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FINLAND AS A KNOWLEDGE ECONOMY — ELEMENTS OF SUCCESS AND LESSONS LEARNED

The article is devoted to the analyses of how knowledge can become the driving force in economic transformation and growth on the example of Finland. Although as recently as the 1970s Finland was relying mainly on resource-intensive industries, it is now the most ICT specialized economy in the world. The Finnish experience shows that it is possible to make significant structural changes in a relatively short time. It is also shows that long-term decisions that shape research and education are possible, and indeed necessary, during short term economic crisis, since they provide guidelines for longer-run growth and help create a sustainable competitive edge.

1. Knowledge economy and globalization

1.1. Transition towards Knowledge Economy

Knowledge has become the **major driving force of economic and social development all** around the world. Coupled with **globalization** and accelerated by rapid distribution and transfer of knowledge by information and telecommunication technologies, this development impacts all countries and regions, public institutions and corporate world, and lives and prospects of individuals.

The knowledge economy is based on the generation and adoption of new knowledge created by scientific research and technological development, investments in education and research, adoption of best practices, and openness to social, economic, and cultural innovations. For advanced **industrialized countries** with high labor and infrastructure costs, the knowledge economy offers competitive advantages in high-technology industries and efficient service sectors. For **natural-resource-based economies** it offers improved technologies and higher-value added products with closer customer linkages, as well as a path towards sustainable development. For **developing countries** knowledge offers possibilities to short-circuit development phases, leapfrog technologies, and faster integration into the global economy by becoming more attractive to international investors.

As an example of knowledge economy components, we can mention the rapid development and adoption **of information and communication technologies (ICT)**. In telecommunications it took more than 100 years to build the fixed-line system. In dramatic contrast, in a couple of decades, the number of mobile telephones worldwide grew to 1.5 billion and now exceeds that of fixed-line connections. Bypassing the economic and quality of life costs of digging up metropolitan streets to install telephone cables and marring the countryside with telephone poles, wireless technologies have brought to all countries domestic and global connectivity as well as advanced digital services. These technologies afford information and knowledge access through the Internet to even the remotest and most peripheral regions.

Research and development, creativity and innovation, and higher education are key elements in transition towards knowledge economy. These developments are the subject of intensive studies all around the world. International organizations, such as the **World Bank** and the **World Economic Forum** have linked these developments also with competitive ranking of regions and countries. The rankings show fairly high degree of volatility and thus the possibility of rapid advances or decline and the emergence of winners and losers. This makes it that much more important to study the factors of success and failure in the creation of new knowledge and its conversion to economic and social benefit.

1.2. Characteristics and Assessment of Knowledge Economy

The **World Bank Knowledge Assessment Method** is based on four pillars essential for success. These pillars are:

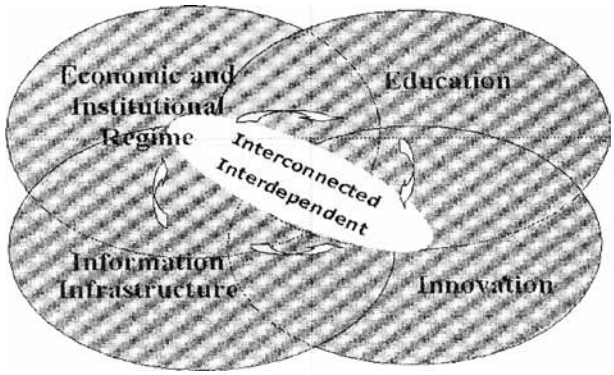
Economic and Institutional Regime provides incentives for the efficient creation, dissemination, and use of existing knowledge.

Education provides educated and skilled population that can use knowledge effectively.

Information infrastructure facilitates effective communication, disseminations, and processing of information.

Innovation system to connecting and assimilating global knowledge, adaptation and creating of local knowledge for economic and social benefit.

Four Pillars of the Knowledge Economy

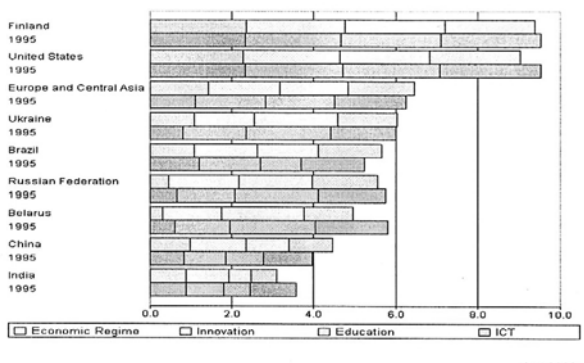


1.3. Russia, Eastern Europe and BRIC Countries

The overall performance of Russia, Eastern European and BRIC are compared with the United Sates and Finland that has been amongst the top-ranked countries in recent years. It should be noted that the rankings over a longer period of time are quite volatile and significant changes have occurred. For instance Finland was in deep economic crisis in the early 1990's but was able to recover and reach top positions largely as a results of good education and innovation performance.



Comparison Group All Countries. Type weighted Year, most recent (KAM 2009)

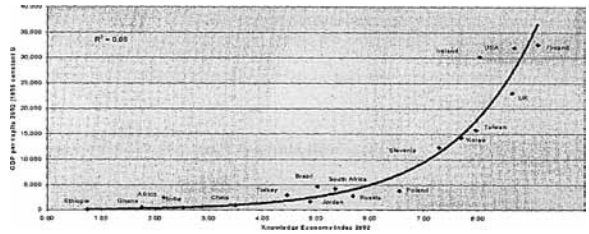


Knowledge Economy Index Comparison Group: All Countries

1.4. Impact of Knowledge Economy and Globalization

The combined effect of globalization and transition towards knowledge economy set new requirements to education and innovation systems. Already today the importance of KE components in the economic performance of countries is illustrated below by the strong correlation of KE-index and GDP of different countries:

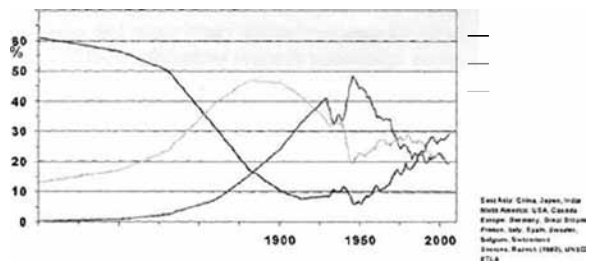
Strong Correlation: GDP/Capita & KEI Regression KEI 2002 and GDP per capita 2002



Source: KAM

The globalization is also rapidly changing the world economy and the comparative advantages of different countries. Large Asian countries that dominated the world economy until the industrial revolution in the mid 1800 are regaining their leading positions in the world economy.

Manufacturing Output by Region in 1750–2005, % of world total



First Unbundling of Industries 1950–2000 Second Unbundling of Services 2000

Because of very competitive labor costs and huge domestics markets China is attracting direct foreign investments and growing at a rate of 9 % annually. But is also becoming a major player in R&D whose investments will soon exceed those of the European Union. Also India is growing fast and has become a major platform of software and service industries.

The rapid economic growth and industrialization East Asia results in a new international division of labor. Many labor intensive industries, such as textile and shoe industries, have moved away from Europe and United States to low cost manufacturing countries. This «first unbundling» has been driven by lowering international tariffs and low-cost containerized shipping and has taken place during last fifty years.

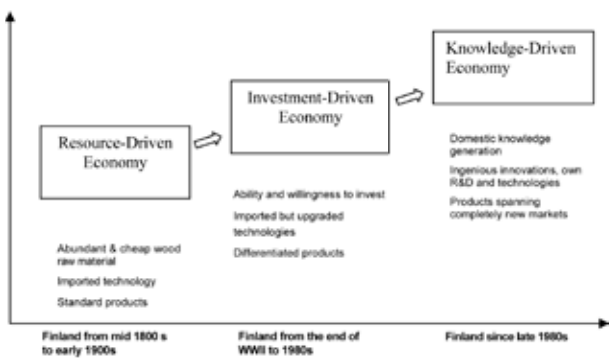
The «second unbundling» affects the tasks inside organizations. For instance accounting work done at the back office of a company can be outsourced, maybe first to a local accounting company but very soon to a low cost country like India. We have already seen much of software industries to move such countries. The second unbundling is likely to happen much faster than the earlier first unbundling. International competition has largely become a competition of investments and the most talented people.

1.5. Stages of Industrial and Economic Development

A typical path to a knowledge-based economy comprises of three stages of industrial development: the resource-driven, investment-driven, and knowledge — or innovation-driven stages.

In the factor — or resource-driven stage of an economy, the competitive advantages of growing and internationally successful industries are based almost solely on the basic factors of production and imported technologies. In the investment-driven stage firms expand their operations by investing in the best technologies available often developed domestically. In the knowledge-driven stage, there is usually a wider range of internationally competitive industries and firms, even in smaller economies. However, a substantial portion of these industries and industrial clusters draw their competitive edge from traditionally strong sectors. Self-created and sophisticated factors of production are crucial for competitive advantage and firms compete in global markets with differentiated goods.

In the case of Finland shown below the three stages span a time horizon of 150 years starting with forest industries and then only lately shifting into knowledge economy. Clearly today these changes occur much faster and many many natural resource based countries want to accelerate the diversification of their economies towards knowledge economy.



Sources: Adapted from Porter (1990) and Hernesniemi and others (1996)

Tunisia clearly has opportunities in all three development stages. For instance, agriculture based food industries can develop higher value added and better branded products. The existing industries can improve productivity and competitiveness by injection of new technologies. And the best research results can be basis of new high tech industries, initially often with international partners.

2. Innovation systems for enhanced competitiveness

Knowledge economy is based upon creation of new knowledge by scientific research and technological development. However, access to this knowledge is only a necessary condition but not yet sufficient for the success of transforming it to economic and social benefit. Large differences are found in this ability and hence the elements of success and failure and best models of achievement are of great interest.

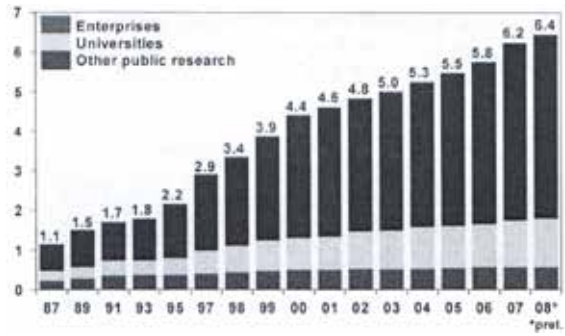
2.1. Research and Development Input and Output

Research and development investments are the basic input to knowledge economy. At an aggregate national level they are measured as the share of GDP invested. The OECD average is about 2.4% of GDP with USA and Japan investing about 2.8% and European Union about 1.9%. The ambitious goals for EU countries set forth by the Lisbon Summit in 2000 call for significant increases reaching about 3% level by 2010 with two thirds coming from private sector. The R&D investments are doubling in EU budgets — the 7th Framework Program for R&D budget is 54 billion euro. Still most of the proposed increases have to take place at national level

Finland has rapidly increased its R&D investments that today exceed 3% of GDP and largely come from Private sector.

R & D Expenditure in Finland

Billion euros



Source: Statistics Finland

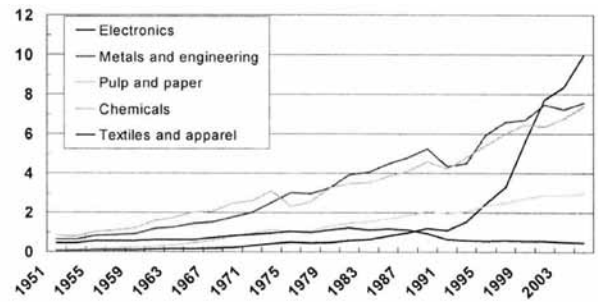
What is the **result of R&D investments and how to measure them**? Classical methods include publication and citation records, advanced degrees and international rewards, patenting activities and creation of new industries. But one would like to

see the impact on the national level measured by **structural changes of the economy**.

In Finland such a change is clearly illustrated below by the rapid growth of **high technology production**. The high technology exports accounted for about 5% in Finland fifteen years ago. The exports were largely dominated by forest industries, which still play a major role in the economy, and today at the global level. However, dependence on the cyclical commodity industry was vulnerable and required frequent devaluations of the currency. Today this is not possible due to common Euro currency regime.

Industrial Production (at 2000 prices)

Billion euros



Source: Statistics Finland. ETLA

2.2. Traditional Versus High Tech Industries

The division of industries in low and high technology categories can be very misleading. Today **all industries need to employ high technology** contributions to maintain their competitiveness (Fig. 1).

It is also very important to secure **the competitiveness of small and medium size companies**. More and more they also need to have export capabilities and face global competition. They need to have access to the best technology but typically can not afford to have there own research personnel and facilities. Hence they need access and collaboration with research capacities of universities and research centers. Such links are particularly strong for small and medium size companies in Finland.

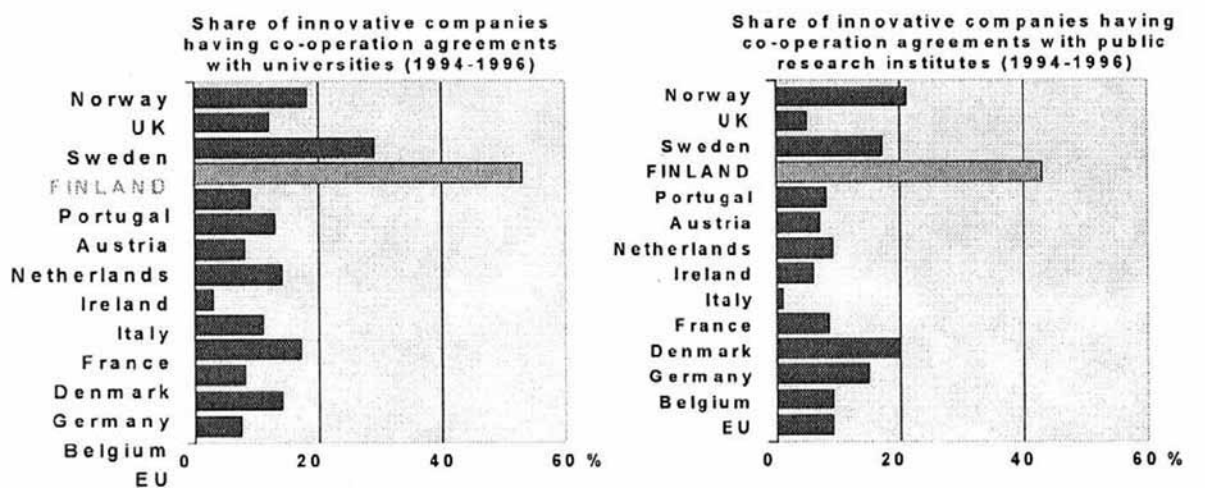
2.3. Competitive Funding and Integrated Innovation System

The key element of a successful R&D funding system is the independence of funding agencies and an appropriate balance between institutional competitive funding.

The **independence of funding agencies** from policy formulation organizations, such as ministries of education and research, lessens the pressures for political favoritism, allows flexible use of funding instruments and financial engineering as well as building up competent funding agencies with highly qualified personnel.

The **competitive funding** is closely related with independent funding agencies. Institutional funding is needed to assure the functioning of the basic educational and research institutions, but it needs to be complemented by competitive funding that offers many advantages. First new fields, such as nanotechnologies can be launched much faster than trying to redirect old institutions in related fields. Secondly, competitive funding makes it possible for talented and entrepreneurial researchers to receive much larger resources and thus encourage new initiatives. Thirdly, it is easier to set up **multidisciplinary projects** and **university-industry partnerships** to assure the utility of especially applied and technological research. And fourthly, since all international funding is competitive experience on a national level is mandatory for international success, as in competitive sports.

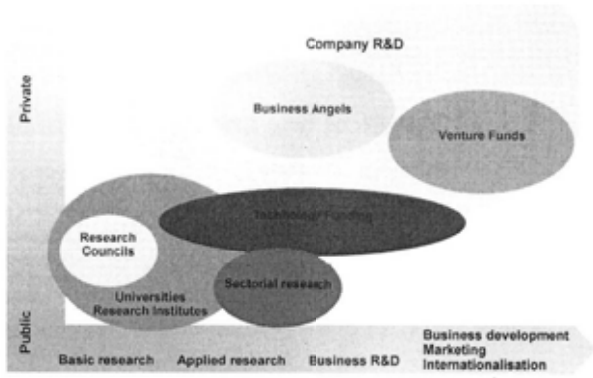
Fig. 1. *Cooperation between companies and universities and research institutes*



Source: Eurostat. Enterprise D G. 2nd Community Innovation Survey

Innovation funding systems also need to fully integrated so that no gaps are left in the support systems. Here again, funding agencies have a much better chance for success including public private partnerships than sector-based schemes. Such an **integrated funding system** is shown below indicating the role of different organizations.

Innovation and Funding System



The role of the public sector is to finance the basic and applied research at universities and sector research shown in the lower left hand corner in the graph. Most developing countries only have this part of the innovation system funded. Even in this area there should be flexible and targeted research based on competitive funding. For instance in Finland universities get less than half of their research funding from the government budget and the rest comes from competitive and private funding.

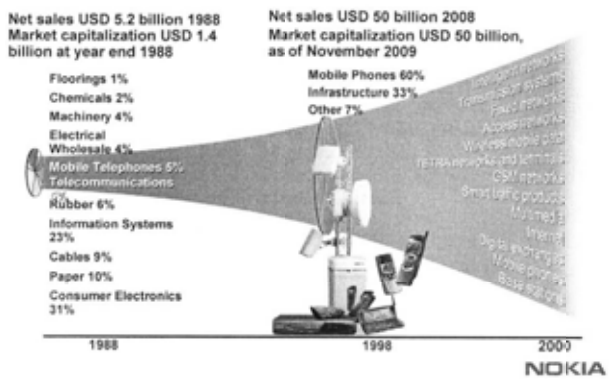
Public-private partnerships are essential in the applied and business R&D. Applied research without industrial partners seldom leads to economic benefits and creation of new employment. Public-private partnerships bring essential benefit also to university research. It brings projects with clearly set goals, budgets and time tables, and offers students pathways to employment in the participating companies. Publicly financed technology funding plays thus a very important role in the innovation system. It should use flexible financing instruments, that is grants for universities and small and medium size companies, risk loans for larger companies, and strategic research programs for complete sectors of industry. Such strategic programs can pull together all players in specific areas, both on industry and university and research side. In these programs research must serve the industry who should have the steering and be in the driving seat. «Technology is the answer but what is the question» is often the best starting point.

The creation of new high technology companies calls for private and institutional venture funding. Their role is very important for diversifying the economic structures. The high technology industries are characterized by narrow time windows, immediately international or even global markets and hence by large development and capital needs. Organic self financed growth is seldom possible and venture capital is needed. The public sector has important roles in venture capital, although it basically belongs to the private sector. The government can adjust the risk-reward balance by tax and amortization rules to attract domestic and international investments. The public sector can help to start venture capital industry and accelerate its growth by matching investments in venture funds. Such funding can also be asymmetrical favoring private investments, for instance by being content with return of capital and leaving profits to be shared by private investors. Typically also the investment decisions need to be left to competent managers rather than to government officials.

2.4. Telecommunication and Network Economies

Finland as a whole has greatly benefited from the phenomenal success of Nokia Corporation in the telecom industries. What started as a minor side avenue grew into the world's largest telecom company in a short time. This helped to introduce rapidly ITC technologies in all fields of the society.

Telecommunications and Nokia's Change



We now see the convergence of different platforms and channels into wideband systems. Telecommunication has the potential of eliminating the disadvantages of peripheral locations and becoming an **equalizer of opportunities**. Access through Internet and mobile communications helps to establish presence and collaborations on the global scale. This has accelerated the adoption of new design and operational tools for all industries as well for service sectors, including banking and financial services.

Services in the Mobile Information Society



Knowledge economies are evolving towards network systems where small research studios can be in collaboration with or serve as embryos for large international corporations. They resemble biological systems with multiple interactions and specialized tasks for different subsystems. The evolution **towards network** economies is accelerated by modern telecommunications linking scientists, industrialists and policy makers all around the world.

3. Consensus building and national strategies

How has such a growth in R&D and other Knowledge Economy pillars been achieved and maintained even in difficult economic times, and especially during them? How to **convince policy makers** of such investments that typically bring fruit at a much later time, if even then? And how to measure the results and effectiveness of such investments to guide them in the optimal direction? These are questions closely related to the development of knowledge economies.

Innovation is a profitable investment for the future



In Finland an important consensus instrument enhancing the political commitments has been also a series **of economic policy and national strategy programs** organized by Sitra, the Finnish Innovation Fund. The participants have included most new members of the Parliament and hence also future ministers and political leaders, industrial, labor market, university and media leaders having an active role in the economic policy formulation. The programs have covered fiscal policy related to budget planning and monetary policy, and structural topics related to globalization and integration, industrial sectors and agriculture, education and research policies, energy and environmental topics, etc. However, the most important part has been an exercise taking form of economic policy formulation at the national level. This illustrates the conflicting goals of economic growth and employment on one hand and the balance and low inflation targets on the other hand and the use and impact of different economic policy instruments. These courses have also supported **effective innovation policies and increasing R&D investments** for improved competitiveness and new knowledge industries.

It is also important that the innovation policy questions are placed high enough in the agenda of public and corporate decisions. In Finland the highest policy organization **is** the **Science and Technology Council** chaired by the Prime Minister and including Ministers of Education and Trade and Industries, and maybe very importantly also the Minister of Finance.

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