

## ТЕОРЕТИЧЕСКИЕ И ПРАКТИЧЕСКИЕ АСПЕКТЫ ПЛАНИРОВАНИЯ ИННОВАЦИОННОЙ ПОЛИТИКИ (НА ПРИМЕРЕ ЭСТОНИИ)

Р. Линнас

Таллиннский технический университет

Поступила в редакцию 12.03.2008

**Аннотация:** В данной статье рассматриваются теоретические и практические аспекты планирования инновационной политики на примере Эстонии. Цель данной статьи – дать обзор основных теоретических и практических факторов успеха или неудачи процесса осуществления инновационной политики, концентрируясь на особенностях планирования инновационной политики в Эстонии. Общая черта, характеризующая инновационную политику в Эстонии, – множество и сложная структура различных стратегических и политических документов, планов действий, программ и проектов. Таким образом, существует реальная угроза того, что может возникнуть значительное расхождение между планируемой инновационной политикой и реально осуществленной инновационной политикой в Эстонии. В данной статье автор анализирует доводы за и против планирования инновационной политики в Эстонии и предлагает некоторые идеи для создания благоприятных предпосылок для успеха осуществления инновационной политики в Эстонии в будущем.

**Ключевые слова:** анализ, экономика, экономический рост, планирование, Эстония, инновация, инновационная политика, политика.

**Abstract:** This case study article treats theoretical and practical aspects of planning of innovation policy based on the case of Estonia. The aim of this particular article is to give an overview of substantial theoretical and practical factors of success or failure of innovation policy implementation process, particularly focusing on peculiarities of planning of innovation policy in Estonia. Estonia's case is respectable and intriguing case for research, because the Republic of Estonia has been able to achieve fast and outstanding economic success during the relatively short period of re-independence, does have Skype, the genome project, e-government, m-services etc, but 'shine of success' is going to disappear. Estonia's capacity of international competition is still suffering because of the small size of the economy, technological backwardness, weak international market position, management mistakes, and weak capital structure. Author is in general opinion that it is very difficult to find arguments to claim that Estonia will be successful in implementing innovation policy, as the planning process was not very much similar to the generally accepted model of policy planning process. A common feature characterising innovation policy in Estonia is the great number and complex structure of various strategic and policy documents, action plans, programmes and projects. It is very difficult to derive or see any interlocking of mentality and clear correlation between these documents and to understand, which document is considered paramount by policy makers. A general characteristic and also problem is that goals are presented disorderly in the meaning of activities and outputs versus outcomes and impacts in the field of innovation. The messages of policy makers are different and in contradictory input-output meaning in different parts of various documents. Based on the above-stated, it is only possible to claim that there was and still is no common understanding of the vision and goals of innovation policy among the makers, executers, other significant participants and stakeholders of the policy. The above-said refers to confusion in the organisation of innovation policy planning and to inadequate quality of planning. Thus, there is a significant threat that there may appear a large gap between planned innovation policy and actually implemented innovation policy in Estonia. In this article, the author analyses the pros and contras of the innovation policy planning in Estonia and offers few ideas to enhance the preconditions for success in future.

**Key words:** analysis, economy, economic growth, planning, Estonia, innovation, innovation policy, policy.

## INTRODUCTION

This case study article treats theoretical and practical aspects of planning of innovation policy (hereinafter PIP) based on the case of Estonia. The aim of this particular article is to give an overview of substantial theoretical and practical factors of success or failure of innovation policy (hereinafter IP) implementation process, particularly focusing on peculiarities of PIP in Estonia, analyse the incentives and disincentives of the sustainable progress of IP and offer some ideas to enhance the preconditions for success in PIP in Estonia. Estonia's case is respectable and intriguing case for research, because the Republic of Estonia has been able to achieve fast and outstanding economic success during the relatively short period of re-independence, does have Skype, the genome project, e-government, m-services etc, but 'shine of success' is going to disappear. Estonia's capacity of international competition is still suffering because of the small size of the economy, technological backwardness, weak international market position, management mistakes, and weak capital structure. Results of this particular study are showing more general picture of PIP in an innovation policy management process. The author is of opinion that preconditions for PIP success for Estonia are not particularly Estonian specific, but do have more wide area of application.

Innovation and IP are to be treated in multi-disciplinary context. The author treated innovation and IP based on evolutionary economics theory, theory of technological change, theory of policy management, general systems theory, general management theory and different innovation theories (clusters theory, network theory). The author performed this particular research based on qualitative approach of methodology and used qualitative methods of collecting, processing and interpreting data. The author is of opinion that qualitative approach and methods are relevant for solving main problem of this particular case study. The author did make a structural review of possible field of innovation and IP research and find to be particularly worthy to focus on the aspect of PIP. The author performed also structural search of relevant theoretical publications, analysed and synthesised collected information. The author conducted a search and made qualitative analysis of strategy and policy documents of Estonia and made a decision to focus on most relevant documents to the research field. Selected out strategy and policy documents concerning innovation, IP and PIP, were qualitatively analyzed by the aspects of semantics and

content. On the bases of results of data collection, analysis and interpretation, author made some conclusions of more general character of PIP.

According to numerous authors, creativity, knowledge, technological change and innovation are four of the most significant factors of economic growth and development of 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), formation of industrial policy (Lundvall 1988, 362; Nielsen 2003, Goh 2004; Dahlman, Routti, Ylä-Anttila 2005, 3, 6) and a new challenge in the transfer to knowledge-based economy (Tijssen 2002, 509). Modern fast growing economies depend more on the creation, acquisition, distribution, and use of knowledge (Wu 2007, 544). According to Perez (2001, 4) "...need to strengthen human capital and increase capacity for innovation» are in focus. As the Republic of Estonia has been able to achieve fast and outstanding economic success based on innovative paradigms applied in public sector and private sector during the relatively short period of re-independence, studying of IP in Estonia is a rewarding object of research.

Estonia does have rather outstanding image of innovator in public and private sector. Estonia does have Skype, the genome project, e-government, m-services etc. Although the development of economy of Estonia, a small open-economy in democratic society, has been rapid, it is not certain that prompt development will be sustainable over a longer-term horizon. According to Bank of Estonia's estimates this year's economic growth is likely to drop more than expected (BoE 2008). 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.*» Innovation is irrefutably a major factor of economic success and has thereby also an important role in generating general welfare. 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.*»

Although several authors bring forth clear sources of success in different countries successfully applying IP, one has to be very careful in transferring the experience of other countries to Estonia, as well as in comparing the impact of Estonia's IP with that of other states, as the take-off positions and political, economic, legal, and cultural environments of different countries vary to a great extent. This averment is also supported by Bruland (1998, 161, 162) and by Peet (2006, 48).

Meng (2005, 105) claims that all countries are standing at the same starting line in the development and application of nanotechnology. Although this claim seems to be correct on the face of it, the author still disagrees. Big and small societies are in possession of very different resources of knowledge, money, people, competencies etc. A political, economic, legal, and cultural internal and external environments vary to a great extent, which is why a common temporal take-off position does not mean that all participants are of identical capabilities and stamina, that all of them are both 'sprinters' and 'marathon runners' at same time. This idea is supported by Perez (2001, 25), who says 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"*, and by Kattel and Kalvet (2005, 13) as well. For small societies, even if completely open, compared with big, rich, and successful economies, it is more complicated to involve and exploit human capital, investment and other resources promptly and intensively. Even the smaller inertia will not compensate the smaller base for forming necessary capacity of allocation of resources. Chew and Chew (2003) claim, based on their studies on Singapore, that *"Singapore is facing two substantial difficulties. First of all, Singapore has limited possibilities, owing to the small domestic market, to involve foreign capital in research and development. Second of all, the public sector has pulled out a lot of knowledge owners from the private sector, which should be the main driver for innovation and development, and that is why the capability of the private sector for innovation is insufficient."* Both of these circumstances are more or less significant and appropriate in the case of Estonia as well, which is why such observations should be closely followed. Furthermore, lot of high-knowledge, creative, initiative and venturous persons are left Estonia, because of better economic and other reasons in abroad. In that light the proficiency, excellence and devotion to PIP is one crucial success factor in achieving great impact of IP.

## 1. INNOVATION POLICY RESEARCH RESULTS IN THE WORLD

### 1.1. Approaches to Innovation and Innovation Policy

This chapter provides a brief overview of innovation and IP research results that should be

helpful in analysing IP making as regards the choice of the approach, main standpoints, and criteria.

A large scale of economists, technological change theorists, policy theorists, system theorists and innovation theorists (Schumpeter 1939; Kline and Rosenberg 1986; Perez 1986; Lundvall 1988; Etzkowitz and Leydesdorff 2000) have defined and treated innovation differently by content, size, nature, and types, but the modern understanding of innovation includes at least three generic attributes: the aspect of change/novelty, the aspect of economics/commerce and the aspect of uncertainty (Arrow 1962; Rosenberg 1995, 171; Caenegem 2007). Different authors (Freeman, 1995; Hughes 1987, 64; Porter 1990, 1998; Lundvall, 1992; Edquist and Lundvall, 1993) have introduced a different treatment of enablers, preconditions and success factors of innovation. The innovation process is dynamic (Lundvall 2000, 2; Newman 2005), non-linear (Kline and Rosenberg 1986; Gomory 1989), social (Alic et al 1992, McElroy 2003), self-organizing (Fuchs 2004, 18) and interactive (Lundvall 1988; Giget 1997; Edward 2000). Innovation systems are complex (Kline and Rosenberg 1986; Hughes 1987, 64), social (Cooke 1998, 11; Katz 2006, 897), dynamic (Lundvall 2000, 2; Carlsson et al 2002, 244) and self-organizing (Rycroft 2003b, 2). IP has a very complex organisation, diverse and many-sided structure and outcomes (positive and negative, expected and non-expected, direct and indirect) affecting the entire society (Rycroft, Kash and Adams 1995; 5) and IP making is an unknown and unknowable exercise (Rycroft 2003a, 4).

Perez (1986, 2) treats innovation in an economic context, differentiating clearly between innovation and invention: *"The invention of a new product or process occurs within what could be called the techno-scientific sphere and it can remain there forever. By contrast, an innovation is an economic fact. The first commercial introduction of an invention transfers it to the techno-economic sphere as an isolated event, the future of which will be decided in the market. In case of failure, it can disappear for a long time or forever. In case of success it can still remain an isolated fact, depending upon the degree of appropriateness, its impact on competitors or on the other areas of economic activity. Yet, the fact with the most far-reaching consequences is the process of massive adoption."* Actually, defining innovation and types of innovation is an infinite process, because the content-related limits of innovation are as boundless as the limits of human thought and activity, for example, up to the thinking standards and social innovation.

Rabson and DeMarco (1999) treat innovation as system-based and state that there are two types of innovation systems: creative style type and psychological type.

Meyer and Loh (2004) treat IP from three aspects: innovation in the public sector (e-government); innovation in the private sector (fostering technological innovation) and innovation in households (building an all-inclusive information society).

Smits and Kuhlmann (2004) claim that five functions play a crucial role in the management of present-day innovation processes. These functions are: (1) management of interfaces, (2) (de-)construction and organising (innovation) systems, (3) providing a platform for learning and experimenting, (4) providing an infrastructure for strategic intelligence and (5) stimulating demand articulation, strategy and vision development (Smits and Kuhlmann 2004). Sommerlatte (2004, 1) states that sustainable innovation is ensured by five significant thrusts: *“(1) a corporate strategy giving top priority to innovation and to building a competency platform; (2) a comprehensive innovation process; (3) a flexible organisation favouring innovation behaviour; (4) multiple innovation partnerships; (5) an innovation culture characterised by effective organisational learning and knowledge management.»*

Luggen, Birkenmeier and Brodbeck (2005, 71) have established the following as preconditions for successful innovation: innovation competence (prerequisite), innovation process (value creator) and innovation (output). Preiss and Spooner (2003) consider intra-organisational and also external factors important in fostering innovation. These factors may be either conducive or adverse. Meyer and Loh (2004), but also many other authors, consider communication and information technologies very important elements in promotion of innovation.

Luggen, Birkenmeier and Brodbeck (2005, 80) also provide the concept of innovation potential and Lane and Klavans (2005, 186) add the concept of the capability of scientific intelligence. The notion of the capability of scientific intelligence has been treated by many authors. For example, Bruland (1998, 167) states that the determiner of innovation performance forms one of the two components of innovation systems: extensive expansion of innovation in economies characterised by rapid expansion and/or high profitability. The possible number of concepts and notions related to innovation is actually also unlimited.

McPherson's and McDonald's (2005, 38) research about Scotland confirms that the innovation process is a dynamic, non-linear, socially coherent, and interactive process. Luggen *et al.*: *„The innovation process is the value creator. It aims to optimise both the portfolio of innovative ideas (effectiveness in the early stages) and the process of innovation projects (efficiency in the project phase). There are two tasks that have to be done continuously. It is the market intelligence and the technology intelligence.»*

## 1.2. Research Results of Innovation Policy Implementation

Wonglimpiyarat (2005) analysed the development of the Silicon Valley via the prism of funding innovation and found that the capacity to foster clusters of innovation, an effective use of university resources, the supporting infrastructure, the culture of willingness to accept risk, and venture capital (VC) programmes are catalysts for economic development.

Morgan, Blake, Poyago-Theotoky (2003) claim that in introducing innovative technologies in Great Britain, such enterprises have been successful that operate in an environment characterised by innovative culture and structures encouraging innovation by long-term strategies.

Ruttan (2004) makes a generalisation claiming that in the USA, global success has been achieved in the areas where the US government has played a significant role in technological development.

Frederick (2004) compared the influence of business researches on the development of policies in New Zealand, Sinaloa, and Mexico (Sinoa) and concluded: *“In New Zealand, innovation policy is dynamic, but little attention is paid to the actual needs of businesses and their decision to opt for self-employment.»* Sinoa, on the other hand, focuses its attention on the creation of businesses, but IP is missing.

Some authors state that structural (Alders, Leede, Looise 2002; Handyside, Light 1998) and socio-dynamic [power and trust (Alders, Leede, Looise 2002), knowledge, devotion, subjectivity] aspects are also relevant from the point of view of successful innovation.

Bruland claims that Scandinavian countries obtained new knowledge by extensive industrial espionage (Bruland 1998, 176) and technical associations (Bruland 1998, 177).

Parayil and Sreekumar (2004), who studied the dynamics of industrial development and innovation in

Hong Kong, claim that *“the success of Hong Kong derives from the fact the modern national innovation system is dynamic, three-threaded, screw-like, the threads being the government, the industry, and the university, and it seems to be led by motivation-based economy.»*

Preiss and Spooner (2003) who studied innovation in Australia, state that *“domestic economy is operated by enterprises, mainly medium-sized and small ones, via the creation and distributing of innovation, but innovation in Australia is inhibited by the tax system and legal restrictions.»*

Based on the example of South Korea, Lee and Kwun (2003) claim that *„the current national innovation system of South Korea is government-initiated, target-oriented or plan-based, and input-focused, which has caused its inability to tackle the existing problematic practices, the loss of entrepreneurship among venture businesses, and the continued reliance of private innovation actors on government initiatives.“*

Lee and Wang (2003), who studied innovation-driven economy in Taiwan, point out that *“Taiwan is moving from the outdated tax-incentives, science-based industrial parks and public research institutions based model to promote R&D and innovation towards a new model relying on new tools (venture capital, innovation incubators, an open laboratory system, and e-commerce).»*

Tsai and Wang state that during the ten-year operation, the innovation policy measurers implemented by the Taiwanese government (establishment of science and industrial parks, extensive budgets for science and technology) have made a considerable breakthrough (Tsai, Wang 2005, 254). Meng says that in Taiwan, technology-holding companies are the main ingredients of innovation clusters and the core element of the national innovation system and *“the main players of innovation clusters are knowledge centres, innovation business units, and the industry»* (Meng 2005, 104). While number of authors argue that business incubators, innovation clusters and networks are important factors of innovation, Tamasy (2007, 460) argues that *“technology-oriented business incubators are a worldwide phenomenon, although empirical research evidence clearly suggests that they tend to fail in supporting entrepreneurship, innovation, and regional development and, therefore, do not fulfil their expected role as policy instrument».*

Kattel and Kalvet (2005, 24) have compared the innovation policy systems of different countries and concluded that *„one of the most significant differences in R&D systems is the fact that the structure of R&D financing in Central and Eastern European countries varies greatly across developed countries; the differences are especially vivid as regards R&D expenditure in the public and private sector».*

Gray and Allan (2002), who studied small and medium enterprises, claim that *„in SME-s, the strongest barrier to innovation are organisational rigidities, staff development and information management, which is why management education becomes very important, being a significant factor of innovational ability“.*

Berg, Pihlajamaa, Nummi, Leinonen and Leivo (Berg *et al* 2004) say that the innovation process requires an appropriate and sufficient assessment system and view the duration and quality of the innovation process from six angles (the quality and duration model): R&D as part of business strategy, R&D as part of product and technology strategy, strategic implementation of R&D, R&D as a sector of business, R&D outputs, and R&D project implementation.

Sutton (1999, 10) classifies policy process into 5 different models: the incrementalist model, the mixed-scanning model, policy as arguments, policy as social experiment and policy as interactive learning. Author is of opinion that IP process in Estonia has in some extent remarkable attributes of all those process models, but there is no clear and clean match with any of those.

Various authors have researched innovation and innovation management in different countries from the point of view of various fields, scopes and aspects and using different methods as well. Their research results are interesting, worthy of attention, and definitely useful. However, it has to be admitted that the results are still too eclectic and fragmented to enable generalisations and fundamental conclusions, which is why it is not easy to pick steady anchors in the selection and usage of IP preconditions, success factors and hindrances for Estonia. Despite of success of large number of scientist in research of innovation related objects of research, there is no possibility to be certain, that one particular country has possibility to copy one-to-one success of implementation of IP of another country in the Globe.

## 2. INNOVATION POLICY PLANNING IN ESTONIA

### 2.1. Innovation, Types of Innovation, Innovation Policy

Different authors argue about the importance of the innovation management process (Cooper 2001, Luggen, Birkenmeier, Brodbeck 2005, Meng 2005). Meng says that “*the innovation process varies depending on the industry type, technology, and company size*». In the case of Estonia, it is not possible to admit that IP makers have paid sufficient attention to this aspect, although the rhetoric is appropriate (EE2014 2004, 14). However, the Estonian National Strategy on Sustainable Development up to the year 2030 “Säästev Eesti 21» (Hereinafter SE21 or Sustainable Estonia 21) represents a positive exception, as the preparation process of the document has been logical and clearly recorded. In earlier IP related documents, Estonian IP makers have not unequivocally specified what is considered innovation and which innovation types and scopes they focus on. The picture is considerably clearer in the case of the R&D strategy for 2007-2013 (hereinafter TEII or Knowledge-based Estonia II), compared with Knowledge-based Estonia I (hereinafter TEI)<sup>1</sup>. A clearer and more consistent reference has been made to technological innovation. The key areas of IP that deserve the most attention include development of user-friendly information technologies and information society, biomedicine and material technologies (TEII 2006, 9). However, the research papers of various authors (Kattel, Kalvet, Kurik, Terk) refer to the fact that in Estonia, the main emphasis lies on technological innovation. Deductively, it is possible to conclude that IP makers have intended to include product innovation, process innovation and organisational innovation.

### 2.2. Innovation Policy Documents

A common feature characterising IP is the great number and complex structure of various strategic and policy documents, action plans, programmes and projects (Proos 2006). The most general document is SE21 which represents, with its fundamental values and nature- and human-centred approach, a philosophical platform for the preparation, interpretation and assessment of all other economic policy 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» (hereinafter EAPGJ), which replaces the document Eesti Edu 2014 (EE2014 or Estonia’s Success 2014), the Knowledge-based Estonia II, the domain strategies, the state budget strategy for 2008-2011, the Estonia’s National Changeover Plan, but also many other domestic, European Union and international strategies, development plans and programmes. In addition to these, economic policy and IP are influenced by strategy documents of other structural policies and domains.

EE2014 (2004, 13) claims that „*the goals, priorities and common view of the future established in the development plan „Estonia’s Success 2014“ form the basis for all other strategic development plans and other documents, especially in the field of economic policy.*» Kattel and Kalvet (2005, 11) confirm this. Thus, both SE21 and EE2014 are „umbrella documents» for documents of different levels and present from-top-to-bottom approach of strategic planning. However, it is difficult to understand, which document is considered paramount by policy makers. In the case of EAPGJ is in use on the contrary from-bottom-to-top approach. According to EAPGJ (2005, 4) “*the Action Plan for Growth and Jobs is based on the sectoral strategies and development plans. From these, the Action Plan highlights and combines measures directly supporting the increase of Estonia’s competitiveness.*» Thus, the messages of policy makers are different and in contradictory input-output meaning in different parts of various documents. Principally, lower-level documents do refer to higher-level documents, but it is very difficult to derive or see any interlocking of mentality and clear correlation between these documents. The story is complicated with single documents themselves as well. For example, TEI is on the one hand principally directed towards building up knowledge-based society, but on the other hand it can be treated as IP elements “environment» and “instruments». The authors of TEII (2006, 5) have tried, at least in words, create some clarity, but it is more a compulsory, seeming, rhetoric activity. The authors of various documents have differing views of society, state governance, policy-making, etc.<sup>2</sup>.

<sup>1</sup> *Teadmiste põhine Eesti I* (TEI, Knowledge-based Estonia I, approved by Estonian Parliament (Riigikogu) on 06.12.2001) is the R&D strategy for 2002–2006 and *Teadmiste põhine Eesti II* (TEII, Knowledge-based Estonia II, approved by Government of Estonia 16.11.2006) is the R&D strategy for 2007–2013.

<sup>2</sup> It is important to know that the different documents embodying Estonia’s innovation policy have been prepared and entered into force at different times by different political forces (decision-makers) and officials (executors), which means today’s decision-makers and executors do not have a uniform overview of the earlier documents. In addition, there exist different subjective interests and devotions in creating preconditions, removing obstacles, and achieving results in the scope expected as regards implementation of the planned action.

Policy-making is an open cyclical process, which means the contents of the documents approved at different times should be reviewed as a full package each time a new policy or sub-policy of policy is being planned. SE21 and EE2014 allow presuming that and the preparation of TEII confirms that this is done in Estonia. At the moment it is difficult to assess how comprehensive and effective this is. It is also impossible to estimate to what extent the content-related meaning of IP is changed without the changes being reflected in policy documents.

From the EE2014 it becomes clear that „*the development plan helps, via competitive economy and knowledge-based society, ensure long-term sustainable economic and socio-economic development, i.e., guarantee people's well-being and quality of life*“. When analysing the EE2014, one cannot help but receiving the impression that the compilers of this document have been slightly confused. At times, they are speaking about a strategy, then again about an action plan or a development plan. This provides a reasoned ground for concluding that the planners and writers of the strategy are not experts in the best combination of knowledge, experience, and skills. The situation is somewhat clearer in the second part of TEII (2006, 5).

The above-said refers to confusion in the organisation of PIP and documentation and to inadequate quality of planning. This is a clear sign of danger. Among other things, the above-stated also refers to a significant real threat that there may appear a large gap between planned policy and actually implemented policy.

### 2.3. Description of the Vision

Lucas (2006) claims that there is no longer-term vision in Estonia, that Estonia spends too little money on research, development and innovation and that the quality of lecturers of Estonian universities is low. The assessment provided by a foreign expert may be disputable from the point of view of scientific evidence, but it is certainly a noteworthy comment, despite the fact the vision is recorded *expressis verbis* in the SE21, EE2014, TEI (2004, 1, 10) and TEII (2006, 7). One cannot completely agree with Lucas' view, as the author of this article is of the opinion the problem lies in the existence of too many visions in Estonia and in the inability to reach a consensus regarding a common IP vision by domains at different levels. The EE2014 describes impact in a too abstract manner; in other documents impact has been treated more clearly, but

in a way not measurable by indicators or criteria, except for in the SE21. The EE2014 describes the vision in a separate chapter, but in such an abstract and general manner that enables today's politicians state the vision has been materialised, but in ten years it is still possible to say it has not. TEII also establishes the vision: Estonia is seen as a knowledge-based society. However, the vision of IP has been described in other parts of EE2014 in a measurable way, although fragmentally. The best description of the vision is presented in SE21.

### 2.4. Innovation Policy Goals

Innovation policy as a thing-in-itself does not have any sense, but does matter as a means in achieving progress in economy, economic growth, strengthen of competition capacity of state and increase of standard of wealth of society. Thus, IP inputs derive from more general values and documents embodying more general and extensive objectives, for example, primarily from the Constitution of Estonia, but also from SE21<sup>3</sup> and other sources. SE21 (2005, 21) sees as the precondition for a successful and significant increase in well-being a transfer from investment-centred economy to innovation-centred economy. Here innovation is both the goal and a means to achieve something more important. Innovation here lies in considerable economic changes. The four prerequisites for innovative success formulated by the authors of SE21<sup>4</sup> are very self-explanatory. At this point, innovation is seen as a means due to the fact that innovation-centred economy helps better ensure the competitive ability of the state and economic subjects, thus promoting the increase of general well-being of Estonians.

Main general goal of economic policy, innovation policy and other policies is described in the

<sup>3</sup> SE21: "Objective no 1: viability of Estonia's cultural space; objective no 2: increase of well-being; objective no 3: coherent society; objective no 4: ecological balance.»

<sup>4</sup> Authors of SE21: "First – 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 the 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 knowledge-based society. Fourth – establishment of sufficient support to movement towards knowledge-based society, since a substantive shift cannot be achieved without it» (SE21 2005, 59).

“Riigiaalearve strateegia 2008-2011/State Budget Strategy for 2008-2011» (hereinafter RES) (2007, 5-6). The main objective of IP has been formulated in EE2014 very generally, but still in the meaning of impact. The main objective is also specified in the form of sub-objectives. It is noteworthy that all the sub-objectives of IP have been expressed from the point of view of their expected influence. In the sphere of Estonia’s public administration, this is more of a rare than an ordinary phenomenon.

In the case of the documents containing Estonia’s IP, the common problem is that it is impossible to establish the relation between the hierarchy of the goals established in the strategic documents of different levels and also that more specific IP objectives are listed in a chaotic and different manner in several places of the same strategic document. In some cases the goal is expressed as a state or an impact, in others as an output, and in some sources as a means.

A general characteristic and also problem is that goals are presented disorderly in the meaning of activities and outputs versus outcomes and impacts in the field of innovation and in other areas as well, in the meaning of innovation as such, and also in the meaning of the document itself. In several cases, only the objective of the document, not its substantial meaning is treated. Consequently, IP makers have not been able to achieve clarity of thought and consistency in giving meaning to, formulating, and documenting the objectives.

Based on the above-stated, it is only possible to claim that there was and still is no common understanding of the vision and goals of IP among the makers, executors, other significant participants and stakeholders of the policy. Kurik and Terk (2005, 3) also draw attention to this fact: „*There are certain difficulties in achieving a common understanding and smooth cooperation between the Ministry of Economic Affairs and Communication and the other ministries such as the Ministry of Education and Research, and the Ministry of Finance. It seems that every ministry has a somewhat different idea of innovation.*» Having a common understanding is the inevitable precondition for success. Thus, a significant risk has materialised in the implementation of IP in Estonia. IP makers (in the broader sense – Author) should in future proceed, for example, from the approach of the SE21 (2005, 12) authors in treating the goals and objectives<sup>5</sup>.

<sup>5</sup> SE21: „The objectives have been described using the following components: content of the objective, components and measurers of the objective, risks to achieving the objective, the expected target status by 2030, the main mechanisms to achieve the objective.»

## 2.5. Innovation Policy Inputs, Elements and Factors

The documents in scope and treated in this research include references to the fact that different inputs have been used in policy-making, i.e., situation descriptions and analysis, but it is not possible to make sure to which extent and quality it has been done and how much they have been taken into account in policy-making. SE21 is an exception. With relatively higher quality are RES and EAPGJ as well.

The IP related documents lack sufficient information regarding the data that formed the basis for analyses, who and how used, processed and interpreted the data, but also the results of the analyses. There is no evidence regarding the estimation of alternatives or giving causes for the selection of excluded and included target groups and criteria for such selection. No information allowing to affirm that possible risks have been considered and appropriate measurers timely planned has transferred from the planning process of innovation policy, but not only that, into the documents forming the basis of the current analysis. Again, SE21 forms a clear exception.

The managerial team, members of the project management organisation, target groups, cooperation partners, the responsible people on political and administrative level, a part of the target groups included (on a very abstract level) and financiers are identifiable. The research, development and innovation strategy also includes the key areas, the role of the state, and the measurers planned for the materialisation of goals.

A more general problem is that documents of different levels of hierarchy have been prepared not in their logical order but randomly and there is not consistency in processes. Preparation and abolishment of important strategy documents, programmes and plans of activities is depending very much on the subjective preferences of policy makers. For example the SE21 should be a document forming a philosophical basis for other strategy documents. In reality, SE21 was prepared a year after TEI and a year before TEII. Unfortunately, the authors of TEII have not considerably linked the output of their mental activity to the values and more general goals established in SE21 as regards the content of the document. Similarly it cannot be established that approval of SE21 would have been accompanied by a wave of conscious reformation, connecting, and analysing of all other strategy documents, including those embodying IP. The EE2014 was abolished by new



cabinet of ministers and replaced with the EAPGJ, before enforcement of the EE2014 without no significant link with the EE2014.

The EE2014, TEI and TEII provide a basis for concluding that the main general policy elements but also particular IP elements are included by IP makers. However, no attention has been paid to the aspects of the financial system of the state, financial intermediaries, good governance and concentration of owners. Levine (2003, 6, 21) considers the role of the financial system in promoting innovation very important. He states that the financial system influences technological innovation (*Ibid*, 2, 16), financial intermediaries influence the extent of technological innovation (*Ibid*, 8), and good governance influences the financing of innovation in the private sector (*Ibid*, 10). The suitability of the financial system and support for the dispersion of the IP 'portfolio' to manage risks have not been analysed in Estonia. It is encouraging to know that the authors of TEII (2006, 7) have allegedly proceeded from other strategy documents, but to which extent the goals established in these documents can be implemented in a synchronised way will be clear after 2013.

## **2.6. Problem identification and wording**

A clear description of the essence of the problem to be solved is not included in the relevant IP strategy documents, and this is a considerable risk. However, description of the essence of problem and sub-problems to be solved and expected results, mostly in measurable manner, are described in the Estonian Action Plan for Growth and Jobs 2005–2007. It is very important to reach a consensus in identifying, interpreting, understanding, acknowledging, attaching importance to, and formulating the problem. If this is not done, it is possible that each single group of participants or each participant may understand the content and scope of the problem in a different way. This may lead to each single group of participants or each individual or a management chain unit initiating an activity or activities in implementing IP that do not result in an actual solution of the problem but start solving a problem of their own. Such multiplicity of activities arising from the multiplicity of conceptions impinges significant counter-effect on the activities and the resulting impact of other participants.

Kattel and Kalvet (2005, 11) state: *"At the same time, several recent studies have proved that the most*

*remarkable problem of the competitive ability of Estonia's economy and of the innovation system lies in the business sector»*, whereas the writers and approvers of policies have not acknowledged, reflected or attached importance to this very real problem.

## **2.7. Preconditions, Success Factors and Measurers**

The most thorough, systemic, and substantial reflection of the context and general preconditions has been provided in SE21 (2005, 9-12). The EE2014 describes success prerequisites as preconditions and as five groups of success factors. Under the latter there is one more level of goals that can be interpreted as independent objectives but also as preconditions for achieving the sub-goals, whereas Estonian Action Plan for Growth and Jobs 2005–2007 describes prerequisites for success in eclectic and selective manner. Some of the goals described in the EE2014 to clarify success factors are measurable, some are not; some influence the society and some do not. However, goals, objectives and targets constituted in the EAPGJ are measurable in direct or indirect way. More general goals, objectives and targets are constituted in the RES as well.

In the course of the present research, no basis was found for a direct analysis of the existence, scope and quality of a resource analysis (knowledge, experience, skills, patents, money, time) made during the innovation policy planning process. In addition, it was not possible to establish how it is ensured that the policy priorities related to time and importance are recorded in the same way in every National Development Plan, in every annual action plan, in state budget of each particular year.

A thorough analysis conducted following Carlota Perez's techno-economical (Perez 2003) and technological changes paradigm (Perez 2001) would have significantly, though not existentially, supported Estonia's IP making, but unfortunately, there are no evidence about this having been done. Kattel and Kalvet (2005, 17), too, consider paradigms important, stressing: *„research, development and innovation policies should always proceed from a specific technology and its stage of development“*. Fortunately, the authors of SE21 have realised that, writing: *"Identification of Estonia's three priority areas is in correlation with changes of the global technological paradigm, enabling Estonian scientists and engineers to participate in global research and development and innovation networks»* (SE21 2005, 68).

It was not possible to view IP via the barriers to innovation policy making described by Bullock, Mountford and Stanley, because there is no information regarding the extent of actual time and funds spent on planning the policy and the readiness to take risks by decision-makers and officials.

The major factors in IP making are the existence of decision-makers', executers', advisers' and financiers' innovative thinking, i.e., free creative thinking<sup>6</sup>, visionary abilities, and visions<sup>7</sup>. Being a native Estonian, having gained various experience<sup>8</sup> both in public sector and in private sector and thus being rather familiar with the situation of Estonia, I dare to claim that as regards the preconditions for IP success, Estonia lacks innovation culture (in sense of broader ground), the country's market is not big enough to attract foreign investment, there are not enough research and development centres of very strong academic-applied competence and capacity, the support of the administrative environment, including legal and taxation environment<sup>9</sup>, is feeble,

<sup>6</sup> The same is claimed by Näpinen: „The more different creative aspirations of free people in the society, the greater the potential of self-organisation, the richer the society without any specific planning or forecasts but from the point of view of the most valuable consciously created products, and the higher the well-being of people.... The diversity of creative actions and ideas of free individuals gives rise to the achievements of a free society via self-organisation (in a non-vigorous reciprocal remote interaction between individuals), which are superior to the total of consciously designed achievements. Progress can be expected only from a society where individual freedom is broadly accepted, where it is rooted in its traditions as a decisive ethical principle» (Näpinen 1994, 159).

<sup>7</sup> However, it is important that visionaries maintained at least some contact with reality. Kivine (2004) points out the utopian forecasts made by them as one of the reasons for product development failures of enterprises.

<sup>8</sup> The most valuable experiences include such positions as Deputy to the Auditor General, Chief Auditor of the Performance Audit Department, and posts directly related to state administration.

<sup>9</sup> This is also claimed by EVCA: “The tax and legal environment for the development of the private equity and venture capital industry is quite unfavourable in Estonia, mainly due to the tax treatment of institutional investors. Limited partners and fund managers, pension funds and insurance companies are still faced with quantitative restrictions when investing in the asset class. Although there is a suitable domestic fund structure for private equity and venture capital, it is not tax transparent for domestic and non-domestic investors, and not free from undue investment restrictions. Furthermore, the country does not provide any tax incentives for investing in the asset class. There is also further room for improvement in the situation for investee companies, with regard to both company incentivization and fiscal R&D incentives. On a more positive note, Estonia has a good environment for retaining talent in investee companies and management funds, although the capital gains taxation for private individuals could still be reviewed.» (EVCA 2006, 39) “Estonia does not provide

the ability of businesses to invest in innovation as well as the general innovative ability are inadequate, and the public sector is unable to compete with the private sector in the labour market. All these components have been at least one of the characteristics in the IP success of different countries. Although Estonia has presented itself as a successful IT-country, there exist different considerable barriers to receiving necessary IT support upon implementing significant policies on the level of the state<sup>10</sup> and local governments and also in the private sector.

## 2.8. Seedbed of Innovation and Knowledge-based Society

It is a great pity that in the era of information technology and on the way to knowledge-based society, several opinion leaders are advocating the idea that Estonian young people should not try to enter universities but choose a vocational school instead. Only a total layman or a cynical satisfier of an instantaneous interest could endanger the sustainability of the Estonian state and nation by propagating such ideas. TEII states that „*the goals established in the strategy will be achieved via four measurers: human capital development, making the organisation of public sector research, development and innovation more efficient, increasing the innovative ability of enterprises, formation of policies aimed at promoting Estonia's long-term development.* (TEII 2006, 6) Can

any tax incentives for investing in private equity and venture capital.» (EVCA 2006, 41) “The Limited Liability Company is not tax transparent either for domestic or for non-domestic investors. However, non-domestic investors can avoid a permanent establishment in Estonia when investing through this vehicle. Management fees are subject to VAT but carried interest is not. A Limited Liability Company is not free from undue investment restrictions.» (EVCA 2006, 41) “Estonia does not provide a favourable environment for company incentivization as there is no specific scheme for supporting the creation and growth of innovative high-potential start-ups (young innovative company – YIQ). The country also lacks a special company tax rate for small and medium-sized enterprises (SMEs). On the positive side, since 1 January 2006 the new flat income tax rate in Estonia has been 23% (the previous rate was 24%), which is below the European average of 25.2%.» (EVCA 2006, 42) “Estonia does not seem to favour any form of investment in R&D as the country does not provide any of the fiscal R&D incentives evaluated in this study: business R&D expenditure, R&D capital expenditure, contracting researchers, technology transfer, cooperation between firms and research institutes/universities, and the creation of innovative firms» (EVCA 2006, 42).

<sup>10</sup> The State Audit Office has estimated most of the information systems created 1993-1999 and databases at their disposal to be institution-centred. Decision no 2-5/004 of Chief Auditor of the Operational Audit Department Performance of Development Projects of Information Systems, 23 February 2001.

anyone explain how it would be possible to develop human capital and achieve knowledge-based society without educated people?

The threat discussed above is further amplified by the outflow of competent experts to foreign countries from both state and local government institutions, research and development institutions, and economic subjects. The current Prime Minister Andrus Ansip is pouring oil on the fire by not seeing a slightest problem here or not wanting to admit it to the public<sup>11</sup>. Fortunately, President of the Republic Toomas-Hendrik Ilves, authors of TEII (TEII 2006, 9), Kurik, Terk (2005, 18), and also Woolridge (2006) are of the opposite opinion. However, the creation and success of IP preconditions does not mainly depend on those people, but, to a great extent, on politicians in the coalition council, the Riigikogu and the Government of the Republic.

## 2.9. Disclosure of Innovation Policy

Innovation policy was weakly acknowledged, prioritised, clarified and made public to all participants (parliamentary parties, state institutions, business organisations, research and development organisations, investors, venture capitalists, households) and stakeholders. IP target groups are diverse, starting from every resident of Estonia in a certain meaning and ending with various corporative and individual target groups in the meaning of single sub-policies of policy or impact aspects. It is impossible to admit that IP makers attached enough importance to communication and marketing activities and thus achieved the concentration of different associations of the society, although authors of EE2014 (2004, 2) claimed that „*implementation of „Estonia’s Success 2014“ must now, when we have the opportunity to use new means and possibilities arising from EU and NATO membership, become a process drawing the society together.*» This has not taken place, which is why it is very difficult to believe that all the important participants *in corpore* and every single participant separately have considered and realised, on a meaningful level, the importance of successful innovation, the preconditions for success, the manageability or unmanageability of processes and sub-processes, the essence of the critical chain from the point of view of inputs and outputs, the connections between measurers and single components and their connections to the expected impact.

<sup>11</sup> Ansip has repeatedly expressed it both in words and in writing. His most extreme speech on this subject was delivered at the Pärnu Management Conference on 13 October 2006.

## 2.10. Achieving common interests of Stakeholders

The success of IP depends on the attitudes, needs, and preferences of the various groups of the society (as participants but also possible beneficiaries of the impact). We have to agree with Kattel and Kalvet (2005, 13) who claim that „*under the circumstances of globalising economy, political and economic interests may no longer coincide*». Life keeps proving that the interests of various interest groups do not coincide even when we are not dealing with the process of globalisation. Innovation policy is, due to its high need for resources, inclusion of the entire society, prolonged duration, and complicated achievement of results, a politically very sensitive issue, which is why there exists a real danger of failure because of the subjective day-to-day policy related interests and the annual cycle of allocating resources from the state budget. Therefore, it would be naïve to believe that the values of all parliamentary parties and their leaders are dedicated to innovation and knowledge based society and that the pragmatic interests of the day-to-day policy support innovation in both the narrower and the broader sense.

The situation in Estonia is even further complicated by the almost perpetual pre-election, election, and post-election time. During a pre-election time, it is very difficult to believe that cooperation and communication between the three significant parties – the state, the university, and the industry – and the chain the Riigikogu – the Government of the Republic – state institutions – private business – households and individuals take place with sufficient necessity, thoroughness and dedication without the instantaneous interests and convictions of a single interest group or individual impairing the achievement of IP goals<sup>12</sup>. It is encouraging that the authors of TEII have considered cooperation relevant (TEII 2006, 10), but this does not mean that one of the most important factors enabling the materialisation of actual and substantial cooperation, needs and opportunities – money – is sufficiently taken into account when the state budget is being prepared and funds allocated<sup>13</sup>.

<sup>12</sup> This conviction is also supported by Kivine (2004), who claims: „*The main reason behind poor results is ... the non-functioning of the value chain of EAS activities*»

<sup>13</sup> The same is stated by the authors of TEII about TEI: „*Unfortunately, Estonia has been unable to follow the financing plan prescribed in the strategy and approved by the Riigikogu. Instead of proceeding from the benchmark level established in the strategy, the actual investments of recent years have been considerably smaller than planned in the strategy, as they have been formed in the course of annual budget negotiations. The strategy has been applied based on the resources actually allocated therefore*» (TE II 2006, 11).

### 3. CONCLUSION AND PROPOSALS

According to Burton (1999, 16) the situation could be improved based on four key elements: Knowledge Creation, Knowledge Protection, Collaborative Business Arrangements for Knowledge Creation and Diffused Entrepreneurship/Entrepreneurial Management. There is great deal for improvement in Estonia in implementing these elements into day-to-day life in public sector, local-government sector and private sector as well.

In order to escape the current waddling and avoid reaching a total standstill, the Estonian innovation policy makers should:

1. Perform an inventory of all the strategy documents, compile a register of these documents, assess the timeliness and topicality of the subject matter of every single strategy, establish a hierarchy of the documents, analyse interaction between the documents and devise a systemic and integral model of strategic planning.

2. To achieve a common long-term agreement for prioritising innovation policy and establishing it in the State Budget Act, and observe that every annual state budget would ensure sufficient financing of innovation policy. State Budget Strategy alone is not good enough tool for this purpose at the moment.

3. To move from output-based and activity-based governance to outcome and impact centred governance. This does not mean that output and activity-based governance is completely useless and out of mode.

4. To select the criteria and indicators characterising innovation policy as regards its outcome and impact to the economy and wealth of society in the best way possible and compile them into an integral and comprehensive system of measurers, which will be used to regularly assess the co-effects and counter-effects of all economic policy and innovation policy strategy documents from the point of view of the most important aspects.

5. To amend the principles and arrangement of financing long-term strategies from the state budget so that they would more than before support fruitful implementation of such strategies.

Unfortunately, it has to be admitted that if the current developments continue, the likelihood of materialisation of success in innovation, innovation policy visions and achievement of innovation policy goals and objectives in Estonia is rather small. Innovation policy planning does not function according to reasoned expectations and there are currently not enough prerequisites for the effective functioning.

### REFERENCES

1. *Alic, John A. Branscomb, Lewis M. Brooks, Harvey. Carter, Ashton B. Epstein, Gerald L.* (1992). *Beyond Spinoff: Military and Commercial Technologies in a Changing World.* (Boston: Harvard Business School Press)
2. *Arrow, Kenneth J.* (1962). The economic implications of learning by doing. *Review of Economic Studies*, 29, 155-173.
3. *Bank of Estonia (BoE).* (2008) Economic policy statement of Eesti Pank: Slowing economic growth inhibits inflation. 20.02.2008. Available at [WWW][http://www.eestipank.info/pub/en/yldine/press/kommentaariid/Arhiiv/\\_2008/\\_202.html?objId=1036335](http://www.eestipank.info/pub/en/yldine/press/kommentaariid/Arhiiv/_2008/_202.html?objId=1036335), 10.03.2008.
4. *Berg, Pekka. Pihlajamaa, Jussi. Nummi, Juha. Leinonen, Mikko. Leivo, Virpi.* (2004) Measurement of the quality and maturity of the innovation process: methodology and case of a medium sized Finnish company. *International Journal of Entrepreneurship and Innovation Management (IJEIM): Papers from the ISPIM 2002 Workshop held in Rome, Guest Editor: Professor Ferdinando Chiaromonte, Vol. 4, No. 4.* Birmingham: Inderscience Enterprises, 37–382.
5. *Bruland, Kristine. Berg, Maxine.* (1998) *Technological revolutions in Europe: historical perspectives.* Cheltenham: Edward Elgar Publishing.
6. *Bullock, Helen. Mountford, Juliet. Stanley, Rebecca.* (2001) *Better Policy Making.* London: Policies Studies Directorate, 83.
7. *Burton, John.* (1999) Innovation, entrepreneurship and the firm: a post-Schumpeterian approach. *International Journal of Technology Management (IJTM), Vol. 17, No.1/2.* Birmingham: Inderscience Publishers, 16–36.
8. *Caenegem, William van.* (2007). *Intellectual property law and innovation.* (New York: Cambridge University Press).
9. *Carlsson, Bo. Jacobsson, Staffan. Holmen, Magnus. Rickne, Annika.* (2002). Innovation systems: analytical and methodological issues. *Research Policy*, 31, 233–245.
10. *Chew, Soon Beng. Chew, Rosalind.* (2003) Promoting innovation in Singapore: changing the mindset *International Journal of Entrepreneurship and Innovation Management (IJEIM), Vol. 3, No. 3,* Birmingham: Inderscience Publishers, 267–281.
11. *Dahlman, Carl J. Routti, Jorma. Ylä-Anttila, Pekka.* (2005) (Eds.) *Finland as a Knowledge Economy. Elements of Success and Lessons Learned. Overview.* Available at [WWW][http://info.worldbank.org/etools/docs/library/201645/Finland\\_ES.pdf](http://info.worldbank.org/etools/docs/library/201645/Finland_ES.pdf), 25.05.2007.
12. *Edquist, Charles. Lundvall, Bengt-Ake.* (1993) Comparing the Danish and Swedish Systems of Innovations. In: Nelson, R.R. (Ed.), *National Innovation Systems.* Oxford University Press, New York.
13. *Eesti edu 2014 (EE2014).* (2004) Vabariigi Valitsuse strateegiadokument. Available at [WWW]<http://www.riigikantselei.ee/failid/EE2014.doc.pdf>, 11.12.2006.
14. *European Private Equity and Venture Capital Association, The (EVCA).* (2006) *Benchmarking European Tax and Legal Environments. Indicators of Tax and Legal Environments Favouring the Development of Private Equity and Venture Capital and Entrepreneurship in Europe.* Available at [WWW][http://www.evca.com/images/attachments/tmpl\\_8\\_art\\_215\\_att\\_1051.pdf](http://www.evca.com/images/attachments/tmpl_8_art_215_att_1051.pdf), 14.12.2006.

15. *Etzkowitz, Henry. Leydesdorff, Loet.* (2000). The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government relations. Available at [WWW]http://users.fmg.uva.nl/leydesdorff/rp2000/, 18.05.2007.
16. *Frederick, Howard H.* (2004) Entrepreneurship policy development: New Zealand in comparison. *International Journal of Entrepreneurship and Small Business (IJESB)*, Vol. 1, No. 3/4. Birmingham: Inderscience Publishers, 294–312.
17. *Freeman, Christopher.* (1995). The 'National System of Innovation' in Historical Perspective. *Cambridge Journal of Economics*, 19(1), 5–24.
18. *Fuchs, Christian.* (2004). Science as a Self-Organizing Meta-Information System. Available at [WWW]http://philsci-archive.pitt.edu/archive/00001621/01/science.pdf, 23.05.2007.
19. *Giget, Marc.* (1997). Technology, Innovation and Strategy: Recent Developments. *International Journal of Technology Management*, 14 (6), 613–634.
20. *Goh, Andrew L.S.* The pursuit of innovation for transition to a knowledge economy: new challenges of industrial policy-making. *International Journal of Technology, Policy and Management (IJTPM)*, Vol. 4, No. 3. Birmingham: Inderscience Publishers, 2004, 218-239.
21. *Gomory, Ralph E.* (1989). Product development: from "ladder science" to the product development cycle. *Harvard Business Review*, 89(6), 99-105.
22. *Gray, Colin. Allan, John.* (2002) Role of management education in developing capacity for innovation in small firms. *International Journal of Entrepreneurship and Innovation Management (IJEIM)*, Vol. 2, No. 4/5. Birmingham: Inderscience Publishers, 373–389.
23. *Handyside, Tim. Light, Janice.* (1998) An experiment in organisation for innovation. *International Journal of Technology Management (IJTM)*, Vol. 15, No. 1/2. Birmingham: Inderscience Publishers, 160-172.
24. *Hollanders, Hugo and Arundel, Anthony.* (2006). 2006 Global Innovation Scoreboard (GIS) Report. Available at [WWW]http://trendchart.cordis.lu/scoreboards/scoreboard2006/pdf/eis\_2006\_global\_innovation\_report.pdf, 25.01.2007.
25. *Hughes, Thomas. P.* (1987). The Evolution of Large Technological Systems. (In W. E. Bijker, T. P. Hughes, T. J. Pinch (Eds.). *The Social Construction of Technological Systems*, 51-82. Cambridge: The MIT Press.)
26. *Kattel, Rainer.* (2004) Governance of Innovation Policy: The Case of Estonia. *TRAMES*, Vol. 8 (58/53), No. 4. Tallinn: Estonian Academy Publishers, 414.
27. *Kattel, Rainer. Kalvet, Tarmo.* (2005) Teadmis-terõhine majandus ning info- ja kommunikatsioonitehnoloogiaalane haridus: hetkeolukord ning väljakutsed. Tallinn: Poliitikauringute Keskus Praxis, 103.
28. *Katz, J Sylvan.* (2000). Institutional recognition. Scale-independent indicators and research evaluation. *Science and Public Policy*, 27(1), 23–36.
29. *Kivine, Märt.* (2004) Riigikontrolli kontrolliaruanne nr 2-5/04/109 „Ettevõtlike Arendamise Sihtasutuse toetatud tootearendusprojektide tulemused». Available at [WWW]http://www.riigikontroll.ee/, 04.12.2006.
30. *Kline, Stephen J. Rosenberg, Nathan.* (1986). An Overview of Innovation. (In R. Landau, N. Rosenberg (Eds.), *The Positive Sum Strategy. Harnessing Technology for Economic Growth*. Washington, D.C.: National Academy Press.)
31. *Kurik, Silja. Terk, Erik.* (2005) European Trend Chart on Innovation: Annual Innovation Policy Trends and Appraisal Report. Estonia 2004-2005. A publication from the Innovation/SMEs Programme. European Commission, Enterprise Directorate-General, 43.
32. *Lane, Peter J. Klavans, Richard.* (2005) Science intelligence capability and innovation performance: an absorptive capacity perspective. *Int. J. Technology Intelligence and Planning*, Vol. 1, No. 2, Birmingham: Inderscience Publishers, 185-204.
33. *Lee, Byoung-Hoon. Kwun, Seog Kyeun.* (2003) Public policy toward the innovation-driven economy in Korea. *International Journal of Entrepreneurship and Innovation Management (IJEIM)*, Vol. 3, No. 3. Birmingham: Inderscience Enterprises, 227–248.
34. *Lee, Joseph S. Wang, Jiann-Chyuan.* (2003) Public policies for the promotion of an innovation-driven economy in Taiwan. *International Journal of Entrepreneurship and Innovation Management (IJEIM)*, Vol. 3, No. 3. Birmingham: Inderscience Enterprises, 227–248.
35. *Leede de, Jan. Looise, Jan C. Alders, Ben C.M.* (2002) Innovation, improvement and operations: an exploration of the management of alignment. *International Journal of Technology Management (IJTM): Special Issue on Integrating Operations, Incremental Change and Radical Innovation. Guest Editor: Dr. Harry Boer*. Vol. 23, No. 4, Birmingham: Inderscience Publishers, 353–368.
36. *Levine, Ross.* (2003) Finance and Growth: Theory and Evidence. Available at [WWW]http://www.econ.brown.edu/fac/Ross\_Levine/Publication/Forthcoming/Forth\_Book\_Durlauf\_FinNGrowth.pdf, 04.12.2006.
37. *Lucas, Edward.* (2006) Eesti vajab lennartmerilikku äratust. *Eesti Päevaleht*, 23.06.2006.
38. *Luggen, Martin. Birkenmeier, Beat. Brodbeck, Harald.* (2005) Innovation Management in network of entrepreneurial firms. *Int. J. Entrepreneurship and Innovation Management*, Vol. 5, Nos. 1/2. Birmingham: Inderscience Enterprises, 69–84.
39. *Lundvall, Bengt-Åke.* (1988). Innovation as an interactive process: from user-producer interaction to the national system of innovation. (In Giovanni Dosi, Christopher Freeman, Richard Nelson, Gerald Silverberg, Luc Soete (Eds.), *Technical Change and Economic Theory* (349-369). Pinter, London.)
40. *Lundvall, Bengt-Åke.* (2000). Introduction. (In Charles Edquist, Maureen McKelvey (Eds.), *Systems of Innovation: Growth, Competitiveness and Employment*. Cheltenham: Edward Elgar Publishing.)
41. *Lundvall, Bengt-Åke.* (2002). Towards a learning society. (In P. Conceição, M. Heitor, Bengt-Åke Lundvall (Eds.), *Innovation, Competence Building And Social Cohesion In Europe: Towards a Learning Society*. Cheltenham: Edward Elgar Publishing.)
42. *Majandus- ja Kommunikatsiooniministeerium (MKM).* (2006) Available at [WWW]http://www.mkm.ee/index.php?id=9042, 05.12.2006.

43. *Marshall, Alfred.* (1920). *Principles of Economics.* (London: Macmillan).
44. *McElroy, Mark W.* (2003). *The New Knowledge Management: Complexity, Learning, and Sustainable Innovation.* (Burlington, MA: KMCI Press/Butterworth-Heinemann).
45. *McPherson, A.H. McDonald, Sean M.* (2005) Local innovation support in Scotland: policy lessons from Glasgow. *Int. J. Foresight and Innovation Policy*, Vol. 2, No. 1. Inderscience Enterprises, 35-56.
46. *Meng, Hsien-Chun.* (2005) Innovation clusters as the national competitiveness tool in the innovation driven economy. *Int. J. Foresight and Innovation Policy*, Vol. 2, No. 1. Birmingham: Inderscience Enterprises, 104-116.
47. *Morgan, C.W., Blake, A, Poyago-Theotoky, J.A.* (2003) The management of technological innovation: lessons from case studies in the UK food and drink industry, *International Journal of Biotechnology (IJBT)*, Vol. 5, No. 3/4. Birmingham: Inderscience Enterprises, 334-353.
48. *Nelson, Richard R.* (1993). *National innovation systems - A comparative analysis.* (New York: Oxford University Press).
49. *Newman, Lenore.* (2005, October 6). Uncertainty, Innovation, and Dynamic Sustainable Development. *Sustainability: Science, Practice, & Policy*, 1(2). Available at [WWW]http://ejournal.nbii.org/archives/vol1iss2/0501-001.newman.html, 25.05.2007.
50. *Nielsen, Klaus.* (2003). Social capital and the evaluation of innovation policies. *International Journal of Technology Management*, 26(2/3/4), 205–225.
51. *Näpinen, Leo.* Iseorganiseerumismõtlemine, selle omandamise vajadus Eesti ühiskonnas. Teaduslugu ja nüüdisaeg IX: Teadusfilosoofia ja teadusmetodoloogia Eestis: Olukord ja perspektiivid. Tallinn: Teaduste Akadeemia Kirjastus, 1994, pp 158–180.
52. *Parayil, Govindan. Sreekumar, T.T.* (2004) Industrial development and the dynamics of innovation in Hong Kong. *International Journal of Technology Management (IJTM)*, Vol. 27, No. 4. Birmingham: Inderscience Enterprises, 369-392.
53. *Peet, John.* (2006) Huvasti, põhjamaa mudel. Veel ühe Euroopa unistuse lõpp. Maailm 2007. Tallinn: Eesti Päevalehe AS, 2006, 48.
54. *Perez, Carlota.* (1985) Technological change and opportunities for development as a moving target. Available at [WWW]http://www.intech.unu.edu/events/herrera\_lectures/herrera\_lectures/2001\_perez.pdf, 05.12.2006.
55. *Perez, Carlota.* (1986) The new technologies: An integrated view. English version of the original Spanish “Las Nuevas Tecnologías: Una Vision de Conjunto», in C. Ominami ed., *LA TERCERA REVOLUCION INDUSTRIAL: IMPACTOS INTERNACIONALES DEL ACTUAL VIRAJE TECNOLÓGICO*, Grupo Editor Latinoamericano, Buenos Aires, 44-89, 36.
56. *Perez, Carlota.* (2003) Technological revolutions and financial capital. The dynamics of bubbles and golden ages. Cheltenham: Edward Elgar Publishing.
57. *Porter, Michael E.* (1990). *The Competitive Advantage of Nations.* (New York: The Free Press).
58. *Preiss, Kenneth J., Spooner, Keri.* (2003) Innovation creation and diffusion in the Australian economy. *International Journal of Entrepreneurship and Innovation Management (IJEIM)*, Vol. 3, No. 3. Birmingham: Inderscience Enterprises, 197-210.
59. *Proos, Ivi.* (2006) Ühiskonna aiast. *Eesti Ekspress*, nr. 17 (855), p B5, 27.04.2006, Tallinn.
60. *Rabson, Jonathan D. DeMarco, David A.* (1999) A model of innovation systems with links to creative style and psychological type, *International Journal of Technology Management (IJTM)*, Vol. 18, No. 5/6/7/8, Birmingham: Inderscience Enterprises, 627-647.
61. *Reinert, Erik S.* (1999) The role of the state in economic growth. *Journal of Economic Studies*, Vol. 26 No. 4/5. MCB University Press (Emerald), 268-326.
62. *Riigieelarve strateegia 2008-2011 (RES).* (2007). Available at [WWW]http://www.agri.ee/public/juurkata-loog/ARENDUSTEGEVUS/RES\_2008-2011.pdf, 23.01.2008.
63. *Rosenberg, Nathan.* (1995). Innovation's Uncertain Terrain. *The McKinsey Quarterly*, 3, 170-185.
64. *Ruttan, Vernon W.* (2004) The role of the public sector in technology development: generalisations from general purpose technologies, *International Journal of Biotechnology (IJBT)*, Vol. 6, No. 4. Birmingham: Inderscience Enterprises, 301-323.
65. *Rycroft, Robert W. Kash, Don E. Adams, Richard.* (1995) Technology Policy: A Fixture on the National Agenda. *Maine Policy Review*, 4(2), 5-12.
66. *Rycroft, Robert.* (2003a). Innovation Networks and Complex Technologies: Policy Implications of the Unknown, and Unknowable. *Occasional Paper Series*, 1-19.
67. *Rycroft, Robert.* (2003b). Self-Organizing Innovation Networks: Implications for Globalization. *Occasional Paper Series*, 1-18.
68. *Schumpeter, Joseph A.* (1939). *Business Cycles: A Theoretical, Historical and Statistical Analysis of Capitalist Process.* (New York: McGraw-Hill).
69. *Schumpeter, Joseph A.* (1942). *Capitalism, Socialism and Democracy.* (New York: Harper).
70. *Smits, Ruud. Kuhlmann, Stefan.* (2004) The rise of systemic instruments in innovation policy. *International Journal of Foresight and Innovation Policy (IJFIP)*, Vol. 1, No. 1/2. Birmingham: Inderscience Enterprises, 4-32.
71. *Sommerlatte, Tom.* (2004) Capital market orientation in innovation management. *International Journal of Product Development (IJPD)*, Vol. 1, No. 1. Birmingham: Inderscience Enterprises, 1-11.
72. *Sutton, Rebecca.* (1999) Working Paper 118. *The Policy Process: An Overview.* London: Chameleon Press Ltd, 35.
73. *Säästev Eesti 21 (SE21).* (2005) Eesti säästva arengu riiklik strateegia. Available at [WWW]http://www.envir.ee/orb.aw/class=file/action=preview/id=90658/SE21\_est\_web.pdf , 11.12.2006.
74. *Tamasy, Christine.* (2007) Rethinking Technology-Oriented Business Incubators: Developing a Robust Policy Instrument for Entrepreneurship, Innovation, and Regional Development? *Growth and Change*, Vol. 38, No. 3, 460–473.
75. *Teadmistepõhine Eesti 2007–2013. Eesti teadus- ja arendustegevuse ning innovatsiooni strateegia. (TEII).* (2006) Available at [WWW]http://www.mkm.ee/failid/TAI\_strateegia\_27\_11\_2006.doc, 05.12.2006.
76. *Tijssen, Robert J.W.* (2002). Science dependence of

*Теоретические и практические аспекты планирования инновационной политики (на примере Эстонии)*

technologies: evidence from inventions and their invent. *Research Policy*, 31, 509–526.

77. *Tsai, K-K. Wang, J-C.* (2005) An examination of Taiwan's innovation policy measurers and their effects. *Int. J. Technology and Globalisation*, Vol.1, No. 2, Birmingham: Inderscience Enterprises, 239–257.

78. *Wonglimpiyarat, Jarunee.* (2005) What are the mechanisms driving the success of the US Silicon Valley? *International*

*Journal of Technology, Policy and Management (IJTPM)*, Vol. 5, No. Birmingham: Inderscience Enterprises, 200–213.

79. *Woolridge, Adrian.* (2006) *Parimate heitlus*. Maailm 2007. Tallinn: Eesti Päevalehe AS, 120.

80. *Wu, Weiping.* (2007) State Policies, Enterprise Dynamism, and Innovation System in Shanghai, China. *Growth and Change*, Vol. 38, No. 4, 544–566.

*Таллинский технологический университет,  
Р. Линнас, аспирант  
Raivo.Linnas@mail.ee*

*Tallin University of Technology  
R. Linnas, post-graduate student,  
Raivo.Linnas@mail.ee*