AN ASSESSMENT AND EVALUATION OF INNOVATION POLICY: THE CASE OF ESTONIA

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Introduction

Economic growth, global competition, technological change, innovation, innovation systems, innovation clusters and networks, a knowledge-based economy and a knowledge-based society constitute a substantial and popular subject of research for scholars and researchers from a number of academic fields, a challenging matter of analysis and concern for policy analysts, policy makers and public servants as well as being a very important subject of management for entrepreneurs in any country. Estonia has Skype, the genome project, e-government and e-elections. It has also experienced success in the radical innovation of its monetary and taxation policies. Estonia is known world-wide for its developmental success story, but the country has made no overall radical progress in innovation to guarantee the long-term continuation of this success.

According to numerous authors, creativity, knowledge, technological change and innovation are four of the most significant factors of economic growth and the development of an economy (Marshall 1920: App. A. 11; Schumpeter 1942: 84–85; Nelson 1993: 3; Freeman 1995: 10; Rosenberg 1995: 179; Bruland 1998: 167; Lundvall 2000: 2; Kattel, Kalvet 2005: 17), the formation of industrial policy (Lundvall 1988: 362; Nielsen 2003; Dahlman, Routti, Ylä-Anttila 2005: 3, 6) and a new challenge in the transition to a knowledge-based economy (Tijssen 2002: 509). Professor Erik S. Reinert (1999) warns, "*Nations which stop innovating do not keep their standard of living; they lose their standard of living even though they keep the same efficiency.*"

A large number of economists, as well as technological change, policy, system and innovation theorists (Schumpeter 1939; Kline, Rosenberg 1986; Perez 1986; Lundvall 1988) have defined and treated innovation differently according to content, size, nature, and types; but the modern understanding of innovation includes at least three generic attributes: the aspects of change/novelty, economics/commerce and uncertainty (Arrow 1962; Rosenberg 1995: 171; Caenegem 2007). Different authors (Hughes 1987: 64; Porter 1990: 1998; Patel, Pavitt 1994; Bruland 1998: 167; Etzkowitz, Leydesdorff 2000: 5) have introduced a different treatment of the enablers, preconditions and success factors of innovation. The innovation process is dynamic (Lundvall 2000: 2; Newman 2005), non-linear (Kline, Rosenberg 1986; Newman 2005), social (Alic *et al*. 1992, McElroy 2003), self-organizing (Fuchs 2004: 18) and interactive (Giget 1997; Edward 2000). Innovation systems are complex (Kline, Rosenberg 1986; Hughes 1987: 64), social (Cooke 1998: 11; Lundvall 2000: 2, 24), dynamic (Lundvall 2000: 2; Carlsson *et al*. 2002: 244) and self-organizing (Rycroft 2003b: 2). Innovation policy (hereinafter IP) has a very complex organisation, a diverse and many-sided structure, and outcomes (positive and nega-

tive, expected and non-expected, direct and indirect) affecting all of society (Rycroft, Kash and Adams 1995: 5). The creation of an IP is also an unknown and unknowable exercise (Rycroft 2003a: 4).

A common feature characterising Estonia's Economic Policy (hereinafter EP) and IP is the great number and complex structure of various strategic and policy documents, action plans, programmes and projects. The most general document is the Estonian National Strategy on Sustainable Development up to the year 2030 "Säästev Eesti 21" (Hereinafter SE21, Sustainable Estonia 21), which represents, with its fundamental values and nature- and human-centred approach, a philosophical platform for the preparation, interpretation and assessment of all other EP and IP related documents. The most relevant documents among those outlining economic growth, technological development, research and development, and innovation activities are the "Estonian Action Plan for Growth and Jobs 2005–2007" (EAPGJ), which replaces the document Eesti Edu 2014 (EE2014, Estonia's Success 2014), the R&D strategy for 2007–2013 "Teadmistepõhine Eesti II" (TEII, Knowledge-based Estonia II), the domain strategies, the state budget strategy for 2008–2011, "Estonia's National Development Plan 2006", Estonia's National Changeover Plan, as well as many other domestic, European Union and international strategies, development plans and programmes. In addition to these, EP and IP are also influenced by strategic documents of other structural policies and domains.

The assessment and evaluation of policies are crucial elements of success in every stage of the policy cycle. (Papaconstantinou, Polt 1997: 9; Shelton 1997: 15) It is highly unlikely that IP implementation can be successful without a proper ex ante and ex post assessment and evaluation (relevant and timely feedback) with high quality, relevant and timely gauges. (Milbergs 2004: 19) The author strongly supports the arguments of different authors (Berg *et al*. 2004; Newman 2005) who argue that development and policy processes, including the innovation process, require an appropriate and sufficient assessment and evaluation system (system of feedback). Without assessment and evaluation one cannot be sure whether and at which speed processes move towards or away from expected goals. (Jordan, Streit 2001: 7–15) However, due to the inherent merit of uncertainty and self-organization of economic and innovation process, even the most perfectly designed assessment and evaluation systems do not give sufficient assurance that the desired goals will be achieved. Designing a coherent, integral assessment and evaluation system for IP integrated with an assessment and evaluation system for EP is far from an easy, cheap, quick and risk-free process, because assessment and evaluation depend on the assessment culture that is an inherent part of the national and global culture as well as a number of sub-cultures such as ethnic culture, organizational culture, etc. (Cameron, Quinn 1999: 10; Cameron, Sine 1999: 21) In addition, the means-ends connections are not clear (Cameron 1980: 70–71), more than one strategy produces the same outcome (Cameron 1980: 71), subunits are not tightly connected (Cameron 1980: 71), and goals are multiple, changing and ambiguous (Cameron 1980: 78). According to Cameron (1980: 70), a class of organizations exists – organized

anarchy- for which none of the four recognized effectiveness evaluation approaches[1] are appropriate. Many government organizations and other participants in the EP and IP implementation processes resemble a kind of organized anarchy.

The aim of this article is to provide an overview of the generic problems and practical aspects of innovation policy assessment and evaluation issues in a small country based on the example of Estonia and to suggest some ideas concerning the principles and design of the framework for an integrated assessment and evaluation model of IP for a small country.

The author performed this particular research based on the qualitative approach of methodology. The more general theoretical basis of this paper rests mainly on the evolutionary economics, system, process, innovation, clusters, networks, and the self-organizing theories, plus others as well. The author performed a wide-scale structural search of the relevant theoretical, scientific, and research publications. On the basis of the results of the qualitative analysis and a synthesis of collected information, the author prepared a sample of gauges concerning the characteristics of the outcome and impact of an IP. The author conducted a search and a qualitative analysis of the Estonian strategy and policy documents, deciding to focus on the most relevant from the point of view of the research field. The selected strategy and policy documents concerning innovation and IP were qualitatively analyzed for semantics and content. The author researched the IP implementation assessment and evaluation tools and gauges as well and analysed them critically. On the basis of the results of the data collected, analyzed and interpreted, the author designed general principles for devising an early draft of a theoretical evaluation and assessment system model and presented some ideas for improving the current system of IP policy assessment and evaluation in Estonia.

Development of Innovation Policy Implementation in Estonia and Problems Concerning Assessment and Evaluation

IP implementation arrangements are at a very early stage in Estonia,[2] thus actually there is the possibility of assessing and evaluating mostly the inputs, activities and some outputs of innovation-related work, the national innovation system (NIS) itself and NIS components, but not the interim and final outcomes and impact of IP in the sense of support for the economic growth and development of society. However, a theoretical possibility of assessing and evaluating the outcomes and impact of IP in Estonia exists in the future too, because there are a number of criteria and indicators for that purpose in the relevant IP documents. To some extent it is already possible

[1] The goal, the system resource process models, and the strategic constituencies approach (Cameron 1980: 68).

[2] "Teadmistepõhine Eesti I" (TEI, Knowledge-based Estonia I) was approved by the Estonian Parliament (Riigikogu) on 06.12.2001¸ "Eesti Edu 2014" (Estonia's Success 2014) was worked out in 2003, SE21 was approved by the Riigikogu in September 2005, "Estonian Action Plan for Growth and Jobs 2005–2007" was approved by the Government of Estonia on 13.10. 2005 and TEII was approved by the Government of Estonia on 23.11.2006.

to evaluate the trends of Estonia's innovation development process compared to the respective trends in other European Union Member States and the world by using some criteria and indicators. In order to assess and evaluate the success of innovation policy as a sub-process of EP, it is possible to use several tools devised by different European Union and global organizations[3]: it is possible to indirectly evaluate Estonia's success in the IP implementation process and compare the results to those recorded in the World Competitiveness Scoreboard[4], the Innobarometer, the Global Summary Innovation Index (GSII), etc. For example, based on the World Competitiveness Scorebook of the IMD, Estonia occupied the 22nd position (out of 55 states) in 2007 (19th in 2006, 26th in 2005, 28th in 2004). (IMD 2008, 2007, 2006)

According to the GSII scores, Estonia's GSII is 0.34, whereas the GSII of Finland, the best performer[5], is 0.76 and the average GSII of the EU25 is 0.50. Thus, Estonia did not make it into the group of the "next-best performers"[6] in 2006, but was among the following countries (Hollanders, Arundel 2006). According to Hollanders and Arundel (2006), "*Estonia is alike in absolute and relative performance and is far behind the innovation leaders, their different relative performance structure might be one explanation for this performance lag.*" According to Gallup (2006: 4),

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[3] By using international assistance, it is possible to assess and evaluate the progress, outcomes and impact of innovation policy success by using various sets of criteria to some extent. The tools devised by various European Union institutions provide certain opportunities to do just that. For example, there exists the Trend Chart Innovation Policy in Europe (Trend Chart workshops, European Innovation Scoreboard, The Annual Synthesis Report, Innobarometer, etc). Estonia has been represented and described by 21 innovation policy gauges, the gauges are described by 24 data fields, and countries have been described using 9 indicators. The European Commission publishes an "Annual Innovation Policy Trends and Appraisal Report", etc. The structural units of the European Union maintain overviews by use of thorough packages of innovation policy gauges.

[4] IMD uses 20 competitiveness factors in 4 groups as follows: Economic Performance (Domestic Economy, International Trade, International Investment, Employment, Prices), Government Efficiency (Public Finance, Fiscal Policy, Institutional Framework, Business Legislation, Societal Framework), Business Efficiency (Productivity, Labour Market, Finance, Management Practices, Attitudes and Values), and Infrastructure (Basic Infrastructure, Technological Infrastructure, Scientific Infrastructure, Health and Environment, Education). (IMD 2007)

[5] Esko Aho, Chairman of the SITRA, argues that "the success of Finnish society is based on education. Good basic education, well-organised professional training and the net of universities reaching the most gifted persons are the warrants of the implementation of the skills of Finns. Finland did have opportunities to offer strong professional knowledges in developing technologies and also basic skills of nation to implement those". (Aho 2005: 32)

[6] Based on the ranking of their GSII scores, the countries can be divided into groups. Finland, Sweden, Switzerland, Japan, the USA, Singapore and Israel are the leaders of global innovation. The first three of these countries are also the most innovative countries in the 2005 EIS8. The next-best group of performers includes Germany, Denmark, the Netherlands, Canada, the UK, the Republic of Korea, France, Iceland, Norway, Belgium, Australia, Austria, Ireland, Luxembourg and New Zealand. The next group of following countries includes Hong Kong, the Russian Federation, Slovenia, Italy, Spain, the Czech Republic, Croatia, Estonia, Hungary and Malta. The group of lagging countries includes Lithuania, Greece, China, Slovakia, South Africa, Portugal, Bulgaria, Turkey, Brazil, Latvia, Mexico, Poland, Argentina, India, Cyprus and Romania.

the percentage of companies acting in a cluster-like environment in Estonia is only 9%, whereas in the United Kingdom cluster-like environments dominate the landscape (at 84%). Our low ratio of companies acting in a cluster-like environment is a warning signal as regards the country's economic sustainability, because clusters are considered to be prominent vehicles of increased innovation and competitiveness. (Porter 1998: 77; Mytelka, Farinelli 2000: 27; Gallup 2006: 3; Hargreaves, Shaw 2006: 153)

The State Audit Office of Estonia evaluated the activities of Enterprise Estonia in product development and the activities of the Ministry of Agriculture in commissioning applied research. As a result, both Enterprise Estonia (Kivine 2004) and the Ministry of Agriculture (Kõrge 2003) received rather harsh judgements. The State Audit Office has justified their grounds for criticising the Government of the Republic regarding the sphere covered by innovation policy.

The "Annual Innovation Policy Trends and Appraisal Report: Estonia 2004–2005"[7] records the results of IP implementation in Estonia. The report highlights 8 strengths, 13 weaknesses, 5 opportunities and 7 threats as regards IP in Estonia (Kurik, Terk 2005: 4). If one compares the positive side (strengths and opportunities) of the results with the negative one (weaknesses and threats), it can be seen that the number of threats and weaknesses is more than that of opportunities and strengths. One can also see that the strengths and opportunities are predominantly central to the related strategies, infrastructure and programmes; i.e., to inputs and outputs, whereas the weaknesses and threats are more content-related. Thus, Estonian policymakers have to focus more on the content-related weaknesses and threats in order to avoid regression in the IP implementation process.

The authors of the most significant document presenting the input of IP in Estonia – the SE21 – have concluded that "*there still exists the threat of becoming a cheap source of outsourcing, as Estonia has no purposeful innovation policy, and the market only cannot ensure it.*" (SE21 2005: 37) It is difficult, though not impossible, to argue with this statement in 2007, although the situation in 2005 was somewhat better than in 2004. (IMD 2006) It is important to remember that in the big success story of Finland's economic development the major sources of its success were innovation, the creation of knowledge and creativity. (Dahlman, Routti, Ylä-Anttila 2005: 1) In addition, the Finnish state strongly supported innovation activities, thus contributing to their success,[8] (Dahlman, Routti, Ylä-Anttila 2005: 6; Moen, Lilja 2005: 359–360) and the participation of state-owned industrial enterprises was significant (Dahlman, Routti, Ylä-Anttila 2005: 7; Moen, Lilja 2005: 363). Kattel and Kalvet (2005: 12) claim that: "*Estonia's economy today is not sustainable in the directest meaning of the word*", and the authors of the SE21 (2005, 37) criticise the current model of the so-called little-interfering state from the point of view of

[7] The report for 2006 was unavailable at the time this article was written.
[8] Here it is appropriate to point out that according to Arthur (1989), subsidizing and protecting new industries in order to capture foreign markets policies is debatable.

sustainability. The authors of the SE21 (2005: 46) consider the basis of success to be the adoption of a knowledge-based society model; i.e., social innovation. The preconditions for a knowledge-based society are an open and free society (Friedman 1962: 133), free people (Näpinen 1994: 169), an environment placing a high value on knowledge (Conner, Prahalad 1996: 477; Teece 1981, 1998), experience and skills (Mytelka, Farinelli 2000: 22), as well as education and a proper educational system (Carlsson *et al*. 2002: 242; Dahlman, Routti, Ylä-Anttila 2005: 11) favouring the upbringing of persons who can fit into a knowledge-based society with a liberal outlook on the world. Innovation is a significant source of a knowledge economy and a knowledge economy is recognized to be a major source of a knowledge society. (Hargreaves, Shaw 2006: 46) Knowledge is strongly recognized as the main driver, source and stimulus of innovation. (Gilbert, Pyka, Ahrweiler 2001; Hargreaves, Shaw 2006: 45–46) There is very little room to acknowledge that the abovementioned crucial preconditions have been met in Estonia.

According to the Global Competitiveness Index's (GSI), rankings, Estonia is still climbing up in the competitiveness rankings. (Lopez-Claros *et al*. 2006: xvii) When comparing the 2005 and 2006 results, it can be stated that Estonia has not made any significant progress. Estonia's CSI ranking for 2006 is 25 on 26 in 2005. Although Estonia is experiencing a positive trend at the moment, the country is only in transition from an efficiency-driven stage to an innovation-driven stage. (Lopez-Claros *et al*. 2006: 13) According to Lopez-Claros and colleagues (2006: 11), efficiency-driven competitiveness becomes increasingly driven by better education and training, efficient markets, and the ability to harness the benefits of existing technologies. As for the innovation-driven stage, one is only able to sustain higher wages and the associated higher standard of living if one's businesses are able to compete with new and unique products. At this stage, companies must compete through innovation, and/or producing new and different goods using the most sophisticated production processes. Estonia occupies the 32nd place ranked by innovation factors (*Ibid*.: 16), the 35th place ranked by business sophistication[9] (*Ibid*.: 22) and the 30th place ranked by innovation.[10] (*Ibid*.: 22) Even though Estonia ranks 16th from the point of view of technological readiness[11] (Porter 2006: 20), the country dropped to the 35th place by the Business Competitiveness Index (BCI) in 2006 – back down to the level of 2003. (Porter 2006: 60) That fact should be considered as a warning sign in the context of economic development and

[9] According to Lopez-Claros and colleagues (2006: 11), business sophistication is particularly important for productivity at the upper end of the global value chain, and is gauged by the quantity and quality of local suppliers, well-developed production processes, and the extent to which companies in a country are turning out the most sophisticated products.

[10] According to Lopez-Claros and colleagues (2006: 11), innovation is particularly important for countries that have reached the high-tech frontier, as it is the only self-sustaining driver of growth.

[11] "The technological readiness pillar thus complements the innovation pillar, described below, as it aims to gauge the existing technological infrastructure and the ability of a country to absorb technology from home or abroad, while the innovation pillar assesses the economy's ability to produce brand new technologies." (Porter 2006: 20)

sustainable growth, because the strength of a business' competitiveness is of utmost importance for sustainable growth in the global market.

Innovation Policy Assessment and Evaluation in Estonia

In the context of managing any policy, including EP and IP, policymakers have to perform a sufficient analysis of the problem to be solved including the available and required inputs, the preconditions, enablers, obstacles, environment, etc., before implementing the policy in question (clarification of the concept of the policy implementation process). Only after this has been done can a later assessment and evaluation be carried out. Based on the results of an analysis and synthesis of the before-mentioned IP documents, it can be concluded that the ex ante analysis performed in the IP planning stage has not been of sufficiently high quality. When talking about internal connections between the different components of innovation policy, it is possible to state that no adequate ex ante analysis of the possible impact, counter-impact and by-impact, as well as the causal relations between the planned inputs and activities *vis-à-vis* the impact, has been performed in Estonia. However, there are some indications that an ex ante analysis has been done in some respects in the case of IP documents at every level. Nevertheless, in Estonia the IP documents (excl SE21), their annexes and application documents manifest a sufficient ex ante analysis of neither the interaction (co- and counter-effects) between the IP and other policies nor the recommended and forecasted co-effects and by-effects. It is incomprehensible how the possible progress, outcomes and impact are to be assessed, evaluated and gauged in the future, as the strategy documents, their annexes and explanatory notes do not include a precise description of the situation from the starting point (point 0). The State Audit Office formulated the main problems of public administration in 2000[12] (Parts 2000). It cannot be denied that some progress has really taken place since then, but these questions are still acute and relevant from the point of view of analysing, assessing and evaluating IP. The situation in Estonia is about the same as in West Virginia, USA, according to Hedge.[13] Although there is evidence that some appropriate gauges helping to assess and evaluate the outcomes and impact of IP exist, a more important problem is that Estonia lacks an integral model involving a comprehensive system of gauges enabling the assessment and evaluation of both the success of the IP process and its interim results regarding its

[12] The State Audit Office formulated the main problems of public administration already in 2000, asking from the government: "How is separating policy-making and implementation of policy going to be ensured? How is differentiation between the main activities and supporting activities of public administrators going to be ensured? How is customer-centeredness going to materialise upon rendering public services and performing public functions? What is administrative responsibility and how do respective processes initiated or materialised posterior to entry into force of a draft? Is the ministry going to be turned into a policy-making body and refrain from the task of policy implementation or rendering of services?"

[13] D. M. Hedge (2007) claims: "While considerable attention has been paid to training analysts-to-be, much less attention has been paid to those who consume policy analysis – policymakers and administrators. That has been a serious and costly mistake. In all too many cases, policy analysis is either not used or riot used properly because the practitioners for whom policy analysis was ostensibly provided lacked an understanding of the nature of policy analysis."

impact on the interaction of all research, development and innovation policies (and EP as well). Estonia does not have a system of aggregated gauges that would enable one to observe IP in an integral and coherent context with all of its different levels and complexities. The fact that the outputs, outcomes and impacts of every single policy or strategy are going to be assessed and evaluated using a package of criteria and indicators, which may even show something in the case of a single strategy or policy, does not yet mean that the general picture of the process is monitored adequately and the success of IP has been ensured. Furthermore, one can hardly find traceable links between IP and EP. According to Katz (2000: 24), evaluation in the social sciences needs a set of indicators that adjust for the effect of size on recognition, impact and collaborative activities when comparing the performance of groups, institutions and nations. Nevertheless, the system of gauges for the assessment and evaluation of the SE21 is thorough and well weighed. (SE21 22, 25, 70) Thus, Estonia has an excellent home-made benchmark for constituting a system of gauges, but a lot of work needs to be done to work out a relevant set of gauges for IP.

When using the different tools of the EU or global organizations to monitor the development or regression of implementing an IP, one has to realize that comparisons like that often involve some dangers as countries are not in a comparable situation from the point of view of an IP impact assessment and they do not have similar goals and objectives. These instruments are useful for observing any movement in the larger scheme of things, but they do not fit in properly with the particularities of each country in the sense of characteristics inherent to the peculiar goals and objectives of each particular country. Furthermore, world-wide and Europe-wide instruments are focused on inputs, the environment (enablers, drivers, inhibitors, actors, etc.) and outputs in an unbalanced way, but the outcomes and impact (Milbergs, Vonortas 2004: 21, 31–34) are only slightly within their focus and scope. For example, there are 12 Global Innovation Scoreboard (GIS) indicators divided into 5 groups[14] (Hollanders, Arundel 2006: 5), but only two indicators in the 'Applications' group express the development or regression of innovation policy implementation from the viewpoint of impact. The European Innovation Scoreboard uses data for 25 indicators divided over 5 broad innovation dimensions (Hollanders, Arundel 2006: 30), but only three[15] of all the indicators express the development or regression of innovation policy implementation from the aspect of impact. According to Milbergs and Vonortas (2004: 21), "*particular attention needs to be given to defining consistent and internationally comparable metrics for innovation demand, knowledge flows, intangible assets, public policy factors, regional innovation net-*

[14] Innovation drivers (New S&E graduates, a labour force with completed tertiary education, researchers per million population), knowledge creation (Public R&D expenditures, business R&D expenditures, scientific articles per million population), diffusion (ICT expenditures WITSA/IDC), applications (exports of high-tech products, share of medium-high/high-tech activities in manufacturing value added), intellectual property (EPO patents per million population, USPTO patents per million population, Triad patents per million population).

[15] SMEs innovating in-house (% of SMEs) of the group 'Innovation & entrepreneurship,' 'Exports of high technology products as a share of total exports' and 'Sales of new-to-market products' (% of turnover) of the group 'Applications.'

works, infrastructures and management practices". There is no doubt that this is important in the very early process phase and is the only way to focus on the inputs, enablers, drivers, actors, activities and outputs, but in more mature phases it is essential to pay attention to the outcomes and impact as well. This statement does not mean that one has the right to switch focus from inputs, enablers, drivers, actors and outputs to only outcomes and impact in a later process phase. Instead, there should be more than one centre of focus and these should be reasonably balanced, taking into account the specific context and life cycle of the process. (USCOTA 1995: 31) Concentrating on results as well as inputs is crucial, because according to Porter (1998) "*modern competition depends on productivity, not on access to inputs*".

The set of IMD criteria (2007) is more informative in the meaning of the outcome of IP implementation. However, when one tries to use a number of these criteria to assess the effectiveness of IP implementation, one will face a significant problem as well. There is no clear, reliable and easy method or technique of finding out exactly how much the success of IP contributes to the success of different aspects in each country or whether there are any links between economic growth or the wealth of society and IP policy implementation. Finding proper indirect gauges is not an easy task either because according to Tijssen (2002: 510), "*what is easy to gauge is hard to correlate and what is easy to correlate is hard to gauge*".

The authors of the SE21 have formulated four prerequisites for innovative success.[16] (SE21 2005: 59) The criteria and indicators to be incorporated in the set of gauges concerning the development or regression of IP have to reflect movement in the context of the abovementioned prerequisites as well.

Some Ideas Concerning the Design of an Integrated IP Assessment and Evaluation Model for Estonia

The author offers a preliminary broad theoretical vision of the principles and framework for designing a tailor-made coherent integral system of IP assessment and evaluation for Estonia. As stated in previous chapters, the author is of the opinion that a coherent integral system of assessment and evaluation of the IP implementation process should be taken under treatment differently in the three main phases of the process: 1) the preparatory and start phase; 2) the smooth running phase and 3) the mature phase. For these three phases of the innovation process it is essential to have different sets of gauges as well, because each phase of the process has a need

[16] "First – the introduction of the principles of knowledge-based management into state governance. The aim is to move from interest-based (sub-) decisions towards inclusive and knowledge-based strategic management in making decisions that determine the development of the society. Second – changes in the creation and use of intellectual resources. As intellectual resources constitute the key resource of a knowledge-based society, a significant increase in and making the best use of this resource is an inevitable precondition for the entire model to take effect. Third – bringing human-nature relations into conformity with the principles of a knowledge-based society. Fourth – the establishment of sufficient support for movement towards a knowledge-based society, since a substantive shift cannot be achieved without it."

for very different information in order to make the right decisions. The gauges listed in sets further on are not meant to be a minimum or complete number of gauges, but are used only as illustrative examples.

Gauges for the preparatory and start phase

In the preparatory and start phase, gauges have to be put together in a manner that, firstly, consists of a set of a sufficient number of the most relevant gauges (criteria and indicators) reflecting the different types of inputs (the financing/funding of innovation (Kattel, Kalvet 2005: 24); the involvement of foreign capital in research and development (Chew, Chew 2003)) contributed to by the public, private and third sectors. This set of gauges is important for the ex ante assessment of the existence and availability of the resources needed for a viable start of the process. In the later phases of the process, it also enables reflection on the development or regression of IP implementation against more major and general goals and objectives driven by or impacted on by IP in line with the most relevant and significant strategy and policy documents of the particular state in question. This set of gauges is the most important because they show the actual effectiveness of the process concerning its impact, more narrowly in the economy and more widely in society. Thirdly, this set of gauges enables one to reflect on the merits and dynamics of innovation and IP in the later phases of the process in a particular country, region or sector of the economy (see Table 1).

Table 1. Enables in later phases of process reflect the merit and dynamics of innovation and IP

Perez 1986: 2	the merit of innovation
Lee, Wang 2003	innovation model
Rabson, Marco 1999	type of innovation
Meyer, Loh 2004	innovation application field
Handyside, Light 1998	structural aspects of IP
Alders, Leede, Looise 2002	socio dynamic aspects of IP
Lee, Kwun 2003	character of innovation system
Frederick 2004	character of innovation process
Tsai, Wang 2005, 254	gauges
Meng 2005: 104	elements of innovation system
Gallup 2006: 6	indicators

This group of gauges is rather a system of meta-information concerning innovation organisation which mainly serves the interests of policy analysts, researchers and scientists.

The author's opinion is that a set of a sufficient number of the most relevant gauges reflecting the different types of inputs contributed to by the public, private and third sectors should consist of at least the amount of total and relative funding allocated to innovation policy implementation. This should include the amount of funding (cross domestic and foreign investments, etc.) for innovation and innovation-related activities, products, and processes; the total and relative amount of innovation bearers

(students, academicians, researchers, civil servants, employers, employees, and RD&I institutions); the total and relative number of patents and trademarks available; the inventions available;[17] the technologies available; the capability for innovation, etc. There is no single "right" and permanent way of composing this group of gauges. One has the possibility of finding suitable gauges from the different tools of the European Union and relevant global organizations, but those have to fit the domestic peculiarities of the country in question as well.

Gauges for the smooth running phase

A set of a sufficient number of the most relevant gauges (criteria and indicators) has to be put together for the smooth running phase reflecting the occurrence and dynamics of thrust, determiners, catalysts, drivers, inhibitors in the particular country, region and sector of the economy (see Table 2).

Table 2. Gauges (criteria and indicators) reflecting the occurrence and dynamics of thrust, determiners, catalysts, drivers, inhibitors in the particular country, region and sector of the economy

Luggen, Birkenmeier, Brodbeck 2005: 80	innovation potential
Chew, Chew 2003	innovation capability
Luggen, Birkenmeyer, Brodbeck 2005: 71	innovation competence
Lane, Klavans 2005: 186	thrusts
Wonglimpiyarat 2005	catalysts
Bruland 1998: 167	determiners
Lopez-Claros *et al*. 2006 : 4	drivers
Gallup 2006: 3	the role and activity of government
Meng 2005: 104	the role of private sector
Meng 2005: 104	the activity of private sector
Frederick 2004	the needs of businesses
Bullock, Mountford, Stanley 2001: 9	innovation process management
Bruland 1998: 176–177	the methods of obtaining new knowledge
Preiss, Spooner 2003	inhibitors
Gray, Allan 2002	rigidities
Lee, Wang 2003	tools
Preiss, Spooner 2003	intra-organisational factors
Preiss, Spooner 2003	external factors

Secondly, changes in various environments (economic, political, legal and cultural), the type of economy (Lee, Wang 2003) and the operators/agents of the economy (Preiss, Spooner 2003) where innovations have to occur and IP has to be implemented in the transition to an innovation-driven economy and knowledge-based society. Thirdly, the success or failure of performance in the meaning of outputs is covered. These three sets of gauges are relevant in order to show progress or

[17] The author is confident that the number of available patents, trademarks and inventions has to be dealt with primarily as inputs to IP, not only as outputs or the outcome of an innovation process.

regression and the vitality of the process as well as characterizing the peculiarities of innovation organization in a particular country. These sets are useful to policy makers, analysts, researchers and scholars.

The author is of the opinion that a set of a sufficient number of the most relevant gauges reflecting the environment (state and changes in economic, political, legal and cultural environments) relevant to the transition to an innovation-driven economy and knowledge-based society should consist of at least the type and condition of the national economy and society; the state of culture, including risk assuming culture, flexibility and adaptability); the innovation potential of businesses, households and the public sector; the availability of skills; the quality of the labour force; different thrusts, catalysts, determiners, restrictions and inhibitors of innovation; the infrastructure supporting innovation; the availability of risk assuming capital and venture capital; the initiative and activity of the government; the initiative and activity of businesses; the initiative and activity of RD&I institutions; the number of clusters; the model and type of the innovation system; investment incentives in innovation fields, etc. The author would like to emphasise that those gauges should not be treated and recognized as primarily reflecting the outcome or impact of IP implementation, but mostly as enablers, drivers, inhibitors, rigidities or other types of factors. The number of the latter may be treated as gauges expressing the interim outcome and impact of the IP implementation process, but not as gauges expressing the final goals.

The following gauges may be considered as gauges (criteria and indicators) reflecting the success or failure of performance regarding output: the amount and ratio of the total and direct investments in RD&I, T&IT, technological development by the state, local government, businesses and RD&I institutions/agents; the number of patents, trade marks, and inventions; improvement and changes of the innovation model, system and processes; achievement in higher education; the transfer of knowledge; the programmes, projects and other gauges driving or supporting innovation; the number of innovations in an organization, process, product or technology; the number of economic agents implementing innovation in the field of an organization, process or system; the development and application of technology, etc. At the same time some of those gauges act as gauges of input as well. There are plenty of possibilities for choosing the appropriate gauges to measure the success or failure of the IP implementation process addressing the results of performance in the sense of outputs. One has the possibility of finding a lot of those in the GIS, the Global Competitiveness Index (GCI), the Business Competitiveness Index (BCI) or in many other sources. It is important not to forget that the outputs or performances completed are not proper gauges for assessing outcomes or impacts in their most inherent sense. However, sometimes their number may reflect a directional trend regarding interim impact.

Gauges for the mature phase

A set of gauges with a sufficient number of gauges (criteria and indicators) has to be designed for the mature phase of innovation process reflecting the outcomes and

impact on society. This set has to enable one to assess the development or regression of IP implementation against more major and general strategic goals and objectives driven by or impacted on by IP in line with the most relevant and significant strategy and policy documents of the particular state in question. This set of gauges is the most important because they show the actual effectiveness of the process regarding impact, more narrowly in the economic sense and more widely in the social sense. A set of a sufficient number of the most relevant gauges reflecting the development or regression of IP implementation assessed against the general goals and objectives driven by or impacted on by IP in line with the most relevant and significant strategy and policy documents of the particular state in question derive from very particular norms and strategy and policy documents. For example, in the case of Estonia, these inputs arise from the Constitution of Estonia, the SE21, the EAPGJ, the TEII, etc. Gauges reflecting the inherent nature of the outcome and impact are those which address any change in the state of the economy and wealth of society in a broader meaning. The author is of the opinion that the set of sufficient gauges reflecting the outcome and impact of an IP includes the following: (see Table 3).

Table 3. Gauges reflecting the outcome and impact of an IP

amount of export of innovative products
amount of export of innovative services
amount of export of innovative technologies
the share of export of innovative products, services, technologies from total export
employment and unemployment ratios
the overall productivity of business
productivity in industry
productivity in agriculture
productivity in services
the total final energy consumption
the total final energy consumption per capita
Internet users
the number of e-services in the government
the number of e-services in local self-government units
the number e-services in businesses
the number of e-services in third sector
the ratio of e-services in the government
the ratio of e-services in local self-government units
the share of high-tech exports from manufactured exports
life expectancy at birth
the human development index
the amount and ratio of pollution
the amount and ratio of consumption of fresh water
the “ecological footprint”
etc.

The author recognizes that trying to design and implement an integral system for the assessment and evaluation of IP impact, including on economic growth and the rise in the wealth of society, is a significant challenge and may end with a low probability of success due to very different objective and subjective reasons. However, each

group of gauges and any single particular gauge in a group have to be very thoroughly, considerately, systematically and creatively composed. All gauges have to be selected in a manner which enables one to work all of them to show a general integral picture and shows the particular development of each particular policy or sub-policy as well. There is no single "right" and permanent way of composing this group of gauges. The possibilities of succeeding are much greater if all the above-mentioned groups of gauges, subgroups of gauges and particular gauges of each group match concurrently with the particular national interests, needs and characteristics as well as with gauges recognized by and used in the relevant European and global organizations concerning innovation and IP implementation. This is an additional factor contributing to the process of designing a more complex, sophisticated and resource consuming IP implementation assessment and evaluation system. The second crucial and tricky factor is that an assessment and evaluation system relevant and fruitful for the starting phase of the innovation policy implementation process is dissimilar to the one applicable and effective for the smooth running or mature phase. This means that such a system of assessment and evaluation is like a moving target, not only in the meaning of an IP life cycle, but also in the sense of the life cycle of a particular society. According to Mahmood and Rufin (2005: 339), the role of the government depends on the technological development of society. The third significant matter is that innovation policy related to different strategies, programmes, projects and actions are in very different phases of implementation simultaneously. Consequently, the assessment and evaluation system should be designed taking into account that very characteristic as well.

Due to the limited space of this article, the author is not going to provide his own deep and more detailed views of designing a coherent integral system of IP assessment and evaluation for Estonia here, but will elaborate on it in a future article.

Conclusions and Proposals

According to Professor Carlotta Perez (2001: 4), the focus nowadays is on the "*need to strengthen human capital and increase capacity for innovation*". Perez (2001: 25) argues that "*staying in the race demands growing support from the environment and constant innovation, intensive investment and probably very skilful manoeuvring in terms of markets and alliances*". According to Burton (1999, 16), the situation can be improved by "*a "Post-Schumpeterian" framework is proposed, based on four key elements: Knowledge Creation; Knowledge Protection; Collaborative Business Arrangements for Knowledge Creation; and Diffused Entrepreneurship/Entrepreneurial Management*". There is plenty of room for improvement as regards implementing these elements into day-to-day life in Estonia.

The research papers of various authors (Kattel, Kalvet, Kurik, Terk) refer to the fact that in Estonia, the main emphasis lies on technological innovation. However, society demands a broader approach to innovation in Estonia; otherwise, the benefits from innovation would be very modest and would not meet the expected inherent state of an innovation-driven economy, a knowledge economy and a knowledge-based society in the Republic of Estonia by the expected deadline.

Estonia has to acknowledge the statement by Lopez-Claros, Altinger, Blanke, Drzeniek and Mia: "*... the most competitive economies in the world will typically be those where concerted efforts have been made to frame policies in a comprehensive way, that is, those which recognize the importance of a broad array of factors, their interconnection, and the need to address the underlying weaknesses they reveal in a proactive way*". (Lopez-Claros *et al*. 2006: 5)

There has been no all-inclusive, integral and systemic evaluation or monitoring with the aim of assessing the effect and interim impact of IP, although IP coordinators commission single project-based audits and assessments. Kurik and Terk (2005: 14) claim that policy gauges are evaluated systematically at more significant milestones. There is not enough evidence to concur completely with this opinion, yet.

Estonia, particularly the government of Estonia, has to make a new thrust in the fields of innovation and IP implementation in order to achieve considerable progress in the development of its economy. The scope of those thrusts must also include the design, implementation and maintenance of a coherent integral system of assessment and evaluation of IP. In order to escape the current waddling around and avoid reaching a total standstill, Estonian innovation policy makers should:

- move from the bureaucratic, activity- and output-based assessment and evaluation approach to the impact-centred assessment and evaluation approach. However, this does not mean that input-oriented, output-oriented and activity-based assessment and evaluation approaches are useless;
- to select a relevant set of criteria and indicators characterising innovation policy as regards its impact in the best way possible and compile them into an integral and comprehensive system of gauges, which will be used to regularly assess and evaluate all innovation policy effects, including co-effects and counter-effects;
- to create prerequisites for strategic administration, including generation of an assessment and evaluation system for strategies. A systemic collection, assessment and evaluation of necessary information, along with the existence of a competent assessment and evaluation centre with the *Riigikogu* or the State Chancellery would be of great help. A competent assessment and evaluation centre should also coordinate the commissioning of external audits, assessments, evaluations and peer reviews;
- to annually compile and publish innovation policy progress reports concerning the most important outcomes and impacts as well.

In a small country where IP resources as inputs are very limited, it is of the utmost importance to have a country-wide coherent IP assessment and evaluation system which will provide a proper and forehanded possibility of correcting any unexpected events or trends using inputs and outputs, otherwise the advantages of the country being small – cultural and institutional flexibility and an openness to external influences (Oinas 2005: 1237) – will be lost. However, one has to remember that preserving rationality in economics – perfect, logical, deductive rationality – is extremely useful in generating solutions to theoretical problems, but in fact it demands much more human behaviour than it can usually deliver. (Arthur 1994: 406)

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