ESTONIAN INNOVATION POLICY ACTIVITY AGAINST THE BACKGROUND OF THE EU MEMBER STATES

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Abstract

Innovation policy is essential to guarantee a country's development and the continuous enhancement of its innovation performance. The aim of this paper is to empirically analyse the position of Estonia in different innovation policy areas compared to other European countries. Seventeen different variables that characterise the activities of the public sector in promoting innovation are used in a principal component analysis to reveal the structure of public sector activities in promoting innovation. The principal component analysis reveals that the activities of the public sector in promoting innovation can be characterised using six components. Analysis of Estonia's position in these policy areas shows that in comparison with other European countries, the extent to which the public sector in Estonia enhances the overall framework for innovation is above the European average and R&D in the higher education sector is also above average. But R&D in the government sector in Estonia is in a weak state; only a small proportion of innovative enterprises in Estonia receive financial support for innovation from the public sector (including support from the EU), and universities and public sector agencies in Estonia only cooperate with firms in innovation activities to a small degree.

Keywords: innovation policy, economic development, the structure of the activities of the public sector in promoting innovation, European comparison, the position of Estonia

JEL Classification: H54, O1, O31, O38, O52

Introduction

In the long-term perspective, the competitiveness of a country is mostly built on innovation – the private and public sector's ability to implement innovations that support development systematically and sustainably. On the one hand, the spontaneous desire of people, enterprises and organizations to find new development paths and new effective ways to operate will always be the basis of innovation. On the other hand, in today's global world, where everything is interconnected and dependent, it is also important to consciously promote innovativeness, develop an institutional environment that fosters innovations and create a consistent balanced system for innovation components. Hence, a public innovation policy that builds a functional innovation system in a country becomes essential in ensuring the country's development.

The importance of innovation is emphasised in the European Commission economic

growth strategy – "Europe 2020". Instead of extensive growth (based on the implementation of additional resources), the new priority is "smart growth" based on knowledge and innovation. According to the strategy, "smart growth" necessitates improving the quality of education, strengthening research performance, promoting innovation and knowledge transfer, making full use of information and communication technologies and ensuring that innovative ideas can be turned into new products and services (European Commission 2010: 9-10).

The public sector innovation policy must be a consistent system of actions that target innovation and with the ultimate aim of increasing the international competitive advantage of the private sector. The efficiency of the innovation policy depends on whether it is in accordance with country's level of development (path dependency), specific characteristics (size, the structure of entrepreneurship, labour force competence, values etc.) and the nature of the international competitive environment.

The objective of the current paper is to empirically analyse the international position of Estonia in different innovation policy areas. In order to achieve the objective the following research tasks have been set:

- systematise the nature of innovation in scientific literature;
- analyse innovation policy instruments, i.e. the activities of the public sector in promoting innovation;
- empirically assess the international position of Estonia in different innovation policy areas.

The paper is structured as follows: firstly, the nature of innovation is explored and a definition of innovation is specified, then innovation policy instruments that help to systematically characterise the activities of the public sector in promoting innovation are analysed, and finally the international position of Estonia in different innovation policy areas is assessed.

The nature of innovation

A diverse range of definitions for innovation exist and innovation is interpreted differently. The term innovation comes from the Latin word *innovare*, meaning "to renew or change" (Marxt, Hacklin 2005: 414). Innovation does not mean inventing something new; it is an invention that is utilised and launched by an entrepreneur (Lundvall 2007: 101). The utilisation of invention distinguishes innovation from research and development.

Over time, the definition of innovation has evolved and become further specified. Schumpeter (1928: 377-378) defined innovation as the combination and creative application of elements of existing and new knowledge to improve existing or develop new products and services, production processes, organization-methods and commercialisations in order to create or maintain added value. The purpose of innovation is to gain competitive advantage on the market and ideally even a short-

term monopolistic position. According to Schumpeter's definition, innovation can only emerge in private sector production and not in public sector services nor in the management and administrative sphere of the private or public sector.

Porter's approach to innovation is a bit broader. According to his definition, innovation may comprise of new technologies or also of new ways to function, and the aim is to achieve competitive advantage (Porter 1990: 45). Porter's definition limits innovation to entrepreneurship in the private or public sector, whereby the innovation that provides competitive advantage may also occur in management. Nevertheless, innovation in public sector services is excluded.

In the Oslo Manual, which is the foundation for innovation research, innovation is defined very broadly (OECD 2005b: 46): "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations." It is emphasised that innovation may also occur in any sector of the economy, including government services such as health or education.

Edquist (2002: 219) also specifies the nature of innovation. Firstly, innovation has to be economically important. Secondly, innovation may by completely new, but usually it is a new combination of existing knowledge. This kind of approach does not limit the area that innovation is implemented.

A broader definition of innovation is given in the Estonian Research and Development and Innovation Strategy "Knowledge-based Estonia 2007–2013" (2007: 9): the implementation of the latest outcome of scientific research as well as existing knowledge, skills and technologies in an innovative manner. According to this definition, innovation may occur in any area.

In each definition the idea of implementation is mentioned – innovation is an invention that will lead to utilisation. Dosi (1988: 222) emphasises that besides seeking, finding, experimenting, developing and imitating a new product, process or organizational structure, it is also essential to accept an innovation into practical application.

Different types of innovation help us understand the importance of innovation. Schumpeter classified innovation according to the new ways an enterprise can act (1982: 66): the introduction of a new good; the introduction of a new method of production; occupying new markets the enterprise has not yet entered; access to a new source of raw materials or half-manufactured goods; a new approach to organizing an industry.

In the Oslo Manual innovation is classified into four categories according to the nature of the innovation (OECD 2005b: 47-51): product innovation – the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses; process innovation – the implementation of a

new or significantly improved production or delivery method; marketing innovation – the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing; organizational innovation – the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Edquist (2001: 7) classifies innovation into product and process innovation, where the first comprises innovations in products and services and the second innovations in technology, organization and marketing.

According to the extent of the innovation, it is possible to differentiate incremental and radical innovation. Incremental innovation is a gradual development of a product or process (Fagerberg 2006: 8); it usually occurs unexpectedly during activities (Smart Innovation 2006: 13). Radical innovations introduce new concepts that depart notably from past practices and help to create products or processes based on a different set of scientific principles and often open up new markets and potential fields of operation (Carayannis *et al.* 2003: 120). The opportunity for the radical innovation usually arises from research and development (R&D), since the aim of R&D is to create new knowledge (Smart Innovation 2006: 13). But radical innovations have a bi-directional effect on an enterprise's competitive advantage: on the one hand, large spending is needed to prepare radical innovations, which also means large risks and substantial losses in the case of failure; on the other hand, successful radical innovation may ensure a long-term competitive advantage for the enterprise.

Based on the previous definitions, innovation in this paper is defined as the implementation of new or existing knowledge in order to create a new or improved product/service or an upgrade in the production, management or marketing process that will increase efficiency.

The purpose of incurring costs and taking risks for the sake of innovation is to achieve competitive advantage on the market in order to increase profits and/or market share, to obtain a monopolistic position on the market in order to increase profits and/or protect the monopolistic position, and to achieve success in public sector services in order to broaden supply and/or reduce costs.

Innovation is often perceived as a "linear process" – first comes scientific activity, then development and finally production and marketing (Fagerberg 2006: 8). Linear innovation models are divided into two: supply-push models (aka science-push and technology-push) and demand-pull models (Molas-Gallart, Davies 2006: 67). But only a small proportion of all innovation occurs from a linear process. In reality, most innovations originate from different sources and different process phases, thus innovation is a "systematic process" (Marinova, Phillimore 2003: 47). Innovation occurs through interaction between many actors (Fagerberg 2006: 4).

The role of the public sector in promoting innovation

Next we will describe innovation policy instruments. Rolfo and Calabrese (2005: 4-5) categorise innovation policy into four types and under each they mention public sector activities in promoting innovation. These policies and instruments are as follows:

- mission policies – financial support for research into cutting edge technologies;
- diffusion and technology transfer policies – grants (through subsidies or tax credits) for the purchase of new machinery or equipment incorporating innovations;
- infrastructural policies – the creation of facilities that promote technological capability, e.g. scientific and technological parks, research centres etc.;
- technological districts – the stimulation of innovation in SMEs by supporting the formation of networks where firms, R&D and financial institutions coexist and jointly evolve innovative initiatives.

Innovation can be promoted in a top-down or a bottom-up manner. According to the top-down perspective, innovation policy is directly linked to national interests and concentrates more on solving macro problems. When innovation policy follows a bottom-up perspective governments, authorities and agencies at the local level have to develop their own distinctive policies, but these have to be based on the national or European Union level. (Howells 2005: 1223, 1225)

Innovation policy instruments can be classified as demand-side oriented or supply-side oriented. Supply-side oriented instruments are more in accordance with the linear view of the innovation process; the systemic approach to innovation emphasises demand-side instruments more (Edquist, Hommen 1999: 63-64). Some demand-side instruments are more suitable for linear processes (e.g. public procurements for technology) and some (e.g. subsidies for firms to cooperate) promote systemic processes.

Edler and Georghiou (2007: 952) emphasise that traditional supply-side innovation policies are inadequate for fostering competitive advantage and thus demand-side instruments have to be created. Demand-side innovation policies are defined as public measures to induce innovations and/or speed up the diffusion of innovations (e.g. new requirements for products and services).

Supply-side innovation policy instruments can be categorised into two groups: the finance group and the services group. The finance group includes five instruments (equity support, fiscal measures, support for public sector research, support for training and mobility, grants for industrial R&D) and the services group includes two (information and brokerage support, networking measures). Demand-side policies can be presented in four main groups: systemic policies, regulation, public procurement and the stimulation of private demand. (Edler, Georghiou 2007: 953) It is essential to note that many policy actions comprise several instruments at the same time.

There are eight conditions which need to be supported by public sector instruments in order to support the development of the innovation system (Wieczorek *et al.* 2009: 22-23): the prevention of undesired and untimely lock-in or the stimulation of creative destruction; the management of interfaces among actors; the stimulation of the participation of relevant actors (especially users); the creation of the conditions for learning and experimenting; the stimulation of the presence of hard and soft institutions; the prevention of overly weak and stringent institutions; the provision of infrastructure for strategic intelligence; and the stimulation of physical and knowledge infrastructure (R&D). In each area there are specific policy instruments that help to promote the functioning and development of the innovation system (table 1).

Table 1. Policy instruments that systematically develop innovation

Area	**Policy instruments**
The prevention of undesired and untimely lock-in or the stimulation of creative destruction	Procurement; loans/guarantees/tax incentives for innovative projects or new technological applications; awards and honours for novel innovations; technology promotion programmes; debates; discourses; venture capital; risk capital
The manage of interfaces among actors	Cooperative research programmes; consensus development conferences; cooperative grants; bridging instruments (e.g. competence centres); collaboration and mobility schemes; policy evaluation procedures; debates facilitating decision-making; science shops; technology transfer
The stimulation of the participation of the relevant actors in the innovation system	Clusters; public-private partnership; interactive stakeholder involvement techniques; network enhancing tools; public debates; scientific workshops; thematic meetings; venture capital; risk capital
The creation of the conditions for learning and experimenting	Education and training programmes; (technology) platforms; foresights; road mapping; scenario development workshops; brainstorming; policy labs; venture capital
The stimulation of the presence of institutions	Awareness building measures; information and education campaigns; public debates; lobbying; voluntary agreements; customs; normative values; ways of conduct
The prevention of overly stringent or weak institutions	Regulations; limits; obligations; rights; principles; norms; agreements; patent laws; standards; taxes; customs; normative values; codes of conduct
The provision of infrastructure for strategic intelligence	Foresight; trend studies; roadmaps; intelligent benchmarking; SWOT analyses; sector and cluster studies; problem/needs/solution analyses; information systems (for programme management or project monitoring); evaluation practices and toolkits; user surveys; information databases; consultancy services; knowledge brokers; knowledge management techniques and tools; knowledge transfer mechanisms; policy intelligence tools (policy monitoring and evaluation tools, innovation systems analyses)
The stimulation of physical and knowledge infrastructure	Classical R&D grants, taxes, loans, schemes; funds (institutional, investment, guarantee); public research labs

Source: Wieczorek *et al.* 2009: 39-40.

Meyer-Krahmer and Kuntze (1992: 103) categorise innovation policy instruments into two: instruments in a narrow sense and in a broader sense. Instruments in a narrow sense comprise institutional funding, financial incentives and other innovation infrastructure and technology transfer mechanisms. Instruments in a broader sense comprise public demand and procurement, corporatist measures, education and training and public policy that is linked to innovation (e.g. competition policy, regulations).

According to Edquist (2006: 190-191), there are ten activities of the public sector that help to develop, diffuse and use innovations in a country:

1. Knowledge inputs to the innovation process, including:
   - the provision of R&D and the creation of new knowledge; and,
   - competence building in the labour force to be used in innovation and R&D activities.
2. Demand-side factors, including:
   - the formation of new product markets; and,
   - the articulation of quality requirements emanating from the demand side with regard to new products.
3. The provision of the constituents of the innovation system, including:
   - creating and changing organizations needed for the development of new fields of innovation;
   - networking through markets and other mechanisms; and,
   - creating and changing institutions that influence innovating organizations and innovation processes by providing incentives or obstacles to innovation (e.g. IPR laws, tax laws, environment and safety regulations, etc.)
4. Support services for innovating firms, including:
   - incubation activities for new innovative efforts (e.g. providing access to facilities, administrative support, etc.);
   - financing innovation processes and other activities that can facilitate the commercialization of knowledge and its adoption; and,
   - the provision of consultancy services of relevance for innovation processes, e.g. technology transfer, commercial information, and legal advice.

Chaminade and Edquist list suitable policy instruments that the public sector can implement in these ten areas (see Chaminade, Edquist 2005: 20-32).

Innovation policy should consider that the factors that influence innovation vary between industries. The same innovation policy instruments may not function well everywhere (Fagerberg 2006: 17). The choice of a country's innovation policy instruments is affected by many factors (OECD 2005a: 33): strengths and weaknesses of the country; opportunities and threats that the country faces and how these are perceived; the development stage of the country; political orientations and differences in the objectives of government; the decision process in policy making; and the economic and industrial inheritance of the country.

An assessment of the international position of Estonia

In the empirical analysis, a variety of variables are used that characterise the activities of the public sector in promoting innovation. Each innovation policy area is described using two to four variables. The choice of variables was made on the basis of content and availability. All together, 17 variables are used in the analysis (table 2).

Table 2. Indicators used in the empirical analysis of the implementation of innovation policy instruments

1. Public sector R&D	
GOVERD	Government sector R&D expenditure (% of GDP)
HERD	Higher education sector R&D expenditure (% of GDP)
2. Business enterprise sector R&D	
GOVtoBES	Government sector funding for business enterprise sector R&D expenditure (% of GDP)
funGOV	Share of enterprises that received funding for innovation activities from central government
funLOC	Share of enterprises that received funding for innovation activities from local or regional authorities
funEU	Share of enterprises that received funding for innovation activities from the European Union
3. Support for cooperation in innovation	
COuni	Share of enterprises that co-operated with universities or other higher education institutions
COgov	Share of enterprises that co-operated with government or public research institutes
BEStoHES	Business enterprise sector funding for higher education sector R&D expenditure (% of GDP)
BEStoGOV	Business enterprise sector funding for government sector R&D expenditure (% of GDP)
4. Development of human resources that are necessary for innovation	
educ14	Total public expenditure on education at primary and secondary level of education (ISCED 1-4) (% of GDP)
educ56	Total public expenditure on education at tertiary level of education (ISCED 5-6) (% of GDP)
empGOV	Total R&D personnel in government sector as % of total employment (full time equivalent)
empHES	Total R&D personnel in higher education sector as % of total employment (full time equivalent)
5. Promoting environment that promotes innovation	
IntelProp	Intellectual property rights are adequately enforced (on scale 0-10)
LegalEnv	Development and application of technology are supported by the legal environment (on scale 0-10)
Procure	Government procurement decisions foster technological innovation (on scale 1-7)

The data used in the empirical analysis originates from the statistical office of the European Union (Eurostat), the OECD statistics database, the World Competitiveness Yearbook by the International Institute for Management Development (IMD) and The Global Competitiveness Report published by the World Economic Forum. The statistics software packages SPSS 16 and STATA 10 are used in the analysis of the data.

In order to find the structure of public sector activities in promoting innovation, a principal component analysis is used (Niglas 2005: 1). With a principal component analysis it is possible to transform a number of correlated variables into a smaller number of uncorrelated variables called components without a significant loss of information. A principal component analysis foremost allows us to understand and quantitatively describe the essence of the structure of "soft" (socio-economic) phenomena because this area is mostly characterised by stochastic correlations. Synthetic components are presented in the same scale – all components have the same mean (equal to 0) and variation (equal to the standard deviation). This simplifies the comparison of different countries using various components. When using a principal component analysis, the number of cases has to be higher than the number of variables, but this is not easily achieved. In the current paper, the sample consists of the 27 member states of the European Union plus Croatia, Turkey, Iceland and Norway. In addition, the countries are viewed using data from two years; therefore, the sample comprises 62 cases. It is considered a good outcome when the number of observations is three times higher than the number of variables (Field 2005: 639-640; OECD 2008: 66). The data from both years is standardised in order to remove the trend.

A principal component analysis assumes that there are no missing values (Remm 2010: 64), but in the current dataset there were seven, and these missing values were replaced using the EM (expectation maximization) algorithm (see Bilmes 1998), which is one of the most common methods for calculating missing values in a principal component analysis (see Chen 2002; Raiko *et al.* 2007; Stanimirova *et al.* 2007).

The outcome of the component analysis for innovation policy variables in European countries is shown in table 3. The principal component analysis decreased the number of variables that describe innovation policy actions almost three times but only one fifth of the information from the initial variables was lost (components describe 81.7% of the overall variance). The suitability of the principal component analysis was assessed using the KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy and Bartlett's test of sphericity (Field 2005: 640, 652) – both gave a positive outcome.

Interpreting these synthetic components and giving them adequate names is a complicated task. In the current paper, the interpretation of components is based on previously designed methodology (see Karu, Reiljan 1983).

The first component has a strong correlation with six variables that characterise the

legal environment for innovation, procurement decisions, education expenditure and R&D expenditure in the higher education sector. The essence of this component is described by the name "Development of innovation support system".

The second component represents three variables that describe the government sector R&D expenditure and R&D personnel in the government sector. The name for the second component is "Government sector R&D funding", since the number of R&D personnel derives from the level of funding.

Table 3. The component structure of innovation policy actions

	C1 Development of innovation support system	C2 Government sector R&D funding	C3 Higher education sector R&D funding	C4 EU funding for business enterprise sector and cooperation with public sector	C5 Business enterprise sector R&D funded by public sector	C6 Central government funding for business enterprise sector
Procure	**0.87**	0.13	-0.05	-0.07	-0.02	0.12
educ14	**0.83**	-0.06	0.05	0.10	-0.12	0.00
LegalEnv	**0.81**	0.03	0.37	-0.03	0.16	0.01
IntelProp	**0.78**	0.07	0.34	0.06	0.34	0.05
educ56	**0.76**	-0.03	0.21	0.28	0.09	0.35
GOVERD	0.05	**0.93**	0.07	-0.12	0.11	-0.11
empGOV	-0.02	**0.90**	-0.01	0.04	-0.15	0.06
BEStoGOV	0.01	**0.82**	0.12	0.21	0.09	0.12
BEStoHES	0.13	0.33	**0.75**	-0.11	-0.02	0.02
empHES	0.30	-0.11	**0.69**	0.33	0.14	-0.04
HERD	**0.61**	-0.05	**0.62**	0.02	0.30	0.02
funEU	-0.04	-0.23	-0.31	**0.80**	-0.03	-0.29
COuni	0.10	0.21	0.23	**0.77**	0.16	0.29
COgov	0.19	**0.45**	0.30	**0.66**	-0.07	0.30
funLOC	-0.08	-0.19	0.13	0.13	**0.85**	0.07
GOVtoBES	0.32	0.31	0.03	-0.07	**0.80**	-0.01
funGOV	0.18	0.04	-0.03	0.07	0.05	**0.93**
Eigenvalue	5.59	2.83	1.86	1.52	1.13	0.96
Cumulative variance explained	32.89	49.55	60.50	69.43	76.06	81.70
Bartlett's test	0.00					
KMO	0.66					

The third component characterises the level of R&D expenditure in the higher education sector and R&D personnel in the higher education sector as a percentage of total employment. The essence of this component is described by the name "Higher education sector R&D funding", since the number of personnel depends on

the funding.

The fourth component has a strong correlation with three variables. The variable *funEU*, which describes the share of enterprises that received funding for innovation activities from the European Union, has the highest component loading. The other two variables characterise the share of enterprises that co-operated with universities, other higher education institutions, government or public research institutes. This component is named "EU funding for business enterprise sector and cooperation with public sector".

The fifth component characterises two variables: the share of enterprises that received funding for innovation activities from local or regional authorities and the government sector funding for R&D expenditure in the business enterprise sector. This component is described by the name "Business enterprise sector R&D funded by public sector".

The sixth component represents only one variable – the share of enterprises that received funding for innovation activities from the central government. Thus, the sixth component is described by the name "Central government funding for business enterprise sector".

Component scores characterise the values of the components for each country. Since every country is represented in the sample twice, each country has two component scores. In order to compare countries, each country is described using the arithmetic mean (appendix 1). Component scores show that the structure of the public sector in promoting innovation varies country by country – countries emphasise different innovation policy areas. Subsequently, the international position of Estonia is described using figures that illustrate the outcome.

The position of Estonia in each component is shown in figure 1, which illustrates the difference from the overall average of all countries and from the minimum and maximum values. Although in general, innovation policy activity in Estonia is below average, it may be considered balanced – the difference from the mean is usually smaller than from the minimum and maximum values.

The diversification of innovation policy shows that in Estonia development success is not expected from one "miracle tool", but a consistent and balanced innovation policy is being implemented. Whether this is adequate for a small country and its level of adeptness has to be researched.

According to component C1 (Development of innovation support system), the level in Estonia is a bit higher (standard deviation 0.26) than the average in Europe and Estonia is ranked in the middle (15th out of 31). So it is clear that support in Estonia for the legal and educational environment for innovation is at the average European level. In terms of the legal environment, the outcome may be considered good. But in order to find out whether support for the education on the average level will reduce the differences between countries development, a deeper analysis of

education financing must be conducted. A comparison with other countries suggests the need to increase support for education. In the first component, the country that is most similar to Estonia is the Netherlands, and relatively similar are Ireland and the United Kingdom. The highest component scores are in Denmark (2.0), Sweden (1.6) and Iceland (1.4) and the lowest (negative) values are in Croatia (-1.8), Slovakia (-1.5) and Turkey (-1.4). Developmental success is mostly achieved by countries with high scores.

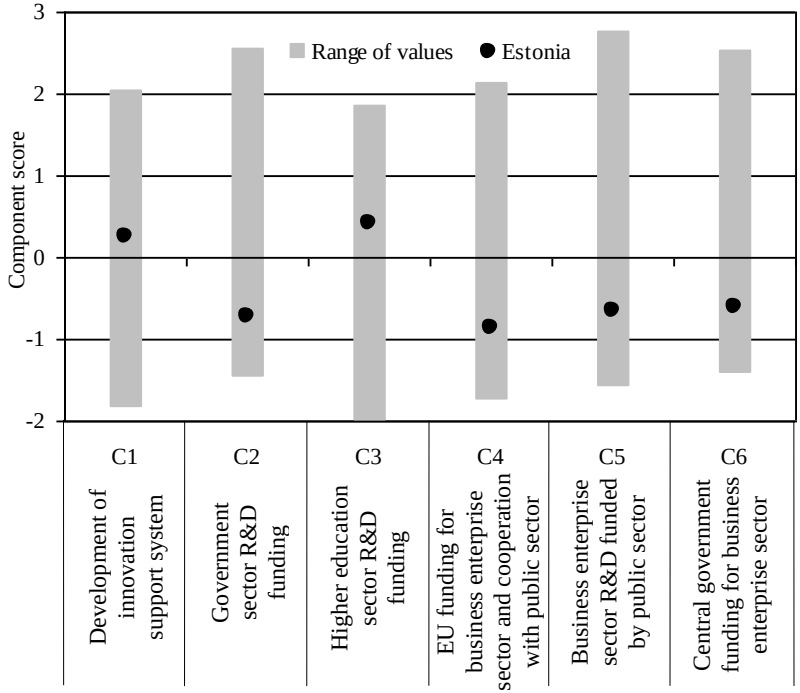

Figure 1. The position of Estonia in regard to the six components characterising innovation policy areas.

According to component C2 (Government sector R&D funding), Estonia's position is lower than the average by 0.71 standard deviations and is ranked 25th – only six countries have lower component scores. Therefore, the government sector and its research and R&D personnel do not create significant science potential for the business sector and is not a supportive cooperation partner. In order to find out whether this science potential and support is at all necessary, the effects of government sector R&D on the business enterprise sector have to be studied. The comparison with other countries provides little explanation for this situation. According to the second component, Estonia is similar to Turkey and Italy, where

small enterprises have a large relative importance. The highest component scores are in Iceland and Slovenia (2.6 and 2.1) and the lowest values are in Malta (-1.5) and Denmark (-1.3). Hence, in this policy area the means in small countries show a marked difference and the reasons for this need to be investigated.

According to component C3 (Higher education sector R&D funding), Estonia's position is higher than average by 0.41 standard deviations and is ranked 11th, indication that Estonian innovation policy has quite high hopes for the promoters of innovation. In a small open country this must be considered important since new knowledge must be passes to specialists through teaching and this is mostly done by academics engaged in R&D. The experience of other countries seems to support this kind of hypothesis. In the third component, Estonia is most similar to Sweden and the United Kingdom and the highest component scores are in Iceland (1.9) and Finland (1.7). The lowest are in Luxembourg (-2.0) and Cyprus (-2.0) – countries where higher education is mostly oriented towards what is being offered by large neighbours.

According to component C4 (EU funding for business enterprise sector and cooperation with public sector), the component score for Estonia is -0.86 and Estonia is ranked 24th. In this area Estonian innovation policy shortages must be acknowledged – the public sector is not capable of establishing cooperation with the business enterprise sector in order to help companies apply and utilise financial support from the European Union. Often it seems that the public sector in Estonia, which organizes the allocation of European Union funds, has replaced its role as consultant to the business sector with the role of controller and punisher. Thereby, the business enterprise sector cannot rely on the public sector for access to financial support from the European Union, but must fear bureaucratic intervention by the public sector. According to the values of this component, Estonia's similarity to Bulgaria and Italy rather confirms this hypothesis. The best outcomes in this policy area are in Finland (2.1), Slovenia (1.8) and Greece (1.8) – these countries are the most successful in getting financial support from the European Union. The lowest values are in Turkey (-1.7), Spain (-1.2) and Iceland (-1.2). The position of Turkey and Iceland derives from the fact that these countries are not European Union member states, and for this reason financial support for innovation is quite low.

According to component C5 (Business enterprise sector R&D funded by public sector), Estonia is on the average level (component score is equal to -0.65) and is ranked 22nd. The low ranking in this policy area derives from the fact that there are no regional authorities in Estonia and in general local municipalities do not have the competence or resources to support innovation in the business enterprise sector. In the fifth component, the most similar countries to Estonia are Slovakia, Poland and Cyprus. The highest component scores are in Austria (2.8), Spain (1.8) and France (1.5). The lowest values are in Malta (-1.6), Iceland (-1.3) and Bulgaria (-1.3).

According to component C6 (Central government funding for business enterprise sector), Estonia's component score is equal to -0.60 and Estonia is ranked 22nd. Direct central government funding for the business enterprise sector requires

adequate competence in terms of long-term innovation policy strategy development and adeptness in the elimination of specific market and system failures. Further research must be conducted in order to determine the existence of this kind of competence and adeptness in Estonia. Therefore, Estonia's moderate outcome in this innovation policy area may be considered normal. According to the sixth component, the most similar countries to Estonia are Latvia and Romania. The central government supports innovation processes in the business enterprise sector the most in Norway and Cyprus (component score accordingly 2.5 and 1.7) and the least in Ireland (-1.4) and Iceland (-1.4). The position of Estonia in reference to other countries seems to verify the balanced innovation policy in the country.

Looking at all the components simultaneously reveals that Finland has the best position among all countries – all six component scores have positive values. The worst performance is in Bulgaria, Poland and Portugal – all three countries have five negative values out of six component scores. Estonia with two above average and four below average values remains formally on the negative side. But in order to give a more precise evaluation, a more profound analysis must be carried out.

Summary

In spite of a hundred years of discussion, there is still not one specific definition for innovation. In the current paper the following definition of innovation was used: the implementation of new or existing knowledge in order to create a new or improved product/service or an upgrade in production, management or marketing process that will increase the efficiency.

The purpose of incurring costs and taking risks for the sake of innovation is to achieve competitive advantage on the market in order to increase profits and/or market share, to obtain a monopolistic position on the market in order to increase profits and/or protect the monopolistic position, and to achieve success in public sector services in order to broaden supply and/or reduce costs.

In a national innovation system, the public sector innovation policy has a substantial role to play. The need for the intervention of the public sector is explained via market and system failures. The public sector promotes innovation by implementing innovation policy instruments. These instruments must be chosen according to development path dependency, established goals and the factors that influence the implementation of the country's innovation policy. In the empirical part of the paper, 17 variables were chosen to describe public sector activities in promoting innovation.

In order to assess the international position of Estonia and the structure of public sector activities in promoting innovation, a principal component analysis was carried out. The sample consisted of 27 European Union member states plus Croatia, Turkey, Iceland and Norway. Each country was represented with values from two years. The principal component analysis revealed that the activities of the public sector in promoting innovation can be described using six components: the

development of an innovation support system, the government sector and higher education sector R&D funding, the business enterprise sector innovation funded by the central government and also by local or regional authorities, European Union funding for the business enterprise sector and cooperation with the public sector, and the business enterprise sector R&D funded by the public sector. On the basis of different innovation policy areas, Estonia is closer to the average values for these countries than the minimum or maximum values.

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Appendix 1. The arithmetic mean of two years component scores for countries

	C1	C2	C3	C4	C5	C6
Belgium	0.00	-0.66	0.87	0.44	0.82	-0.02
Bulgaria	-1.09	0.93	-0.81	-0.96	-1.28	-0.66
Czech Republic	0.10	1.24	-1.38	-0.03	0.91	-0.51
Denmark	2.04	-1.32	0.87	0.30	-0.83	-0.36
Germany	-0.02	1.18	0.70	-1.12	0.82	-0.68
Estonia	**0.26**	**-0.71**	**0.41**	**-0.86**	**-0.65**	**-0.60**
Ireland	0.35	-1.22	-0.42	0.51	0.82	-1.39
Greece	-1.05	-1.24	0.24	1.76	-0.31	0.18
Spain	-0.85	0.26	0.34	-1.24	1.77	0.03
France	0.45	0.69	-0.41	-0.34	1.47	-0.36
Italy	-1.38	-0.69	0.09	-0.98	1.36	0.15
Cyprus	1.15	-1.00	-1.97	0.00	-0.70	1.72
Latvia	-0.58	-0.43	0.26	1.26	-0.46	-1.34
Lithuania	-0.70	-0.45	0.97	0.83	-0.75	-0.61
Luxembourg	0.97	1.16	-1.99	-0.39	-0.29	0.47
Hungary	-0.63	0.49	-0.55	0.94	-0.33	0.26
Malta	0.76	-1.45	-1.27	-1.09	-1.56	0.16
Netherlands	0.31	0.12	1.05	-0.19	-0.05	1.15
Austria	0.58	-0.58	-0.08	0.30	2.76	0.90
Poland	-0.26	-0.03	-0.92	0.97	-0.67	-1.11
Portugal	0.62	-0.94	-0.10	-0.59	-0.89	-0.34
Romania	-1.11	0.19	-1.17	-0.71	0.41	-0.59
Slovenia	-0.51	2.07	-1.24	1.77	-0.28	0.46
Slovakia	-1.51	-0.14	0.09	0.93	-0.64	-0.66
Finland	0.89	1.12	1.68	2.14	0.07	1.50
Sweden	1.55	-0.42	0.40	0.24	1.11	-1.28
United Kingdom	0.36	-0.67	0.46	-0.15	0.23	-0.37
Croatia	-1.81	0.29	0.72	-0.41	-0.57	1.52
Turkey	-1.42	-0.71	1.17	-1.72	-0.74	1.23
Iceland	1.43	2.55	1.85	-1.16	-1.30	-1.39
Norway	1.10	0.38	0.16	-0.46	-0.26	2.54