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Science and Technology Policies in Networked Environment

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Policies that drive Innovation

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Executive Summary

Knowledge Economy has become a key concept in international discurse to accelerate economic and social development in any country around the world. Knowledge Economy or knowledge-based economy refers to building knowledge base of economy that generates economic growth, employment, exports and productivity and enhances social and regional development. These outputs can be achieved through long-term investment in knowledge base of economy, meaning investment in education system, science and technology and research and development. This means a systemic approach in any country to build their innovation system both at the national level and at the regional level.

In this paper I will compare science and technology policies, and other related policies, in building national innovation system as a knowledge base for economy in Finland and South Africa. The objective is to compare these economies as knowledge economies by focusing on policies, and what are the similarities and differences between policies in these countries.

1. Introduction

To build a national innovation system, a country or region needs to integrate innovation policy or science and technology policy to the economic policy objectives. This policy identifies the key objectives of a country or region to build their knowledge economy, their priority areas and means/instruments to implement these policies. In addition to the policy the national or regional innovation system is a key to understanding the stakeholders, their role and expected outcomes of the system.

Science Parks are internationally known to play a crucial role in regional or local development. The models of Science Parks differ but in general they integrate (public) research organizations, universities, private industries and local government. The concept of Science Park varies from physical infrastructure entity to a collaborative network of research organizations, enterprises and local/regional government. The components are research/innovation, incubation and learning. These roles vary from country to country but the main role is to create an environment for collaboration between the above-mentioned entities that add value to each other's. It is important to look critically to the role of Science Parks, not just as infrastructure arrangements but also particularly as spaces for building knowledge capacity of the region and turn it into a catalyst for economic growth for the region.

In Finland the science and technology development is closely connected to industrial policy and regional policy. The key aspects of industrials policy are R & D in high technology areas relevant to Finland, such as ICT, environmental management, forest management, biotechnology (bio fuels), health and e-learning. These areas are relevant in the future for Finland but it is also understood that these areas can make Finland a key player in global economy. In the regional development of Finland, the collaboration and networking between public and private sector, (local governments/ municipalities and industry) is the key for regional development. Science Parks and Centres of Expertise are vehicles of this development. It would be important to look critically the collaboration between Science Parks, TE-centres and Technology Offices in Finland.

A new science and technology approach is to build Strategic Centres of Technology in key areas like forestry, ICT, health, environment and biotechnology. These centres are networks of research institutes, private sector and universities. The Centres are limited companies and the stakeholders can hold shares depending on their interest to invest.

In South Africa, the Department of Science and Technology, in its 10-years plan supports building knowledge-based economy. SA has identifies strategic areas for its future development in science and technology, like biotechnology, ICT, nanotechnology, and space technology. The role of Science Parks is critical in regional and local development. Therefore, the role and establishment of Science Parks is critical for building the knowledge base of the region/province. There are only a few Science Parks in South Africa, but there are science clusters (biotechnology, ICT etc.), incubation centres and research clusters. The 10-year plan of DST provides a guideline for building knowledge-based economy. In that context the role of Science Parks will be renegotiated.

This paper will provide comparative policy analysis of national innovation systems.

2. Finland's Path from Industrial to Knowledge Economy

Globally Finland is one of the leading information societies measured by technology and its use, competitiveness and education (PISA-study). Finland managed to change its economic development from the severe economic crisis as a result of the collapse of industrial base of the economy in the early 1990's to an information economy and society. This development took place with collaboration between public and private sector and a long-term trust building process in society. Some of the key characteristics in Finland have been long term investment in public education and R & D, building political trust, government support for the development of information society (Information Society Program), regulatory environment supporting competition and participation of all key stakeholders in the decision-making for building an information society.

Information and communication technology, innovation capacity and education are key elements of a knowledge-based society. Building the knowledge-base of the society is perhaps the strongest element of competitiveness and success of any country today and in the future.

But where Finland comes from and what we have done so far? Firstly, we have invested for decades in our education system that is public and free for everyone, from kindergarten to doctoral degree. Second, public sector has given a push through technological and financing institutions to build the Finnish innovation system, but gradually the private sector has invested more and more in R & D. Today the private sector is financing almost 2/3 of total R & D investments. Third, there is a systemic approach to build collaboration between science and technology on one hand, and the Finnish innovation system on the other. Fourth, Finland has built a shared vision as a knowledge-based society - or information society - and as a global player in ICT, and fifth, the information and communications market was deregulated and opened for free competition at a very early stage, in order to make the ICT serve business, people and the country and to generate economic growth.

Finland is by its population a small country - 5.2 million. Economy was dominated by a strong pulp and paper industries, while the metal industry has gradually become the second largest sector. In the early 1990's Finland suffered a heavy economic recession, which was due to a number of simultaneous factors. First, the fall of Soviet Union - one of our biggest export countries for industrial products. Second, the economic recession in our other main export countries led to the fall of both export volumes of pulp and paper products, as well as their prices, and third, we had recently liberalized our financial markets in a care-free fashion which led to an overheated economy and then the bubble burst. Our international credit-worthiness went down, a lot of companies went bankrupt, and the unemployment rate was close to 19 %.

Finland really had to re-invent itself. We formulated new vision and national policies for the future. One of the big things was to build Finland as a knowledge-based society and a global player in ICTs.
It was not just the right analysis and right policies at a time, we were lucky, too. At the same time Nokia, now the flagship of the Finnish ICTs, changed its multi-sectoral industrial structure like pulp and paper, consumer electronics, tires, rubber boots etc. into an ICT company. Nokia has since become a world leader in mobile phones and their applications.

3. Science and Technology Policy and Innovation System in Finland

Finland's recent economic development is a result of policies towards innovation and information society or ICT4D. Tarmo Lemola summarizes development Finland's technology policies in the following way: "from the late 1960s onwards the policy can be divided on the basis of its content into three phases. The same conditions, instruments and operating modes of technology policy appear in each phase. The first phase, which began in the mid-1960s, can be called the period of *research policy*. The focus during the second phase, which began at the turn of the 1980s, was on the development of technologies and may be referred to as the period of *technology policy*. The latest *innovation policy* phase began in the early 1990s. Innovation policy involves both scientific and technological development being examined from the standpoint of innovations, taking account of innovation-promoting factors such as science and technology, and emphasising the perspectives of technology transfer, diffusion and commercialisation. The transition from technology policy to innovation policy was also shaped by economic crisis" (1).

Further, since the early 1990's an information society policy and strategy was produced to guide the transition from industrial economy (that reached a severe recession at that time) to information economy where leading technology was ICT. The goal of the policy was to make Finland a global leader in ICT products and services (2).

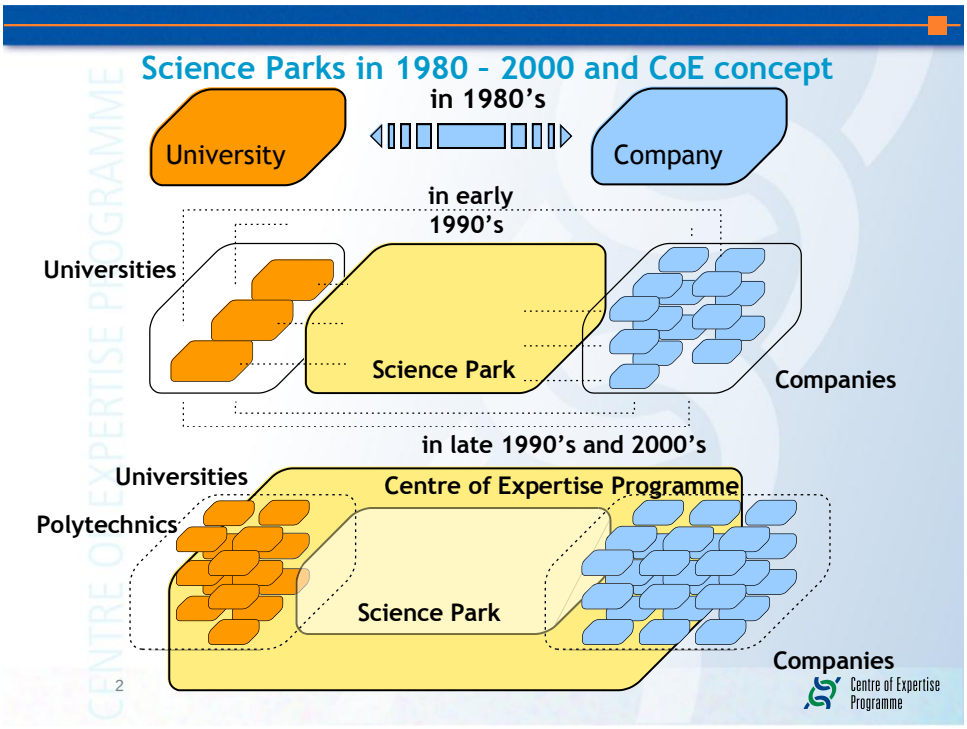
The Innovation Policy aims at the following: 1) promote the overall functionality of the innovation system and the system's ability to renew itself, 2) enhance the knowledge base, 3) improve the quality and targeting of research, 4) promote the adaptation and commercialisation of research results, and 5) secure adequate economic prerequisites for the activities. The continuous development of human resources ensures top-quality competence for the future as well. (3)

The Finnish Innovation System reflects innovation an instrument to economic growth. There is both division of labour between stakeholders and collaboration between public and private sector.

Science Parks and Centers of Excellence are interventions in the innovation system and implementation of the innovation policy. The role of science parks has been collaboration between universities and companies through research programs and R & D in the 1990's. The Science Parks in Finland today provide a place for research collaboration between industry, universities and other agencies. They are also incubators in high technology areas and provide a space for learning.

Another instrument, the Centers of Expertise Progam is a based on regional economic strengths and provides networked programs of collaboration between universities, research institutes, industry, regional and national public agencies. This program aims at building regional high-level expertise.

Figure 1. Science Parks and Centers of Expertise



4. Science and Technology and the Future of Finland: Finnsight 2015

Science and technology have played an important role in Finland's recent development. But how do we face the new challenges posed by the global economy? Finland needs to formulate new approaches to our science and technology, and especially the innovation culture and policy in order to meet the challenges of the next 10 to 15 years.

The public sector and private sector have taken new initiatives to meet these challenges. One of them is The Finnsight 2015 foresight project. It brought together top experts in science, technology, business, economy and social policy to consider how Finland can keep its position among the world leaders in creating new technologies and especially innovations. The work was carried out by Academy of Finland and Tekes, the Finnish Funding Agency for Technology and Innovation. Finnsight 2015 deals with trends in science, technology, business and society that have to be taken into account and utilized when building a common future for the entire society.

There is a shared understanding among all stake-holders that strengthening competitiveness and innovations is a key to Finland's future development and success. It is also understood that the country needs a common vision to meet the future challenges of business and society as a whole. The objective of Finnsight 2015 is to identify focus areas and priorities in the fields of science, technology, industry and the society as a whole, in order to meet future challenges.

The foresight work also helped to define the Strategic Centers of Excellence in Science, Technology and Innovation. The Finnsight work was carried out by expert panels from industry and research and other walks of life. The foresight methodology integrates surveys of the future,

expert's panels and policy analysis. The target is to identify challenges in the science, technology and innovation environment and to asses how to best respond to these challenges. The common vision for science and technology is that the country needs multi- and interdisciplinary cooperation in science and technology, new forms of collaboration and networking.

Some of the challenges of the science and innovation system in Finland were identified as:
1. Public research system needs renewal. In general there is need for multidisciplinary research and collaboration between universities. The division of labor between Academy of Finland (basic research) and The Technology Agency of Finland (TEKES) (applied research) should be revisited.
2. Companies need to invest even more in research and development (not only production). How will that be encouraged?
3. Do the investments in knowledge and competence generate economic growth, employment and welfare in Finland? In other words, is it relevant from the point of view of people?
4. What are the priority areas science and technology and how they will be funded?

The key tasks of the Finnsight 2015 are: 1. identify key driving forces that influence the business, industry and society in Finland, and 2. identify key challenges and priority areas for research and innovation, that promote business and industry competitiveness and, hence the welfare of the society.

The driving forces to impact business and industry and the whole society in the future of Finland are identified as the following ones:

1. Globalization will further increase mobility of goods, services, capital, people, ideas, cultures and values across borders. Inter-dependency between countries, economies and cultures will further increase. Finland will loose traditional and lower-level industrial jobs to other parts of the world, and the economic growth is further shifting to other parts of the world. Market success is no longer dependent on technological innovation only, but requires more information and knowledge on the behavior of individuals and their lifestyles. People have more choices in their everyday life but they also become increasingly vulnerable while life in the globally inter-dependent world becomes more un-predictable, even unstable.
2. Change in the population structure. The aging population in Finland will influence labor markets, consumption and needs for services. Changes in the population structure change the economy and society as a whole.
3. ICTs are opening new opportunities as information and knowledge become accessible everywhere and anytime. This changes communication patterns, work methods and place, and social interaction between individuals.
4. Sustainable development challenges us and requires long-term investments in environment. Climate change, changes in the world's ecosystems, water scarcity and problems, and waste management call for new solutions both in consumption and in production.
5. A competent workforce is crucial for success in any country. There is increasing competition for competent work force globally. In the future we have to invest in skills that integrate scientific and technological know-how with business, cultural, social and legal competencies. A good living and working environment for a competent workforce become increasingly important.
6. Open source becomes more relevant globally. Work becomes independent of time and location as organizations are global and managed through ICT networks. Therefore,

Finland needs a more skilled and competent workforce in this changing, globally networked environment.

7. Multicultural equality becomes important. People are increasingly working in multicultural environments where multicultural equality is a must.
8. Global governance and managing changes requires more international co-operation, regulations, standards and agreements. Nation-states continue to be important players but they will need to work together. Managing risks and security become increasingly important. (4)

5. Science and Technology Policy: Towards Knowledge-Based Economy in South Africa

Science and Technology are seen essential to provide the means for South Africa to become economically competitive on a global scale, and to provide services and infrastructure for the country. The National R & D Strategy of South Africa published in 2002 rests on three pillars:

- Innovation
- Science, engineering and technology (SET) human resources and transformation
- Creating an effective government S&T system.

The current mission of DST Strategy for South Africa (2005/6-2008/10) is:

- To develop, coordinate and manage the National System of Innovation that brings maximum human capital, sustainable economic growth and improved quality of life for all.
- The principal goals of this strategy are:
- To ensure that the National System of Innovation addresses national growth and development goals in both the first and the second economy;
- To develop and maintain a highly competent and representative cohort of scientists in South Africa;
- To ensure that South Africa has world class scientific infrastructure in place;
- To administer an optimal set of funding instruments;
- To respond creatively to global challenges

Finland is currently supporting South African National Innovation System (SANSI) through a cooperation program (COFISA) with Finland. This program aims at:

- promote awareness and coordination of the functions of the SANSI, and facilitate knowledge sharing within the SANSI;
- enhance policy development and Foresighting capacity of SANSI
- Act as a catalyst for the establishment of science parks at the provincial level, (with an initial focus on Gauteng, the Western Cape and the Eastern Cape);
- Support the ongoing operation of science parks through knowledge sharing and funding;
- Coordinate knowledge-sharing and cooperation between all science parks;
- Promote coordination and collaboration with other national and provincial innovation.

mechanisms such as research institutes and centres of excellence;

- Focus on improving communication and collaboration between the national and provincial levels;
- Promote the use of science parks as facilitators of innovation for and by

impoverished communities.

DST's 10-year plan focuses on Innovation towards a knowledge economy. The Economic Cluster of South African government set a 'critical path' trajectory from 2007 towards 2017 that will mobilize government to achieve the national goals of halving unemployment and halving poverty by 2014 and of achieving the 6% GDP growth rate by 2010 target set by the Accelerated and Shared Growth Initiative of South Africa (ASGISA). These instruments of planning and direction-setting for government and the economy both recognize the role of science and technology in developing dynamic economic growth sectors. There is also recognition that research and development is likely to contribute to economic growth in some sectors but not in others.

Whilst the very objective of the Ten Year Plan is to escalate and strategically direct science and technology activities to transform the economy to a knowledge economy, we must not lose sight of the other critical aspects of societal transformation that demands growth in the numbers of black and women scientists, engineers and technology experts and demands that the benefits of government investment have a strong and positive impact on the lives of the poor. As this Ten Year Plan is 'people centred', geared towards growing the research workforce and its capabilities, the national plan striving for service excellence, also underpins the principles-based guiding framework for the Ten Year Plan.

There are two principles of building knowledge-based society in South Africa:

1. The principle of societal accountability for science, people and society: Government is the guardian of issues around ethics, safety, health and environmental issues, and

2. A functioning National System of Innovation. For functioning innovation system, there are the following principles:

    a) The principle of Market Failure. On its own, the market invests too little on R&D, and that investment is typically too short term.

    b) The principle of Completeness: The country must be active along the full innovation chain

    c) The principle of Competitive Advantage: The government should invest in areas of highest return.

    d) The principle of Critical Mass: Investment in any Research Area must be made at a critical mass.

    e) The principle of life-cycle planning: Capital equipment must be planned for on a holistic basis.

    f) The principle of absorptive capacity: The scale up must be consistent for the system to have the appropriate absorptive capacity.

    g) The principle of evidence based policy: There is a need for ongoing monitoring and evaluation to identify bottlenecks in absorptive capacity.

This Ten Year Plan developed by the Department of Science and Technology (DST), presents a set of actions and investments that will drive this transformation, namely: strengthening human capital development; knowledge generation and exploitation; and enablers to address the 'innovation chasm' between research results and socio-economic outcomes. (5)

6. Conclusions

Finland's science and technology policies represent historically longer term investments in knowledge base of society. Science and technology and innovation policy are integrated into economic and industrial policies but also into education policies. The national innovation system functions in collaboration between public and private sector, and there is a division of labour between actors in the innovation system. A small country can also do this easily. There is also a new networked approach to develop strengths of Finland to be able to play a role in global economy.

South Africa has recognized knowledge based economy and investments in education and research to be a strong player in global economy and in Africa. Department of Science and Technology focus on knowledge economy and innovation in its ten year plan 2008-2018. The role of different players in the national innovation system is not clear. However, the focus on innovation chasm, transforming innovations into commercial products and services has been recognized. The Technology Innovation Agency has been established and clusters based on regional/provincial strengths are supported. South Africa is a large country and economy. It has a great potential to create provincial clusters and build collaboration at the national and provincial level. Building knowledge base of society takes years and decades, and building provincial innovation systems by establishing science parks and centres of expertise may provide new platforms for building provincial innovation system that is supported by national innovation system and enabling environment.

References:

(1)Lemola,Tarmo (2001), Management of Engineering and Technology, 2001. PICMET apos; 01. Portland International Conference, Volume 1, Issue 2001 Page(s):483 vol.1 –

(2) Tapper, Helena (2001), *The Potential Risks of the Local in the Global Information Society*. Journal of Social Philosophy, Winter 2000, vol.31, no. 4, pp. 524-534, Blackwell Publishing, USA

(3) Science, Technology, Innovation by Science and Technology Policy Council of Finland Series of publications: Science and Technology Policy Council of Finland, 2006

(4) Finnsight 2015. http://www.finnsight2015.fi

(5) Innovation towards a knowledge economy. The Ten Year Plan for South African (2008 – 2018). DST, South Africa