enterprises are less innovative on an average, but they try to introduce new products for market**. Only every seventh micro enterprise is product innovative novel innovator, but the share of new products for market in net turnover amounts to almost 40%. This indicator is two times higher than the corresponding indicator of the basic survey. Consequently, **a micro enterprise that is successful in the market with new products guarantees itself a substantial net turnover compared with those which are not successful**.

Observing innovation in a more detailed way, the picture is as follows in Table 4.1.2.

[26] *660 enterprises of the basic survey, NACE codes 24–26, 29–33, 64.2, 65–67, 73, 74.2 and 74.3*
[27] *The enterprises in respective fields from the main survey.*

Table 4.1.2 Innovativeness by activity in micro-enterprises compared with those of the basic survey, (%), 1998–2000[28]

Activity	*Enterprises with 3-9 employees*	*Enterprises with more than 9 employees*
Manufacture of chemicals and chemical products	40.4	72.4
Manufacture of rubber and plastic products	44.6	40.4
Manufacture of other non-metallic mineral products	41.7	35.7
Manufacture of machinery and equipment n.e.c.	21.6	47.9
Manufacture of office machinery and computers	–	40.0
Manufacture of electrical machinery and apparatus n.e.c.	X	29.7
Manufacture of radio, television and communication equipment and apparatus	35.5	64.6
Manufacture of medical, precision and optical instruments, watches and clocks	50.0	52.9
Telecommunications	58.3	68.9
Financial intermediation, except insurance and pension funding	8.3	46.0
Insurance and pension funding, except compulsory social security	–	73.1
Computer and related activities	X	36.4
Research and development	51.3	65.7
Research and development	58.3	85.2
Architectural and engineering activities and related technical consultancy	25.3	34.8
Technical testing and analysis	29.1	31.8

It is surprising that almost half of micro enterprises with the main activity of research and development do not really carry out R&D which once again proves the fact that the concept itself and its meaning by the definition is *terra incognita* for some enterprises.

There are many economic activities where innovation of micro enterprises is not lower than that of big enterprises, but in several economic activities it is more than two times smaller. The difference is most drastic in financial intermediation but it is understandable as in the case of micro enterprises we mostly have to deal with currency exchange bureaus.

Table 4.1.3 Innovation activities in micro-enterprises compared with those of the basic survey (%), 2000

Indicator	*Enterprises with 3-9 employees*	*Enterprises with more than 9 employees of the same activities*
No expenditure on innovation in 2000	72.7	59.9
Expenditure on innovation at least 5% of turnover in 2000	19.0	17.1
Innovators by type of innovation activity, 2000:		
Intramural R&D	60.7	59.7
Extramural R&D	17.6	28.8
Acquisition of machinery and equipment	57.7	61.4
Acquisition of knowledge	28.9	31.3
Training	33.1	46.9
Market introduction	20.0	25.8
Other	22.5	21.3
Enterprises supported by public sector, 1998-2000	4.8	5.9
Enterprises involved in innovation co-operation, 1998-2000	40.0	40.2
Hampered innovation activities for innovators, 1998–2000:		
Project was delayed	34.4	34.2
Project was not started	23.4	15.9
Project was burdened with other serious problems	25.5	21.4

[28] *Small number of respondents (less than 3) in some economic activities turns the value of the indicator confidential (marked with X in the table and hereinafter).*

Table 4.1.3 shows that **there are no significant differences between micro enterprises and enterprises with the same economic activities belonging to the basic survey, except the fact that micro enterprises are less innovative and that is the reason why the share of the enterprises which have no innovation costs, is bigger**.

The reasons why non-innovative enterprises had no innovative activities entirely coincide: two fifths are satisfied with previous innovations, unpretentious market conditions are the reason for another two fifths and hampering factors for one fifths. Comparing the share of hampering factors in two groups of enterprises, it can be observed that **for micro enterprises lack of financial sources is more essential, but lack of competent personnel is of small importance**. This is only natural as the share of employees with the third level of education was bigger in the small enterprises with the observed economic activities.

As concerns protection of innovation, micro enterprises are less intensive, the share of valid patents and registration of design patterns was two times smaller, the share of registration of trademarks three times smaller and the share of strategic methods (secrecy, complexity, lead time advantage on competitors) 1.5 times smaller.

Table 4.1.4. Significant changes in micro enterprises compared with those of the basic survey (%), 1998–2000

Field of change	*Enterprises with 3-9 employees*	*Enterprises with more than 9 employees of the same activities*
All changes	46.0	60.4
of which in: strategy	17.5	31.0
management	11.0	29.6
structure	15.5	38.9
marketing	14.0	24.1
aesthetic	28.5	36.4

Micro enterprises included less than a half enterprises with significant changes as against 60% of the enterprises of the basic survey. The changes were more one-sided as the share of micro enterprises with some changes was 1.5 times to 2.5 times lower. It is natural that enterprises with 3–9 employees have less need to re-organise their structure, change management or strategy of action.

5 What Could be Learned

The main content of this publication was concentrated to the describing of the innovative activities of Estonian enterprises. This chapter aims at pointing out some important issues and suggestions to policy makers and also to the entrepreneurs and managers. Some of these recommendations come directly from the results of the survey described afore, but some are based on the comprehensions and experiences of the experts involved in the survey.

5.1 Recommendations to policy makers

Many companies have proven their innovativeness, as the share of innovators (according to the indicators used in this survey) was relatively high (36%). But there are two main problems: (a) low commercial relevance of innovation activities is systemic feature of Estonian economy. The percent of sales based on product innovation is 16%, which is 2 times lower than the EU level. Innovation expenditure intensity in Estonia is also lower than in the EU (accordingly 2.3% and 3.7% in manufacturing); (b) low radical nature of innovations – most innovations are realised by acquiring and introducing new equipment as the dominant mode of process innovations and the share of products new to the market in the total sales is only 6%.

Although the public sector cannot implement innovation for the entrepreneurs, it can influence the situation by creating better conditions for entrepreneurs through several types of innovation-oriented activities.

During last years Estonia has implemented rather well developed innovation policies, particularly concerning the support mechanisms to the high technology and medium-high technology enterprises (especially spin-off companies) in their innovation activities and to conduce the university-enterprises cooperation. These measures are largely launched after this innovation survey was accomplished, therefore we can't make any conclusions about these measures on the bases of the results of this survey. But we can consider that **the current policy is not enough wide ranged and complex to support the enterprises in solving the problems with their innovation projects'. So the Estonian innovation policy needs further developments**.

Policies for innovativeness and awareness raising

- **The measures of raising innovation awareness need strengthening**. The entrepreneurs should be informed, on the one hand, about the trends in world economy, the changes oncoming in different sectors, the reasons of tightening competition, and, on the other hand, the necessity of improved competence and development activity for succeeding in the market. It will be impossible to carry on as before in the conditions of new markets and new competitors.

- **Black scenarios**. It would be good to draft scenarios: what will happen if the enterprises' innovativeness (incl. significant expansion of R&D activity) will not increase, the prices and wages will rise after inevitable price convergence in the open economic environment (specially after the joining with the EU) and the current competitive advantages of Estonian enterprises will disappear. The presence of such an analysis could provide a positive impulse to the policymakers and entrepreneurs to react as soon as possible (before it is far too late).

- Besides the support schemes oriented to the high technology (or enterprises close to high tech) enterprises **the measures should be drawn and launched to satisfy the needs of wider range of enterprises – Estonian traditional medium and low technology enterprises – to support them on the developing and raising of the value-added of their products** (product variations, somewhat modified products which can be produced with the existing producing capacity and, also technology transfer). The dominating support measure should not be in the form of the grants, but rather by loans and loan guarantees, equity investments for the period or fostering the equity investments with security programmes. The concrete forms of aid could for example be adjusted from the subordinated loan schemes (mezzanine financing) implemented in Austria. Also equity investments schemes and giving a partial loan guarantee to investors (in case of technology related investments). In both cases the scheme should include the item of sharing the profits with the supporter if the project would be successful (e.g. with KredEx).

- **Policy measures should support companies developing products new for the market in order to increase the added value of export**. It is even more important, regarding the improvement of competitiveness, to develop and bring to the market completely new products.

- **The experiences of innovative entrepreneurs should be documented as showcases for training other entrepreneurs and students**. Competitions of new business ideas and creative product ideas could be launched as an inter-university educational project supported by the state but also by large companies interested in monitoring such ideas and recruiting authors of such ideas. The project could be a tool for developing the innovative awareness in the whole Estonian society and raising the profile of the university sector as a partner in innovative activities.

Cooperation

The extent of cooperation in innovation process among the Estonian innovative enterprises is not lower than the EU average, but the cooperation patterns are too much supplier-client based. Both infrastructure organisations (state support institutions, science parks etc), research institutes are much less important sources of innovation for Estonian firms than for the EU.

- **Policy should try to shift innovation cooperation from exclusively value chain based to national system of innovation based, i.e. more linked to local infrastructure and research organisations**. On the one hand this would help to develop the Estonian enterprises to implement more value-added products, on the other hand it would strengthen the research institutes and bring the potential science closer to the real life, which also increases the relevance of the education.

- **Create incentives to strengthen large enterprise and university co-operation**. Although the universities have already implemented some schemes for cooperation with enterprises, they should be developed further. The survey results revealed the large enterprises' low interest towards/confidence in research establishments. At the same time, the success of the large enterprises is important for the development of the state and combining the resources of Estonia's research establishments and large enterprises could provide the development of both with a positive impulse.

- **Encourage large international companies to be engaged in science and technology park activities in Estonia**. Large foreign firms are important sources of resources for the development of economy, besides the finances they also possess experience and connections, which Estonia itself lacks so far. Many small Estonian New Technology Based Firms could reach the world market through their participation. The encouragement of the international enterprises needs the well-designed references to the large companies followed by organised visits, overview materials, answering to the specific questions of the entrepreneurs, etc. And then international corporations are interested in developing their competence centres in Estonia, they could be supported by special public-private partnership options for training and developing qualified local staff for such purposes.

- **Develop supportive measures for domestic and international partnerships between enterprises for innovative product development and international marketing efforts.** In the context of a globalised world, the cooperation between firms is becoming increasingly important. Since the markets are international, it also requires international cooperation to operate in these markets.

Regional differences

Innovation activity and access to information differs widely in Estonia as to region.

- **A holistic approach to diminish such differences should include development of e-government, e-procurement, etc., training of local entrepreneurs and measures to improve the infrastructure for innovative entrepreneurship**. Large regional differences of innovative activity are not inevitable in Estonia as a small territory. Although R&D activity generally concentrates to Tallinn and Tartu (because of the highest scientific potential there), access to information and support measures for the realisation of innovation projects should be equally available in all Estonia's regions.

Human resources

Despite the relatively high education level in Estonia, the acquired knowledge and skills are not sufficient to meet the renewed requirements of the enterprises. At the same time even the existing resources are not properly used as is demonstrated by the weak cooperation with research institutions and their staff.

- **There should be policy activities which would co-fund training programs in cooperation with private sector**. The point is that there are deficiencies in firm and sector specific knowledge, i.e. general level of education is not sufficient for growth. On the one hand, the enterprises cannot train all the staff, on the other hand, neither is the public sector able to do it, because the training bases are outdated to school the specialists needed by the business and their renewal is highly expensive. Therefore the resources should be pooled to find the best solution.

- **More stress on technical sciences education**. There is a lack in engineers and technicians supply, what is needed to motivate the enterprises (also foreign firms) to carry through innovations (also in co-operation with research institutions) in Estonia. This is especially important if we want to encourage large foreign enterprises to settle down in Estonia and not only by establishing of the low value-added producing plants, but especially more high technology related activities. The alluring of foreign companies, who are looking for the location and people (also for R&D) into Estonia, requires serious preliminary work in both – in the education of labour force and in the active promotion campaigns.

- **Programmes for specialists' mobility**. The awareness of the entrepreneurs and to some extent their confidence in the staff of research establishments are low, at the same time, specialists should be involved in the realisation of many innovation projects. Certain schemes are needed to organise it more easily. State support schemes could contribute to the emergence of confidence between the entrepreneurs and researchers and cooperation would increase the experience. All bureaucratic obstacles complicating the process of hiring highly qualified foreign experts to Estonian companies and inhibiting inviting foreign academic staff and students to Estonian universities should be eliminated. Corresponding residence and work permit procedures should be simplified and the administrative practice of their application has to be made more customer-friendly.

- **Strategic management including technology management and marketing etc. Training programmes, publications and promotion programmes are needed in these fields**. The strategic management and further, innovation management of the Estonian entrepreneurs is relatively weak. No long-term plans are made, market response and demand are ignored in product development. These skills vital for the development of enterprises must be improved.

- **Integrated training programmes**. Proceeding from the previous item – the enterprises cannot manage processes as whole. This is partly the fault of the Estonian educational system, which is frequently speciality-specific. The cooperation between different faculties and creation of interdisciplinary curricula must be encouraged. Integrated courses should be held, enabling to meet, for example, food technologists and marketing specialists, so as to create an experience of associations between different specialities in business. Integrated development programmes could start from training representatives of innovative companies for efficient monitoring of international technological and market information and assessing the need for patenting their inventions or protecting their trademarks at foreign target markets. Participants, who have proven their competence by good training results and created specific action plans in the training process, could have priority to use state support measures for further steps in their innovative activities: participating in international fairs, using patent experts, access to international data bases etc.

Economic openness

Enterprises with foreign and domestic market orientation innovate to similar extent. This suggests that the policy of openness is paying off.

- **Current openness should continue**. Domestic market oriented firms have similar degree of demand for innovation as foreign market oriented firms. Therefore the competition is currently equal to the enterprises operating in the domestic or foreign markets.

- **EU common market promotion**. The trademark "Made in EU" becomes important. Through accommodation to the EU standards, all markets inside the EU will become open and there will be no need to adjust to different requirements of various countries, also this trademark gives better possibilities to go to the U.S. market than "Made in Estonia".

Finances for innovation

The biggest obstacle of innovation has been the lack of finances.

- **To create a financial system supporting innovative activity through state guarantees**. The lack of finance is the serious obstacle for innovations. Invested profits are tax free in Estonia and in general it has given more resources to the enterprises, but this is insufficient, because the SME's assets are too limited for serious innovation projects. At the same time their economic indicators as a whole are less stable, which makes applying for loans in commercial banks complicated. State guarantees could probably increase the demand for innovation. This presumes e.g. the expansion of the KredEx practice, especially concerning the innovation-targeted loan guarantees.

  The combination of money and expertise is needed for supporting the innovation activities. Often companies "do not know what they do not know" and therefore this support money must be connected to the innovation related knowledge.

- To support enterprises in all stages of their innovation projects, the creation of state venture capital fund should be thought over.

- **Policy solution is to improve demand for technology through public procurement**. Estonia's public sector has so far been a rather important client for the firms offering IT solutions and has thus supported their development and the spreading of IT tools. Such a practice could be used to contribute to the development and spreading of other technologies, professional design, high quality etc.

Research and development activities

Despite R&D being only one component of innovation activities it is more and more important one in the globalised competing world economy.

- **Continue measures to support R&D in business sector**. R&D performers have much more positive effects of their innovation activities when compared to non-R&D performers. R&D performers are more network oriented in their innovation activities.

- **Target public support for marketing, intellectual property protection and networking activities to innovative SME-s, which are showing high innovation expenditure intensity**. Estonian innovative enterprises will face considerable problems connected with the protection of intellectual property and the marketing of products.

- **State co-financing of more risky development projects, providing the enterprises with an incentive to reach the first product development project or R&D project (technologically more risky projects), will have a significant effect on the development and competitiveness of Estonia's business**. The transfer of additional skills or knowledge in the enterprise, accompanying the co-financing, is important, this is "smart money". Practice has proven that simple distribution of cash does not have any special economic effect.

Widening the policy makers circle

- State institutions must not change the market but help the market. The contribution of such market agents as private consulting firms, associations of enterprises, different funds etc must be effectively used in the process of working out and implementing the innovation policy tasks.

5.2 Suggestions to entrepreneurs

In the presentation of results of such a state-conducted survey the entrepreneurs frequently ask themselves: "So what if I know that Estonia's innovation activity is as it is and worse than in the EU countries? What do I earn from this?" The answer to this question can be divided in two parts: how does the entrepreneur benefit from innovation? And how will the entrepreneur benefit from this survey?

First, since innovation is a novel use in the economic process of an invention, discovery, a new or existing knowledge, it will provide the entrepreneur with an opportunity to create a competitive advantage, even a short-term monopoly, to earn thus greater profit. Secondly, the results of this survey enable the entrepreneur to hold a small benchmarking with competitors in Estonia and Europe. Benchmarking is useful for the entrepreneur by enabling to avoid the mistakes made by firms with previous experience and to follow their moves, which led to success.

Hereinafter are some recommendations made on the bases of the discussions of experts, to which one may pay attention to boost the competitiveness of the enterprises.

- **Monitor different information sources**. First, it is important to find out, which information the enterprise needs for innovation and from which sources the necessary information can be obtained. Information on possible changes/trends/new actors is an important resource for a firm's successful operations. Innovative ideas emerge from interplay of diversified information sources: clients, suppliers, universities and research centres, foreign and domestic partners and even competitors. E.g. the council (or special working group) of enterprise could give good advice and be a constructive opponent for innovative entrepreneurs. Some members of the council should act as gatekeepers monitoring new information sources for innovation. Bring some representatives of universities and research centres to the council of your company.

- **Hold regular technology audits and benchmarking with other enterprises of the sector and outside it**. A technology audit can help to prevent undesirable surprises.

- **Develop the long-term strategy** aiming at long-term international competitiveness considering long-term developments of the state and the world economy, including accession to the EU. **Integrate the innovative activities (incl. training of staff) with the strategy**. An Estonian entrepreneur unfortunately does not plan ahead his activities for a longer term than one year (at best). One cannot naturally foresee everything, but it would be necessary to be informed of the general economic and political trends and to draft the plans of developing one's enterprise in that light. For example, EU accession will have the following impact on my sector – in order to remain competitive, the enterprises has to make the following changes. Making gradual changes is less painful to the enterprise and therefore it is reasonable to determine the strategic stages and to start acting today, rather than to delay it until the last moment. If you do not know where to start and how to act, ask how knows – use professional consultants, take a deeper look at successful competitors, compare yourself with the companies from another sector, use students and researchers to analyse your business and related sectors.

- **Align innovative efforts to develop new products, market surveys and developing the marketing plan**. Innovative products have the potential to generate high profits if smart marketing supports their innovative features. Customers understand the value of really innovative products only as the result of consultative sales efforts. Customer feedback is a key information source for further product development.

- **Protect the intellectual property, including new products**. Intellectual property protection should be an integral part of the long-term innovation strategy. In order to maintain one's advantages in the market it is vital to protect one's products/services with the registration of trademarks, brands, patents, industrial design solutions etc. Intellectual property is something the others do not have as yet and if it is registered, the other (e.g. capable of more rapid action) firms cannot use it to deprive the solution's owner of its advantage.

- **Linking personnel policy to the firm's strategy**. It is a fact that the education market does not provide "readymade" (with the knowledge and skills necessary to the firm) specialists. In order to improve the situation for Estonia as a whole, but primarily for one's own enterprise, staff development should be undertaken. I.e. on the one hand the training of existing staff and on the other hand, the bringing of trainees to the enterprise so as to ensure it quality labour in the future.

Innovative organisations have new styles in people management: management by results should be used, creativity should be encouraged, flexible organisational structure could be introduced etc.

- **Be engaged in international networks and learning communities that support innovative activities and knowledge transfer. Look for strategic alliances in large-scale innovative activities**. This recommendation is connected with the monitoring of sources of information – it is always useful to be informed of the current events. Participation in the international networks provides the best review of the developments in the world markets and the emerging trends, as well as the fastest access to novel solutions, which will improve your enterprise's competitiveness.

- **Elaborate enterprises' common strategies for internationalisation. Cooperate with other companies in developing the common marketing and supply procedures in order to create "win-win" situation**. Like seems to be the success story of the large service firms – common internet and mobile services systems: calculate and pay for electricity, etc., declare the taxes via internet banking; pay for car parking or bus ticket or in the shop via mobile phone. Everyone will benefit – banks, traders, telecom-services providers etc. It is also possible to find common interest for the exporting industrial enterprises or small services firms or in cooperation of services and industry to succeed in (domestic and) foreign markets.

- **Analyse the organisation structure and management practice of the company**. Is there enough motivation for generating and developing new process and product innovation? Does the organisational structure and decision-making process support new product champions? **Consistent use of different management methods (Total Quality Management, ISO standards) and the use of corresponding consultations**. Systematic use of organisational analysis techniques. Better planning of an enterprise's activity is based on an idea of the strengths and weaknesses of the organisation. It is useful to involve consultants in order to receive a more adequate idea.

- **Use the services of specialists and consultants** in obtaining information or new methods introduction process, as well as problems solving etc – because no one is an expert in all fields and the use of a good specialist will be eventually cheaper for the entrepreneur than to learn from mistakes. The survey results showed a relatively low cooperation with consultation firms (although it only concerned innovation-related cooperation) as compared to cooperation with suppliers, consumers and even competing enterprises.

- **Specialise**. Although the Estonian enterprises are already operating in the EU countries' markets, competition will become even worse with accession and for all enterprises (incl. those not engaged in export). It is therefore vitally important to specialise in an activity, where the firm is the strongest, so as to direct the limited resources (the survey showed that the lack of finances, as well as quality labour are the main factors obstructing innovation) in the development of that activity and the improvement of competitiveness.

- **Personalise your products**. The survey results also showed the problems of the enterprises in the marketing skills of products/services. Personal approach is one of the possible strategies. In the development of the product marketing it would also be reasonable to use out-sourcing if the firm has no resources to hire full-time specialists.

- **Take advantage of the common market opportunities**. Joining the EU will not mean only problems to the entrepreneur. The quality requirements to the products/services and production processes are in the interests of the market. Since the demands are high, adjusting the firm to meet them grants a positive advantage in expanding to all markets.

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Appendix 1 | The Methodology and Sample of the Survey

The population of survey were economically active enterprises in Estonia in 2000 as defined in the statistical profile of the Statistical Office. If it was for some reason impossible to define an enterprise as statistical unit, other units like groups of enterprises were used (the respondents included three groups with two enterprises). The sample of survey was formed in compliance with the EUROSTAT methodological recommendations based on the statistical profile of the Statistical Office by two main characteristics – main economic activity and number of employees. Taking into consideration the small size of Estonia, the survey was conducted as **total** survey in the framework of economic activities in the sample.

The sample of the survey comprised mining and quarrying enterprises, manufacturing enterprises and service enterprises with the following economic activities (NACE codes coincide with the codes of EMTAK (classification of Estonian economic activities):

Activity	*NACE code*
Mining and quarrying	10–14
Manufacturing	15–37
Electricity, gas and water supply	40–41
Wholesale trade	51
Transport, storage and communication	60–64
Financial intermediation	65–67
Computer and related activities	72
Research and development	73
Architectural and engineering activities	74.2
Technical testing and analysis	74.3

By number of employees, the Third Innovation Survey of the European Union (hereinafter **the basic survey** or **CIS3**) included all enterprises with 10 and more employees in the abovementioned economic activities. Besides basic survey, **survey on micro enterprises** was conducted. The sample of this survey comprised enterprises with less than 10 employees in technologically intensive economic activities.

The survey on micro enterprises covered enterprises with 3–9 employees in the following economic activities (with the exception of "Research and Development" where at the request of the customer also enterprises with 0–2 employees were questioned):

Activity	*NACE code*
Manufacture of chemicals and chemical products	24
Manufacture of rubber and plastic products	25
Manufacture of other non-metallic mineral products	26
Manufacture of machinery and equipment n.e.c.	29
Manufacture of office machinery and computers	30
Manufacture of electrical machinery and apparatus n.e.c.	31
Manufacture of radio, television and communication equipment and apparatus	32
Manufacture of medical, precision and optical instruments, watches and clocks	33
Telecommunications	64.2
Financial intermediation, except insurance and pension funding	65
Insurance and pension funding, except compulsory social security	66
Activities auxiliary to financial intermediation	67
Computer and related activities	72
Research and development	73
Architectural and engineering activities and related technical consultancy	74.2
Technical testing and analysis	74.3

The enterprises in the sample were distributed by structural subgroups or strata according to the two basic characteristics: (1) By code of economic activity, the characteristics of belonging into the stratum was NACE two-digit code (excl. code 74 of which two strata 74.2 and 74.3 were formed); (2) By the number of employees enterprises were divided into 8 size classes:

1 – 250+
2 – 100–249
3 – 50–99
4 – 20–49
5 – 10–19
6 – 5–9
7 – 3–4
8 – 0–2

For international comparison with the results of the Second Innovation Survey of the European Union (CIS2) joint size classes are used: enterprises with big number of employees – 250+, average – 50–249 – and small number of employees – 10–49 in service and enterprises with 20–49 employees in industry.

The regional factor was not possible to be taken into consideration in dividing the enterprises into strata due to the small number of enterprises. This is the reason why detailed analysis should be avoided while analysing the results by region. In case of small number of enterprises in the group under analysis the results may be distorted.

The questionnaire of the survey coincided with that of EUROSTAT. Some of non-obligatory questions were left out, some questions that arose local interest were added – distribution of market area between the East and the West, evaluation on the innovative services of the state and on information of these services.

To be more exact, using the EUROSTAT numeration presented in Annex 3 of the contract, non-obligatory questions or their parts were left out: 0.3 (average lifetime of the product), 0.8.2 (the part of the question as regards the expected change in the number of employees with tertiary level of education), 0.8.3 (number of female employees with tertiary level of education), 11.1a (the part of the question on the number of patent applications), 11.1b (the part of the question on the number of valid patents), 11.1c (part of net sales, which has been covered either with patent applications or valid patents).

The following questions were modified: 0.1 (distribution into parent and subsidiary companies was added); 0.4 (distribution of international market area into East and West market was added); 4.1 (innovation costs by kind were drafted, in EUROSTAT version training, marketing and other costs were presented as total).
The question on services of the state in the sphere of innovation and information on these services was added.

The preliminary sample of the basic survey includes 3,571 enterprises and the survey on small enterprises includes 872 enterprises. In the course of conducting of the survey, the enterprises who were not active in 2000 (i.e. they were in bankruptcy) dropped out of the sample. Single enterprises dropped out of the survey or moved to another stratum because their economic activity had changed compared to the data of the statistical profile. The result of changing in the umber of employees was either moving to another stratum, moving from basic survey to the small enterprises' survey or vice versa and in some cases dropping out of the survey. Main changes occurred in the case of enterprises with less than 20 employees as the data of these enterprises could have been outdated in the statistical profile for they had not been included in the sample of regular surveys in the reference period. As the survey was a total survey in the framework of the sample after considering the changes 3,490 enterprises remained in the sample of the basic survey, the number of small enterprises in the survey on small enterprises was 777.

FINAL SAMPLE BY STRATA

NACE code	*SME*				*CIS3*					
Number of employees:	*0–2*	*3–4*	*5–9*	*total*	*10–19*	*20–49*	*50–99*	*100–249*	*250+*	*total*
10					9	10	4	2	1	26
11					–	–	–	–	4	4
12					–	–	–	–	–	–
13					–	–	–	–	–	–
14					3	3	–	2	–	8
15					79	89	36	31	18	253
16					–	–	–	–	–	–
17					31	33	11	7	9	91
18					73	83	38	8	12	214
19					14	12	5	6	1	38
20					132	130	40	20	4	326
21					7	8	3	–	2	20
22					67	31	19	8	3	128
23					–	1	–	–	2	3
24		16	10	26	12	9	9	5	2	37
25		9	20	29	36	23	8	4	1	72
26		10	30	40	24	30	10	9	2	75
27					–	2	1	1	–	4
28					90	71	29	9	2	201
29		35	40	75	24	28	14	8	4	78
30		1	0	1	3	2	–	–	–	5
31		8	12	20	11	5	11	3	1	31
32		20	8	28	11	8	6	1	5	31
33		18	12	30	12	5	4	3	1	25
34					1	5	3	1	1	11
35					12	7	5	2	1	27
36					55	47	26	18	6	152
37					–	3	1	–	–	4
40					54	39	7	4	7	111
41					16	11	1	3	1	32
51					424	196	43	16	2	681
60					137	82	35	13	9	276
61					3	3	4	1	2	13
62					–	1	1	1	1	4
63					92	64	17	16	5	194
64		12	12	24	4	13	7	5	4	33
65		28	25	53	12	9	3	1	3	28
66		–	1	1	3	3	3	2	2	13
67		15	13	28	14	7	1	1	–	23
72		57	64	121	34	20	6	–	–	60
73	18	3	3	24	5	4	–	–	–	9
74.2		127	128	255	88	31	5	1	–	125
74.3		10	12	22	13	8	3	–	–	24
TOTAL	18	369	390	**777**	1605	1136	419	212	118	**3490**

In the course of data collection, the enterprises were sent questionnaires by post, as well as the first reminder with the questionnaire and the second reminder without it. Respondents were also reminded of the questionnaire by telephone. Enterprises could also download the questionnaire as document file from the web site of the Statistical Office in Estonian as well as a translated version in Russian. The Russian translation was also sent to respondents at their wish by post. This guaranteed extremely high response rate – in the basic survey 74.3% and in the small enterprises' survey 65.1%. The average response rate of the European Union in the previous innovation survey in 1997 was significantly lower – only 57%.

RESPONSE RATE BY STRATA

NACE code	*SME*				*CIS3*					
Number of employees:	*0–2*	*3–4*	*5–9*	*total*	*10–19*	*20–49*	*50–99*	*100–249*	*250+*	*total*
10					77.8	100.0	100.0	100.0	100.0	92.3
11					–	–	–	–	100.0	100.0
12					–	–	–	–	–	–
13					–	–	–	–	–	–
14					100.0	100.0	–	100.0	–	100.0
15					62.0	75.3	80.6	83.9	83.3	73.5
16					–	–	–	–	–	–
17					64.5	75.8	90.9	100.0	66.7	74.7
18					72.6	75.9	78.9	87.5	91.7	76.6
19					78.6	66.7	100.0	100.0	100.0	81.6
20					72.0	80.0	67.5	95.0	25.0	75.5
21					42.9	75.0	33.3	–	100.0	60.0
22					71.6	74.2	78.9	87.5	33.3	73.4
23					–	100.0	–	–	100.0	100.0
24		62.5	70.0	65.4	83.3	77.8	66.7	60.0	100.0	75.7
25		66.7	70.0	69.0	72.2	87.0	100.0	100.0	100.0	81.9
26		60.0	66.7	65.0	91.7	80.0	90.0	100.0	100.0	88.0
27					–	100.0	100.0	100.0	–	100.0
28					81.1	83.1	72.4	88.9	50.0	80.6
29		65.7	60.0	62.7	62.5	85.7	100.0	75.0	100.0	80.8
30		0.0	–	0.0	33.3	100.0	–	–	–	60.0
31		62.5	75.0	70.0	90.9	100.0	100.0	100.0	100.0	96.8
32		55.0	75.0	60.7	63.6	62.5	83.3	100.0	80.0	71.0
33		66.7	50.0	60.0	100.0	80.0	100.0	66.7	100.0	92.0
34					100.0	80.0	33.3	0.0	100.0	63.6
35					75.0	85.7	100.0	100.0	100.0	85.2
36					52.7	74.5	69.2	77.8	83.3	66.4
37					–	33.3	0.0	–	–	25.0
40					81.5	89.7	71.4	100.0	100.0	85.6
41					81.3	81.8	100.0	100.0	100.0	84.4
51					57.3	68.9	81.4	50.0	50.0	62.0
60					74.5	81.7	88.6	84.6	100.0	79.7
61					66.7	100.0	50.0	100.0	50.0	69.2
62					–	100.0	100.0	100.0	100.0	100.0
63					67.4	78.1	58.8	87.5	100.0	72.7
64		50.0	83.3	66.7	100.0	76.9	71.4	40.0	50.0	69.7
65		71.4	68.0	69.8	66.7	66.7	0.0	100.0	66.7	60.7
66		–	0.0	0.0	66.7	100.0	100.0	100.0	100.0	92.3
67		53.3	76.9	64.3	64.3	42.9	0.0	100.0	–	56.5
72		50.9	57.8	54.5	73.5	70.0	83.3	–	–	73.3
73	44.4	66.7	100.0	54.2	40.0	75.0	–	–	–	55.6
74.2		66.9	75.8	71.4	83.0	93.5	100.0	100.0	–	86.4
74.3		80.0	58.3	68.2	92.3	87.5	100.0	–	–	91.7
TOTAL	44.4	62.6	68.5	**65.1**	68.8	77.7	78.8	84.0	83.1	**74.3**

In the given table the strata in which no enterprises responded have been shaded. As for data processing weights were calculated for enterprises of each stratum (inversely proportionally to the percentage of respondents), where the total of weights of enterprises must equal the total number of enterprises in the final sample, the weights of enterprises of the corresponding number of employees were reduced over all economic activities, so that this condition would be fulfilled.

WEIGHTS BY STRATA

NACE code	*SME*			*CIS3*				
Number of employees:	*0–2*	*3–4*	*5–9*	*10–19*	*20–49*	*50–99*	*100–249*	*250+*
10				1.2857	1.0000	1.0152	1.0056	1.0000
11				–	–	–	–	1.0000
12				–	–	–	–	–
13				–	–	–	–	–
14				1.0000	1.0000	–	1.0056	–
15				1.6122	1.3284	1.2565	1.1979	1.2000
16				–	–	–	–	–
17				1.5500	1.3200	1.1152	1.0056	1.5000
18				1.3774	1.3175	1.2818	1.1485	1.0909
19				1.2727	1.5000	1.0152	1.0056	1,0000
20				1.3895	1.2500	1.4966	1.0582	4.0000
21				2.3333	1.3333	3.0152	0.0000	1.0000
22				1.3958	1.3478	1.2818	1.1485	3.0000
23				–	1.0000	–	–	1.0000
24		1.6043	1.4323	1.2000	1.2857	1.5152	1.6723	1.0000
25		1.5043	1.4323	1.3846	1.1500	1.0152	1.0056	1.0000
26		1.6710	1.5037	1.0909	1.2500	1.1263	1.0056	1.0000
27				–	1.0000	1.0152	1.0056	–
28				1.2329	1.2034	1.3961	1.1306	2.0000
29		1.5261	1.6704	1.6000	1.1667	1.0152	1.3390	1.0000
30		–	–	3.0000	1.0000	0.0000	0.0000	–
31		1.6043	1.3371	1.1000	1.0000	1.0152	1.0056	1.0000
32		1.8225	1.3371	1.5714	1.6000	1.2152	1.0056	1.2500
33		1.5043	2.0037	1.0000	1.2500	1.0152	1.5056	1.0000
34				1.0000	1.2500	3.0152	0.0000	1.0000
35				1.3333	1.1667	1.0152	1.0056	1.0000
36				1.8966	1.3429	1.4596	1.2913	1.2000
37				–	3.0000	–	–	–
40				1.2273	1.1143	1.4152	1.0056	1.0000
41				1.2308	1.2222	1.0152	1.0056	1.0000
51				1.7449	1.4519	1.2437	2.0056	2.0000
60				1.3431	1.2239	1.1442	1.1874	1.0000
61				1.5000	1.0000	2.0152	1.0056	2.0000
62				–	1.0000	1.0152	1.0056	1.0000
63				1.4839	1.2800	1.7152	1.1485	1.0000
64		2.0043	1.2037	1.0000	1.3000	1.4152	2.5056	2.0000
65		1.4043	1.4743	1.5000	1.5000	0.0000	1.0056	1.5000
66		–	–	1.5000	1.0000	1.0152	1.0056	1.0000
67		1.8793	1.3037	1.5556	2.3333	–	1.0056	–
72		1.9698	1.7335	1.3600	1.4286	1.2152	–	–
73	2.2500	1.5043	1.0037	2.5000	1.3333	–	–	–
74.2		1.4984	1.3233	1.2055	1.0690	1.0152	1.0056	–
74.3		1.2543	1.7180	1.0833	1.1429	1.0152	–	–

In case of uncertain data, logical mistakes or unanswered questions the data were adjusted, contacting the respondents by phone or by e-mail.

Appendix 2 | Questionnaire

Business register code ☐☐☐☐☐☐☐☐ **Sample code** ☐☐☐☐
(Check the code)

STATISTIKAAMET
Endla 15, 15174 Tallinn

Contact persons:
Aavo Heinlo
tel (0) 625 9217
fax (0) 625 9370
e-mail: aavo.heinlo@stat.ee

Hille Vares
tel (0) 625 9193
fax (0) 625 9370
e-mail: hille.vares@stat.ee

Statistical Offices guarantees the confidentiality of data

INNOVATION ACTIVITIES IN ENTERPRISES

IN YEARS 1998–2000

SURVEY QUESTIONNAIRE

Present survey collects data on innovation activities in enterprises in years 1998–2000. An innovation, as defined in this survey, is a new or significantly improved product (good or service) introduced to the market or the introduction within your enterprise of a new or significantly improved process.
The questionnaire must be filled by enterprises without innovation activities as well.
Before filling please look into annex where one can found the definitions and examples (see definitions No. 3, 7 ja 12 – **innovation**, **product innovation** and **process innovation**). In the case of questions one can get answer from contact persons shown in the top of this page.

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.
If needed the mother enterprise can present data together with daughter enterprises which are legal units. This can be done only in condition that daughter enterprises themseleves will not fill and send out the questionnaire to Statistical Office separately. In such case corresponding remarks must be added at page 11.

A 1 **Main activity** *(Write; see definition No 6)*

_____ ☐☐☐☐☐☐
Will be filled by SO

A 2 Is your enterprise part of a concern? *(Tick; see definitions No 2 and 5)*

1 ☐ YES 2 ☐ NO

*If yes, continue with question **A3**, if no, then with **A4***

A 3 Is your enterprise parent or subsidiary enterprise? *(Tick; see definitions No 2 and 5)*

1. ☐ Parent
2. ☐ Subsidiary ➔ _____ What is the country of parent enterprise? (*Write*) ☐☐ Will be filled by SO

A 4	Did your enterprise have foreign equity in in 2000? *(Tick)* 1 ☐ YES 2 ☐ NO *If yes, continue with question **A5**, if no, then with **A6***
A 5	What was the share of foreign equity in percentages? *(Tick the appropriate)* 1 ☐ Less than 50% 2 ☐ 50%–99% 3 ☐ 100%
A 6	Did any of these changes occur to your enterprise during the period 1998–2000? 1. Your enterprise was established *(Tick)* 1 ☐ YES 2 ☐ NO 2. Turnover increased by 10 % or more due to merger with another enterprise or part of it *(Tick; see definition No 8)* 1 ☐ YES 2 ☐ NO 3. Turnover decreased by 10 % or more due to sale or closure of part of the enterprise *(Tick; see definition No 8)* 1 ☐ YES 2 ☐ NO
A 7	What is your enterprise's most significant market? *(Tick the most appropriate alternative)* 1. LOCAL (within a distance of around 50 km from the location of your enterprise) In Estonia 1 ☐ Estonia together with neighbouring countries border territory 2 ☐ 2. NATIONAL *(In Estonia with a distance of more than 50 km from the location of your enterprise)* ☐ 3. INTERNATIONAL *(If international, answer the following)* ☐ Is the export to the Western market (incl. EU cand. countries) bigger than to Eastern market (Russia, Ukraina and so on) 1 ☐ YES 2 ☐ NO

NB! When answering the questions A8-A10 the unit is thousand Estonian kroons without decimal places

A 8	Total turnover (including export and taxes except VAT) *(See definition No 8; for Insurance services: Gross premiums written)* in year 1998 ☐ 000 kroons in year 2000 ☐ 000 kroons
A 9	Exports *(See definition No 1)* in year 1998 ☐ 000 kroons in year 2000 ☐ 000 kroons
A 10	Gross investment in tangible goods *(See definition No 4)* in year 1998 ☐ 000 kroons in year 2000 ☐ 000 kroons
A 11	1. Number of employees *(Annual average. If not available, number of employees at the end of the year can be used; see definition No 13)* in year 1998 ☐ in year 2000 ☐ of which with higher (incl higher professional) or secondary professional based on secondary general education in year 2000 ☐ 2. Do you expected change in number of employees for year 2002? *(Tick, in case of increase estimate it in procents compared with 2000)* 1 no change ☐ 2 reduction ☐ 3 increase ☐ ➔ ☐ %

B. INNOVATION ACTIVITIES

An innovation, as defined in this survey, is a new or significantly improved product (good or service) introduced to the market or the introduction within your enterprise of a new or significantly improved process. The innovation is based on the results of new technological developments, new combinations of existing technology or utilisation of other knowledge acquired by your enterprise.

1. PRODUCT INNOVATION

Product innovation is a good or service which is either new or significantly improved with respect to its fundamental characteristics, technical specifications, incorporated software or other immaterial components, intended uses, or user friendliness.
The innovation should be **new to your enterprise**; it has **not necessarily** to be **new to the market**. It does not matter whether the innovation was developed by your enterprise or by another enterprise. Changes of a solely aesthetically nature, and **purely selling** of innovations wholly produced and developed by other enterprises, shall not be included.
For examples of innovations see Annex, definition No 12 – **product innovation**.

B 1 During the period 1998–2000, did your enterprise introduce onto the market any new or significantly improved products for your enterprise? *(Tick)*

1 ☐ YES 2 ☐ NO

*If yes, continue with question **B2**, if no, then with **B5**.*

B 2 Who developed these products (goods or services)?
(Tick the most appropriate alternative)

1. Mainly your enterprise ☐
2. Concern, your enterprise is part of ☐
3. Your enterprise in co-operation with other enterprises or institutions ☐
4. Other enterprises or institutions ☐

Please give a short description of your most important product innovation.

_____

_____

_____

_____

B 3 How your turnover in 2000 was distributed between:

New or significantly improved products (goods or services) introduced during the period 1998–2000 ☐☐☐ %

Unchanged or only marginally modified products (goods or services) during the period 1998–2000 ☐☐☐ %

Total turnover in 2000 1 0 0 %

B 4 During the period 1998–2000, did your enterprise introduce new or significantly improved products (goods or services) not only new for your enterprise, but also new for your enterprise's market?

1 ☐ YES ➔ Please estimate the contribution of these products in total turnover in 2000 ☐☐☐ %

2 ☐ NO

2. PROCESS INNOVATION

Process innovation includes new and significantly improved production technology, new and significantly improved methods of supplying services and of delivering products. The outcome should be significant with respect to the level of output, quality of products (goods/services) or costs of production and distribution.
The innovation should be **new to your enterprise**; your enterprise has not necessarily to be the first to introduce this process. It does not matter whether the innovation was developed by your enterprise or by another enterprise. Purely **organisational or managerial changes** shall not be included.
For examples of innovations see Annex, definition No 7 – **process innovation**.

B 5 During the period 1998–2000, has your enterprise introduced any new or significantly improved production processes including methods of supplying services and ways of delivering products?

1 ☐ YES 2 ☐ NO *(Tick)*

*If yes, continue with question **B6**, if no, then with **B7***

B 6 Who work out or developed these processes? *(Please tick the most appropriate alternative)*

1. Mainly your enterprise ☐
2. Concern, your enterprise is part of ☐
3. Your enterprise in co-operation with other enterprises or institutions ☐
4. Other enterprises or institutions ☐

Please give a short description of your most important process innovation

_____

_____

_____

_____

3. NOT YET COMPLETED OR ABANDONED INNOVATION ACTIVITIES

B 7 Did your enterprise have during period 1998–2000 any product or process projects (including any R&D projects), which *(See definition No 9)*

1 – were not completed by the end of 2000? 1 ☐ YES 2 ☐ NO

2 – were abandoned uncompleted? 1 ☐ YES 2 ☐ NO

NB! If your enterprise had no innovation activity on period under question and you answered No to each of questions B1, B5, B7, you should continue the filling in with question **I2**, if you had innovation activities, then continue with question **C1**.

C. EXPENDITURE ON INNOVATION ACTIVITIES IN 2000

Expenditure on innovation activities include expenditure on development or introduction new or significantly improved products (goods or services) or processes, as well the expenditure on yet not completed or abandoned innovation projects. Both – current expenditures (on labour force, equipment, materials, purchased services and so on) and investments – should be included.

C 1 Did your enterprise engage in the following innovation activities in 2000?
(Tick for the following innovation activities their presence or absence. In the case of Yes give an estimate of the related expenditures; the unit is thousand Estonian kroons without decimal places)

1. Intramural research & experimental development (R&D) *(See definition No. 9)*
   All creative work undertaken within your enterprise on a systematic basis in order to increase the stock of knowledge, and the use of this stock of knowledge to devise new applications, such as new and improved products (goods/ services) and processes (including software research)

   1 ☐ YES 2 ☐ NO _____ 000 kroons

2. Acquisition of extramural R&D
   Same activities as above, but performed by other companies (including other enterprises within your concern), public institution or nonprofit association

   1 ☐ YES 2 ☐ NO _____ 000 kroons

3. Acquisition of machinery and equipment for innovation activities
   Machinery or equipment (including computer hardware) purchasec for the development or introduction new or significantly improved products (goods or services) or processes

   1 ☐ YES 2 ☐ NO _____ 000 kroons

4. Acquisition of other external knowledge for innovation activities
   Purchase of rights to use patents and non-patented inventions, licenses, know-how, trademarks, software and other types of knowledge for use in your enterprise's innovation activities

   1 ☐ YES 2 ☐ NO _____ 000 kroons

5. Training connected with innovation activities
   Internal or external training for your personnel directly aimed at the development and/or introduction of product or process innovations

   1 ☐ YES 2 ☐ NO _____ 000 kroons

6. Market introduction of innovations
   Internal or external marketing activities directly aimed at the market introduction of your enterprise's new or significantly improved products (goods/services), (may include preliminary market research, market tests and launch advertising, but exclude the building of distribution networks to market innovations)

   1 ☐ YES 2 ☐ NO _____ 000 kroons

7. Design, other preparations for production/deliveries
   Expenditure on development or introduction new or significantly improved products or processes not covered elsewhere

   1 ☐ YES 2 ☐ NO _____ 000 kroons

Total expenditure on innovation activities _____ 000 kroons

D. INTRAMURAL RESEARCH AND EXPERIMENTAL DEVELOPMENT

If you enterprise had intramural R&D-activities, then fill in following data:
(See definitions No 9, 10 and 11)

D 1 Number of employees engaged in intramural R&D activities within your enterprise in 2000 ☐

Number of person-years expended by those employees on R&D in 2000 *(See definition No 11)* ☐

D 2 How did your enterprise engage in R&D during 1998–2000?

1. Continuously ☐ 2. Occasionally ☐ *(Tick)*

E. EFFECTS OF INNOVATION DURING 1998–2000

The result of innovation activity may have different effects for your enterprise. For the presented alternatives, please indicate the degree of impact at the end of 2000 by innovation activity undertaken by your enterprise during the period 1998–2000

E 1 Result of innovation activity *(Tick appropriate on every row)*

	Degree of impact			*Not*
	high	*medium*	*low*	*relevant*
	1	*2*	*3*	*9*
1. Increased range of goods or services	☐	☐	☐	☐
2. Increased market or market share	☐	☐	☐	☐
3. Improved quality in goods or services	☐	☐	☐	☐
4. Improved quality in goods or services	☐	☐	☐	☐
5. Increased production capacity	☐	☐	☐	☐
6. Reduced labour costs per produced unit	☐	☐	☐	☐
7. Reduced materials and energy per produced unit	☐	☐	☐	☐
8. Improved environmental impact or health and safety aspects	☐	☐	☐	☐
9. Met regulations or standards	☐	☐	☐	☐

F. PUBLIC FUNDING OF INNOVATION ACTIVITIES

Public funding includes financial support in terms of grants and loans, including a subsidy element, and loan guarantees from government, municipalities or the European Union. Ordinary payments for orders of public customers shall not be included.

F 1 Did your enterprise receive any public financial support for innovation activities during the period 1998–2000? *(Tick)*

1. Municipalities	1 ☐	YES	2 ☐	NO
2. Government (incl. funds financed by government)	1 ☐	YES	2 ☐	NO
3. The European Union	1 ☐	YES	2 ☐	NO

F 2 Has your enterprise received funding from the EU's 4th (1994–98) or 5th (1998–2002) Framework Programmes for RTD? 1 ☐ YES 2 ☐ NO

G. INNOVATION COOPERATION DURING THE PERIOD 1998–2000

Innovation co-operation means active participation in joint R&D and other innovation projects with other enterprises or universities or scientific institutions. It does not necessarily imply that both partners derive immediate commercial benefit from the venture. Pure contracting out of work, where there is no active collaboration, is not regarded as co-operation.

G 1 Did your enterprise have any co-operation arrangements on innovation activities with other enterprises or institutions during 1998–2000?

1 ☐ YES 2 ☐ NO

*If yes, continue with question **G2**, if no, then with **H1***

G 2 Who were your partners and where were they located? *(Tick all appropriate answers)*

	Estonia	*EU/EFTA*[1]	*EU CC*[2]	*US*	*Japan*	*Other*
1. Other enterprises within your concern	☐	☐	☐	☐	☐	☐
2. Suppliers of equipment, materials, components or software	☐	☐	☐	☐	☐	☐
3. Clients or customers	☐	☐	☐	☐	☐	☐
4. Competitors and other firms from the same industry	☐	☐	☐	☐	☐	☐
5. Consultants	☐	☐	☐	☐	☐	☐
6. Enterprises offering R&D services	☐	☐	☐	☐	☐	☐
7. Universities and higher schools, their units and institutes	☐	☐	☐	☐	☐	☐
8. Public and private non-profit R&D-institutions	☐	☐	☐	☐	☐	☐

G 3 How important was the cooperation with the partners? *(Tick appropriate in every row)*

	Importance of co-operation			*Absence of co-operation*
	high	*medium*	*low*	
	1	*2*	*3*	*9*
1. Other enterprises within your concern	☐	☐	☐	☐
2. Suppliers of equipment, materials, components or software	☐	☐	☐	☐
3. Clients or customers	☐	☐	☐	☐
4. Competitors and other firms from the same industry	☐	☐	☐	☐
5. Consultants	☐	☐	☐	☐
6. Enterprises offering R&D services	☐	☐	☐	☐
7. Universities and higher schools, their units and institutes	☐	☐	☐	☐
8. Public and private non-profit R&D-institutions	☐	☐	☐	☐

[1] *EU: Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden and the United Kingdom. EFTA: Iceland, Liechtenstein, Norway, Switzerland.*

[2] *EU Candidate Countries (excl Estonia): Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak Republic, Slovenia Republic.*

H. SOURCES FOR INNOVATION DURING THE PERIOD 1998–2000

The main sources of information needed for suggesting new innovation projects or contributing to the implementation of existing projects are asked in this question.

H 1 Information source *(Tick appropriate in every row)*

	Importance of source high 1	medium 2	low 3	*Not used* 9
1. Within the enterprise	☐	☐	☐	☐
2. Other enterprises within your concern	☐	☐	☐	☐
3. Suppliers of equipment, materials, components or software	☐	☐	☐	☐
4. Clients or customers	☐	☐	☐	☐
5. Competitors and other firms from the same industry	☐	☐	☐	☐
6. Consultants	☐	☐	☐	☐
7. Universities and higher schools, their units and institutes	☐	☐	☐	☐
8. Public and private non-profit R&D institutions	☐	☐	☐	☐
9. Professional conferences, meetings, journals	☐	☐	☐	☐
10. Fairs, exhibitions	☐	☐	☐	☐

I. FACTORS HAMPERING INNOVATION ACTIVITIES

I 1 During the period 1998–2000 was any of your innovation activity …? *(Tick)*

1 – seriously delayed	1 ☐	YES	2 ☐	NO
2 – prevented to be started	1 ☐	YES	2 ☐	NO
3 – burdened with other serious problems	1 ☐	YES	2 ☐	NO

NB! *Continue with question* ***I3***

I 2 There was no innovation activity in your enterprise during the period 1998–2000. Were any of the following reasons relevant for this? *(Tick)*

1. No need due to prior innovations	1 ☐	YES	2 ☐	NO
2. No need due to market conditions	1 ☐	YES	2 ☐	NO
3. Factors impeding innovation	1 ☐	YES	2 ☐	NO

I 3 If your enterprise experienced any hampering factors during the period 1998–2000, please grade the importance of the relevant factors

(Tick the degree of importance or unrelevancy of factors your experienced)

	Degree of importance of the factor high 1	medium 2	low 3	*Not used* 9
Economic factors				
1. Excessive perceived economic risks	☐	☐	☐	☐
2. Innovation costs too high	☐	☐	☐	☐
3. Lack of appropriate sources of finance	☐	☐	☐	☐

		Degree of importance of the factor: high 1	medium 2	low 3	Not used 9
	Internal factors within the enterprise				
	4. Organisational rigidities	☐	☐	☐	☐
	5. Lack of qualified personnel	☐	☐	☐	☐
	6. Lack of information on technology	☐	☐	☐	☐
	7. Lack of information on markets	☐	☐	☐	☐
	Other factors				
	8. Insufficient flexibility of regulations or standards	☐	☐	☐	☐
	9. Lack of customer responsiveness to new goods or services	☐	☐	☐	☐

I4 How do your estimate the services rendered by the state and local governments that support innovation activities and information about these services in Estonia? *(Tick)*

	1	2	9
1. Services satisfy	☐ YES	☐ NO	☐ Can't say
2. Enough services	☐ YES	☐ NO	☐ Can't say
3. Information about services satisfies	☐ YES	☐ NO	☐ Can't say
4. Enough information	☐ YES	☐ NO	☐ Can't say

Have you any proposals how the situation can be improved?

_____

_____

_____

J. INNOVATION PROTECTION (incl PATENTS)

J1 During the period 1998–2000, did your enterprise, or your concern, apply for at least one patent to protect inventions or innovations developed by your enterprise?

1 ☐ YES 2 ☐ NO *(Tick)*

J2 During the period 1998–2000, did your enterprise (or your concern) apply for at least one patent to protect inventions or innovations developed by your enterprise?

1 ☐ YES 2 ☐ NO *(Tick)*

J3 During the period 1998–2000, did your enterprise (or your concern) make use of any of these other methods to protect inventions or innovations developed in your enterprise?

Formal methods *(Tick)*

1. Registration of design patterns	1 ☐ YES	2 ☐ NO
2. Trademarks	1 ☐ YES	2 ☐ NO
3. Copyright	1 ☐ YES	2 ☐ NO

Strategic methods

4. Secrecy	1 ☐ YES	2 ☐ NO
5. Complexity of design	1 ☐ YES	2 ☐ NO
6. Lead-time advantage on competitors	1 ☐ YES	2 ☐ NO

K. OTHER IMPORTANT STRATEGICAL AND ORGANISATIONAL CHANGES IN YOUR ENTERPRISE

Previous questions have so far only dealt with new and significantly improved products and processes in your enterprise. This final question refers to other creative improvements that might have been undertaken by your enterprise and were not covered by previous questions.

K 1 Did your enterprise during the period 1998–2000 undertake any of the following activities?
(Tick showing the presence or absence of listed changes)

1. Strategy – implementation of new or significantly changed corporate strategies
   1 ☐ YES 2 ☐ NO
2. Management – implementation of new, advanced management techniques
   1 ☐ YES 2 ☐ NO
3. Structure – implementation of new or significantly changed organizational structures
   1 ☐ YES 2 ☐ NO
4. Marketing – changing significantly your enterprise's marketing concepts/strategies
   1 ☐ YES 2 ☐ NO
5. Appearance of product – significant changes in the aesthetic appearance or design or other subjective changes in at least one of your products
   1 ☐ YES 2 ☐ NO

COMMENTS AND PROPOSALS

Person(s) who filled in the questionnaire			Date	Head of enterprise *(name, signature)*
Name				
Telephone				
Fax				
E–mail				

Thank you!