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**Critical Factors of National Innovation Finance System  
– Perspectives from Peru and Finland**

Research proposal  
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# 1 BACKGROUND OF THE STUDY

## 1.1 Innovation and innovation systems

Innovation is seen as successful production, assimilation and exploitation of novelty in the economic and social spheres. Innovation offers new solutions to problems and thus makes it possible to meet the needs of both the individual and the society. The context of innovation has changed over the past twenty years; the increasingly rapid dissemination of new technologies and the constant changes which require ongoing adaptation are challenge for society as a whole. Innovation is an essential precondition for growth, maintaining employment and competitiveness of an economy (*Green Paper on Innovation* 1995, 1-2, 5).

Innovation has many roles. It can act as a driving force and point firms towards ambitious long-term objectives. Innovation can lead to the renewal of industrial structures and to emergence of new sectors of economic activity. An innovative firm has a number of characteristic features which can be grouped into two major categories of skills; strategic and organizational. The strategic skills include: long-term view, ability to identify and even anticipate market trends, and the willingness and skills to collect, process and assimilate technological and economic information. This is why a modern “strategist” needs information about the future. This can be achieved using the diverse methods developed in the field of futures studies. The organizational skills include a taste for and mastery of risk, internal cooperation between the various operational departments and external cooperation with public research, consultancies, customers and suppliers, involvement of the firm in the process of change, and investment in human resources.

While innovation happens mainly within firms, it is actually a collective process because when a firm innovates it rarely does it only on the basis of its own internal resources of knowledge, skills and finance. Innovation in the firm happens with the help offered by outside investors providing finance, the skills and knowledge of other firms and the services of consultants. Innovation also relies on research results and other knowledge outputs from universities and R&D institutes. An innovation system is a system made up of economic institutions, economic actors and a knowledge infrastructure, all of which contribute to the development and spreading of new knowledge and new technologies. They also compose the structural and legislative setting in which the government can carry out politics that improve prerequisites for innovation (Georghiou et al. 2003, 13; *Green Paper on Innovation* 1995, 1-2; ECLAC 1996; Freeman, 1987; Nelson, 1993; Lundvall, 1992; Cimoli and Dosi, 1995; and

ECLAC, 2000 and 2002; Melo 2001; see also Winter1987, Hall 1993, Grant 1996). Firm-level innovation also occurs in the context of a national innovation system. (*Knowledge, Innovation and...*2003, 4–5; 19–20; Georghiou, Smith, Toivanen & Ylä-Anttila 2003, 13; *Green Paper on Innovation* 1995).

In this study the perceptions of the different actors in national innovation system are studied from the point-of view of finance. In order to study and understand these different actors an approach called *systems approach* is applied. Situations characterized by rapid change, multiple interests, limited resources and high complexity are characteristics of the “systems approach”. Systems approach means an emphasis on “the big picture” and considering the functions of system’s parts based on their relations with one another and within the system’s larger context. In this study, the different actors within a national innovation finance system are the system’s parts, and the national innovation system is the larger context. The systems approach is a multi-disciplinary approach to defining and solving complex, high-variety, dynamic, continuous and interactive problems (Leonard & Beer 2005.)

## 1.2 Innovation Finance

In the traditional microeconomic theory a market failure occurs when markets fail to achieve the most efficient allocation of resources. In the field of innovation, the basic market failure usually lies in the knowledge creation. According to Kenneth Arrow (1962), knowledge as a commodity has at least four distinctive characteristics that differs it from other goods and services. First, the economic value of knowledge cannot be conveyed to a potential user without transmitting the knowledge itself and hence, once transmitted there remains nothing to sell. Secondly, the cost of transmission of knowledge is negligible or zero. Thirdly, even if the number of the users of knowledge rises, the costs of production of it do not; the marginal cost of extra users of knowledge is therefore zero. This makes knowledge a public good, which cannot be created or traded via markets. Finally, private market actors may be unable to carry the high levels of risk which is usually accompanied with the attempts to create useful knowledge. (Nelson 1959; Arrow 1962). It is widely recognized that to generate innovation capacity, it is essential to encourage suitable private investments and at the same time adopt policies to institutionalize and promote relations between those engaged in scientific research and in the business system.

In addition to public financing, venture capital investments are one of the most important sources of financing innovations. VC is a form of ownership and for that reason some of the problems associated with knowledge as a commodity are reduced using venture capital in innovation finance. Venture capital-backed firms are found to

be faster in developing their products and bringing them to the market than non VC-backed firms. Also, VC-backed firms produce more patents (Virtanen, M. 1996; Hall 2002; Gompers & Lerner 1999; Gompers 1999; Auer, 1990). There is a wide consensus stating that a vibrant venture capital industry is a cornerstone of USA's leadership in the commercialization of technological innovation (Bottazzi & Da Rin 2002, 231; Hellman et al. 2002). A related belief is also that the lack of venture capital markets hinders other continents from competition (See e.g. Bottazzi & Da Rin 2002, 231; Green Paper on Innovation 1994; ECLAC 2004; Nunura 2002). Public policies offer the possibility of promoting innovation both by favoring the development for technological capacity at the microeconomic level and by strengthening innovation systems. The growth of productivity in a production system depends not only on individual systems but on the density, depth and dynamism of the knowledge flows transmitted within the innovation system (ECLAC 2004.)

## 2 RESEARCH DESIGN

The aim of this study is to understand innovation finance. This study takes a systemic view to innovation finance, and sees it as a complex process of interaction between different (human) actors. The two building blocks of the process of innovation are the company itself as a creator and administrator of knowledge, and the national innovation system as the provider of the environment and the resources necessary. The study is an attempt to evaluate national innovation systems from the point of view of financing, and assess their implications to innovation activity in companies. The research question to be answered is:

*From the point of view of finance, which are the critical factors of national innovation systems that affect to the future potential of the companies innovation activity?*

This study is a case study; the two case countries used are Peru and Finland. The sub-questions deriving from the main research questions are: How do the different actors of innovation finance see the future (both probable and desirable)? Which are the driving forces of change in the national innovation systems? How are national innovation system seen to change over time? How can innovation finance be developed in the two case countries?

The research process can be divided into various phases:

1. An extensive literature review on the historical development phases of innovation finance in the two case countries.
2. Making sense of the present situation by finding out who are the main actors of the national innovation systems of Peru and Finland, and by understanding the problems that hinder the effectiveness of innovation finance in the two countries.
3. Mapping the critical factors (obstacles and incentives) affecting to the future of innovation finance in the two case countries.
4. Comparing the most significant factors of the two case countries; similarities, differences and analyzing what affects these factors.
5. Understanding the activities of finance providers in the two countries.
6. Finding out new tools to exploit the factors of innovation finance.

The research questions drive the methodological choices. The main research methodology used in this study is a qualitative case study method. In this study, the financial systems are seen as interaction systems between different actors. The empirical data is collected through interviews and futures workshops. The interviews will gain deep insight into the minds of different actors in the innovation finance systems of the case country. The futures workshop is used to gather together the experts of the national innovation finance systems and to gain knowledge and consensus of the critical factors of the future of innovation finance in Peru and in Finland. From the point of view of this study, comparing two nations with very different backgrounds (Peru and Finland), and their similarities and differences, it will be possible to gain deeper understanding of the innovation finance process and the critical factors in national innovation finance systems. The study also consists of extensive literature review and contains statistical information.

The scope of this study expands from the historical point of view to the future. The purpose of *futures methodology* is to systematically explore, create and test both possible and desirable futures in order to improve decisions. The applications of futures methods can help people to have a shared future vision of economic competition toward a common goal. Futures knowledge can act as *early warning* in the fast phase and complexity of change today and help to create more intelligent decisions by increasing the time-space of analysis. To study future is to study *potential change*. It is a multi-disciplinary examination of change in all major areas of life to find the interactive dynamics that are creating the next age. The value of future studies methods do not lie in discovering new factual knowledge, but producing perceptions and insights to that body of knowledge (Glenn 2005). Herman Hahn (1986) differentiates futures research from futures studies. Futures research is decision-oriented and it seeks to identify and describe current forces that should be understood in order to make more intelligent decisions, whereas future studies are academic, subject or question-oriented. The complete backgrounds that might be relevant to a policy decision may not be possible to know, but the most critical factors are possible to know very quickly using the futures methods. Academic research has the responsibility to understand the issues as completely as possible.

### 3 INNOVATION FINANCE IN THE TWO CASE COUNTRIES

Finland has adopted the broad definition of innovation system for over a decade ago, and the development of innovation environments has wide political support in the country. The Finnish innovation system is built on collaboration between public and private partners. From the point of view of the Finnish government, the systematic investments in international science and technology cooperation as well as the growth in information industries have been developing the economy favorably. Finland's advantages are the high level of education, research and know-how. Despite of this, entrepreneurship and entrepreneurial activity are not at the desired level in Finland. According to Science and Technology Policy Council of Finland, there are three main targets in accelerating the internationalization of the innovation system and improving the overall conditions for innovation. These are, first developing education and career prospects in research and increasing research knowledge. The second target is strengthening the social and technological innovations, and the third developing innovation funding (Knowledge, Innovation and...2003, 4–5; 19–20; Georghiou et al. 2003, 13; Making Finland a Leading... 2005, 14–15).

According to Lee et al. (2000) in Europe, it takes twelve times longer from an idea to venture and it requires four times more financial capital, than in the USA. While in the USA, growth companies are already acknowledged as the main growth engines of the economy. Their importance on the national economy has only been widely acknowledged far more recently in Finland. In USA, the cultural and fiscal environments embrace entrepreneurship. Certain lack of social security is perhaps a factor that drives people to try harder and take more risks. In Finland the vast net of social benefits might be discouraging them to take risks. In consequence, the Finnish business environment drives minimization of risk at the expense of profit, whereas the American drives maximizing of profit at the expense of risk. (Valtonen & Bouix, 1997, 40-42.) In Finland, there are several different governmental agencies and semi-public organizations subsidizing young growth companies on the national and local levels. The Finnish system is fragmented, complicated, time-consuming and ineffective. In Finland, the general attitude on entrepreneurship is increasingly positive, the market boasts opportunities and the level of education of the workforce is at a very high level in global comparison. Despite of all this, the entrepreneurial activity is not wide spawn. (Hautamäki and Lemola 2004; Karhia, Koivula & Seppä 2005).

The acceleration of creating new innovative ventures and finding appropriate and effective ways to finance them are the key issues in maintaining the competitiveness of the Finnish economy. The public expenditure on R&D in Finland accounts for 3.5% of GDP, one of the highest figures in the world. Despite of this, the R&D investments have not grown significantly over the last few years. Successful public spending on R&D

complements the private sector and encourages companies to invest further in research and development. In order to boost growth of employment and productivity in the economy, the increase in R&D investment must lead to the commercialization of products or production processes (Georghiu et al. 2003).

Even though the Finnish innovation and business environments have been found to be competitive during the last few years, this is no guarantee of success in the future. When weighing the present situation in the light of the visible challenges of the global economy, there are good grounds for concluding that without significant structural reforms and redirection of resources, Finland will probably lose its competitive ability. For a long time, the core of Finland's competitiveness policy has been a commitment to know-how and product development and Finland has succeeded relatively well in this respect. The main problem, however, is the inadequate investment. (*Making Finland a Leading...* 2005). This is why focusing on the innovation finance is important to the whole economy.

There are some measurements that can be used to measure the innovation activity of different nations. If we measure innovation output in patents, Western Europe and U.S.A. are the world leaders, with 47.7% and 33.4% shares of all the European patents. Their shares are respectively 19.9% for Western Europe and 51.5% for U.S.A in the U.S. patents. The figure for Latin America in both patents (European and U.S) is only 0.2 percent (Melo 2001; Barré 1998). The comparison in expenditure on R&D by countries show that whereas the world leaders (Finland, the United States and the Republic of Korea) invest between 2.8 and 3.42 points of their GDP into R&D, Latin America and the Caribbean as a whole devote only 0.5 point of their GDP to research and development (ECLAC 2004).

In developing countries, the innovation activity is lower than in the developed countries; the number of people and institutions involved in innovation processes is smaller, the institutions are smaller in size, there are fewer of them and they are less developed (Melo 2001.) In the review of six Latin American countries the innovative processes of these countries were found out to be "informal". This means that companies do not have a formal internal structure of research and development. In the sample of the study, 63.6 percent of the firms stated that they had introduced innovations, but only 15.7 percent had a formal R&D department. Another proof of this informality was that the management in many firms did not know the amount the company was spending on research and development. In Uruguay, 60% of firms did not know how much they were spending on R&D, and in Mexico the amount was 71.4% (Sutz 1998; See also CONACYT 1998: Durán et al. 1998; INDEC 1998). In the study "Science, Technology and Innovation and Technological Innovation in Peru" (1999) only 1.8% percent of the companies were involved in scientific and technological development (Nunura 2002, 15-16.)

The poor performance of Peru in the field of innovation is a direct result of the lack of interest and understanding of the role of science and technology in the economic development (Kuramoto & Torero 2004.) The human resource development in Latin American countries imposes constraints on the development of their innovation systems. This may be partly explained by the different structure and development phase of the Latin American countries and partly by the low demand for scholars. The firms have not been seeing the knowledge investments as crucial to their profit making; generally the universities produce more researchers than the amount demanded by the productive system (Melo 2001). While it might seem that differences between national innovation systems in developing and developed countries are purely quantitative, in fact these quantitative differences reflect a deeper divide. The innovation systems in developing countries are also qualitatively different from those in the more developed countries and therefore they are at a clear disadvantage. Melo (2001) points out that the cooperation among businesses themselves and between business communities, universities and research institutions is limited and inadequate. These institutions are the main actors in the innovation systems of Latin American countries; therefore it seems clear that there are disadvantages in the system compared to USA or Europe, for instance. Also, unlike in most of the developed countries, the dominant component of the innovation efforts is the public sector; whereas in the developed countries, the private sector leads the innovations activities. In Peru the low participation of the private sector in science and technology activities draws attention; 95% of the expenses in science and technology activities is provided by the public sector and only 5% by the private (Nunura 2002, 15-16; Melo 2001). From all the countries in the Latin America, Peru is situated at the bottom of the measurements. The level of science, technology and innovation finance in Peru is relatively low. In 1999 only 0.89% of the GDP (US\$ 445.5 million) was assigned to science and technology activities and barely 0.08% of GDP (US\$ 41.7 million) to scientific research and experimental development (R&D) (Nunura 2002, 14).

In 2005, for the first time in its history, Peru formulated a long-term National Plan for Science, Technology and Innovation (*Plan Nacional de Ciencia, Tecnología y e Innovación* 2005). The time horizon of the plan is 15 years, from 2006 to 2021. There have been several attempts to create a plan like this before, but they have suffered from the lack of political support, and they have not been able to activate the parties involved. The main objective of the plan is to create sustainable development by new plan of science, technology and innovation for Peru. It is crucial to Peru to succeed in strengthening the national system for science, technology and innovation. This can be achieved through constructing institutional networks that coordinate efficiently the activities of science, technology and innovation policy in all levels, local, regional and national, as well as develop suitable conditions for international cooperation. The plan

has been designed to contribute to sustainable human growth through better competitiveness, rational use of natural resources and environmental conservation. The plan also demands involvement from the involved parts of the state, academic and research institutions, the productive sectors as well as international organizations (*Plan Nacional Estratégico*. 2005, 6-7).

Various studies and international examples prove that systematic investments into innovation develop economies favorably (See e.g. Scherer 1991; Carazo et al. 2000.) In Peru, there exists no national capital market or funds for risk capital for the development of new ventures, although their value as an impulse for the competitiveness of the economy has been recognized (*Plan Nacional Estratégico 2005*, 32). Receiving more innovation finance is essential for Peru because R&D activities are very profitable in long term and enhance the competitiveness of a country.

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