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KNOWLEDGE ECONOMY DEVELOPMENTS IN FINLAND – INFORMATION SOCIETY AND CONSENSUS PROGRAMS

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1. KNOWLEDGE ECONOMY

Knowledge Economy, Information Society, Innovation Systems, and Consensus Programs are discussed in this paper in the wider context of structural changes in the economic development. These trends are illustrated by **developments in Finland** which has been ranked on the top in many recent competitiveness evaluations. Some of these experiences can be shared and can serve as useful models also in other countries. However, each country must develop its own strategies, as discussed in our e-Brasil conference.

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.

The analysis and results presented here relate to the studies in Finland and the recent World Bank book **"Finland as a Knowledge Economy – Elements of Success and Lessons Learned",** the Overview of which is available the web site

http://info.worldbank.org/etools/docs/library/201645/Finland_ES.pdf

Finland has managed to emerge from a deep recession and economic crisis in the early 1990's as the top-ranked country in recent rankings of knowledge and competitiveness indexes. This possibility of rapid change is encouraging and the lessons learned can be useful to other countries, including the transition economies and developing countries.

1.1. Characteristics of 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)**, such as wireless mobile telecommunication. It took more than 100 years to build the fixed-line telephone system in industrialized countries. In dramatic contrast, in a couple of decades, the number of mobile telephones worldwide recently reached 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, poorest, and most peripheral regions.

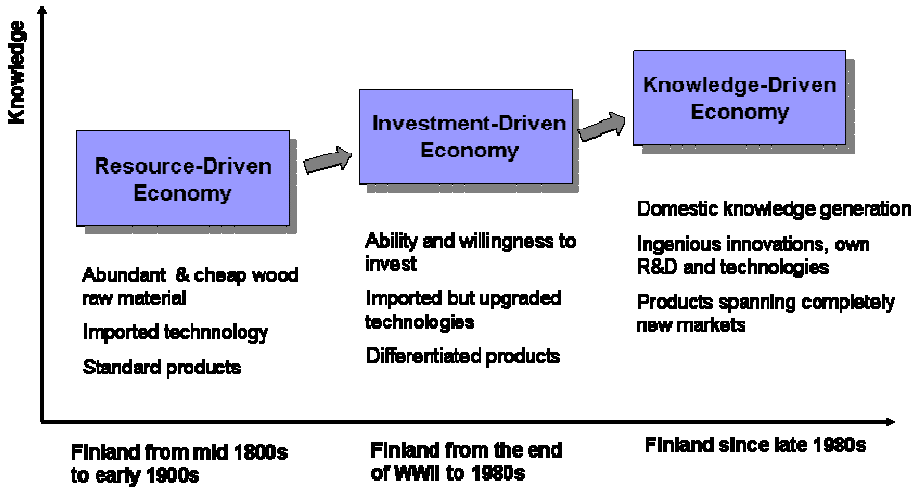
In recent years, the **economic theories** pertaining to the knowledge economy have been the subject of intensive research. They often are characterized by positive feedback and turbulent evolutions resulting in **virtuous or vicious circles** of development. For instance, high-technology industries differ significantly from traditional industries. Their products typically have short life cycles and narrow time windows, immediate international or even global markets. Consequently, the high-tech industries are characterized by high research–and often also by high capital–intensity. Their cost structures are

dominated by development expenses and marketing efforts rather than by manufacturing and material costs.

The conversion of knowledge into economic and social benefits requires good **innovation systems**, including **highly qualified personnel** and efficient technology transfer and venture capital. However, equally and perhaps even more important than the creation of new high technology industries is to maintain and improve the performance and competitiveness of traditional industries by providing them access to high technology and knowledge.

The new knowledge environment offers many opportunities to active players. Rapid growth leading even to world market dominance is possible as illustrated by many success stories around the world. On the other hand, these same characteristics can lead to greater polarization between **winners and losers**. International competition is strengthening the demand for the most qualified people and for international investments. Hence, the questions of **social inclusion** and avoiding the **digital divide** call for attention.

The study of the knowledge economy derives from a simple examination of the historical phases of development along the lines of Michael Porter. 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 as illustrated for Finland below.



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

While describing the characteristic features typical of different development stages of the economy, the framework also gives insights into the different roles of policies in the different stages. Obviously, **different policies** are appropriate **at different phases**. The three stages cannot be strictly separated from one another. Rather, they overlap and certain features of each can be identified throughout, starting from the initial stage of early industrialization.

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. There is very little national production of investment goods. Firms rely on technologies developed elsewhere; primarily inexpensive and widely available technologies are used. The economy remains sensitive to fluctuations in the world commodity and capital markets. The growing prosperity can be channeled partly to nationally vital investments and export revenues help to build an economic infrastructure and institutions, such as educational and financial systems.

In the **investment-driven** stage national competitive advantage is characterized by the willingness and ability of firms to expand their operations by investing aggressively in modern and efficient production technologies and facilities. The firms tend to acquire the best technologies available. Foreign technologies are not only applied but also improved for own purposes. However, firms still compete with relatively standardized products using efficient methods of production. Industry and economic policies

are geared toward enhancing investment by channeling capital toward particular industries, providing tax incentives, and using aggressive exchange rate policies to boost exports.

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. Many innovative firms and industries emerge in fields that have strong linkages with traditional ones. Entrepreneurship increase domestic rivalry and innovations are spurred by increased competition in the product market. Self-created and sophisticated factors of production are crucial for competitive advantage and firms compete in global markets with differentiated goods.

1.2. Knowledge Economy Studies

Theknowledge economy plays an increasing role in all countries. In order to understand its functioning, challenges and opportunities for development the **World Bank Institute** have conducted the following country studies :

Korea and the Knowledge-based Economy – Making the Transition, 2000.

China and the Knowledge Economy – Seizing the 21st Century, 2001.

India and Knowledge Economy – Leveraging Strengths and Opportunities, 2005.

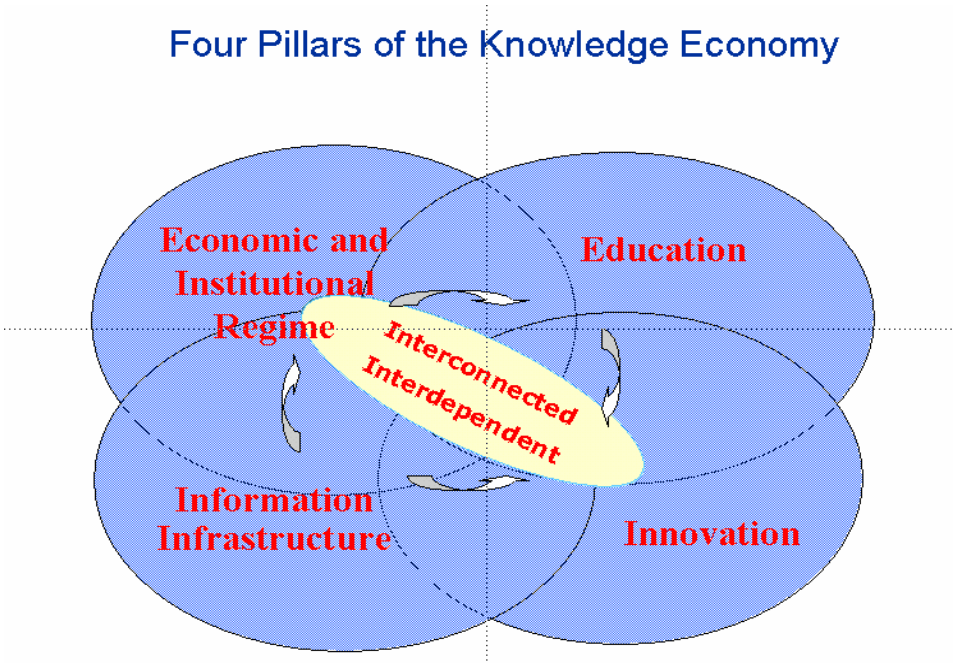
Finland as a Knowledge Economy – Elements of Success and Lessons Learned, 2006.

The role of knowledge in development and in the changing economic structures should have impact on the policies, instruments and priorities. To what extent investments in traditional infrastructures could and should move towards knowledge economy components? What are these components at different levels of development and what are best opportunities for investments?

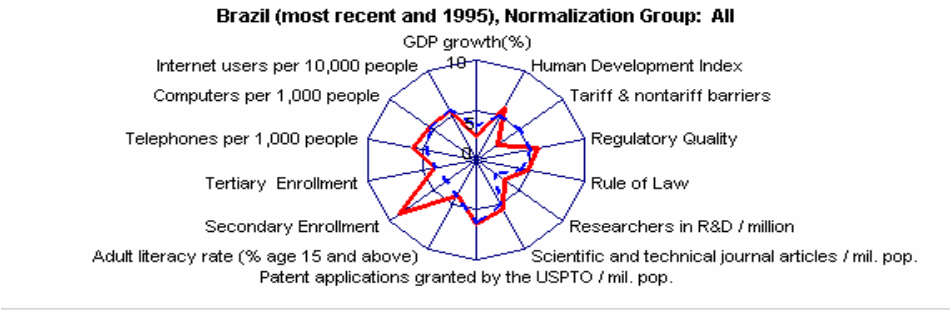
These studies also have a role in formulating policies for economic and social development. Policy makers need to formulate their own assessment for what is most beneficial for their countries. Duplication of success stories or avoiding wrong choices by others is not easy or even possible in most cases. But learning from the experiences of other countries is certainly recommended in the global world.

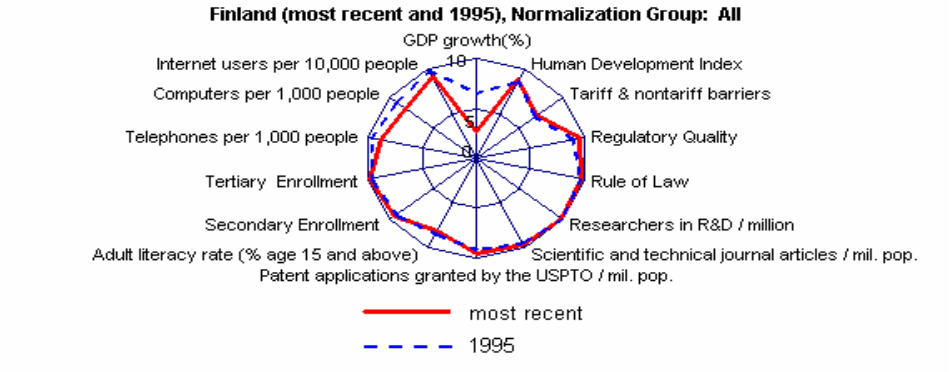
The World Bank **Knowledge Assessment Methodology** is based on four pillars essential for success as listed and illustrated below.

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.



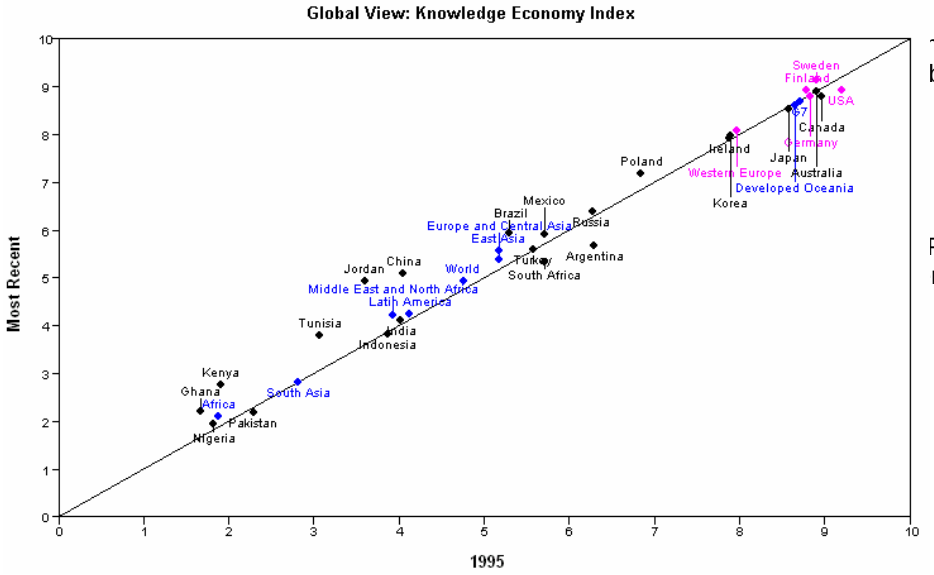
The four pillars are interconnected and interdependent. They can be disaggregated to more detailed indicators, as illustrated in the country profiles of Brazil and Finland. Similar profiles and comparisons to global and regional areas are available for all countries.





The overall picture and comparisons with various regions and countries are given in the next using the **aggregate knowledge economy index (KEI)**. Figure also suggests that there is strong persistence–at least over the medium term–in the group of advanced knowledge economies. However, taking a longer horizon, there are examples of rapid structural change and even of leapfrogging.

Knowledge economy index by countries and regions, *1995 and the most recent year*



2. EDUCATION SYSTEMS FOR KNOWLEDGE ECONOMY

Education is the key element of a knowledge-based, innovation-driven economy. It affects both the supply of innovation and the demand for it. Human capital and skilled labor are complementary to technological advances: new technologies can not be adopted in production without sufficient workforce training and education. On the other hand, the demand side also is important. Innovations may not take place due to a lack of demanding customers and consumers.

Equality by gender, region, and socioeconomic background are fundamental principles of a good education policy. Everyone needs to receive a good basic education. Furthermore, it is the goal of the educational system that no one relies on basic education alone. Previously, equality was considered **quantitatively**, and the distribution of schools and access to them were measures of equality. Nowadays, equal **quality** of education for everyone is the goal, and individual learning results are the measure of interest.

In the knowledge economy, in which the majority of the jobs involve information gathering, processing, and production, proficiency in these basic literacy skills forms the foundation for the efficient functioning of the society. Basic education provides the basis for developing these skills. Equal opportunity to acquire education is necessary for **recruitment of the best talents** needed for knowledge economy development.

The vision of lifelong learning lies at the heart of the Information Society strategy of the European Union (EU), outlined in its **eLearning Program**. A major driver for this objective resides within the rapid demographic change of labor force and the need for continuous education. Network-assisted training has been suggested as a means for flexible and efficient “change of generation.”

The development efforts on **Internet-based schooling** have produced a range of virtual learning environments and large differences exist among and within countries in the use of information technology in schools.

For the development of online tertiary level education in Finland, the Finnish **Virtual University** (www.virtuaaliyliopisto.fi) was established for 2001–2004 as a cooperative project organization among all 21 Finnish universities. Its goal was to harmonize universities’ information systems and to share services to benefit students, teachers, researchers, and administrators. The organization has initiated the development of a national database for virtual courses, and that includes online student counseling. The teaching staff, in turn, is provided online access to tools, materials, and support for the design and

implementation of virtual courses. The ultimate aim of the Virtual University project has been to establish originated operating models and services as part of permanent activities of universities.

3. INNOVATION SYSTEMS

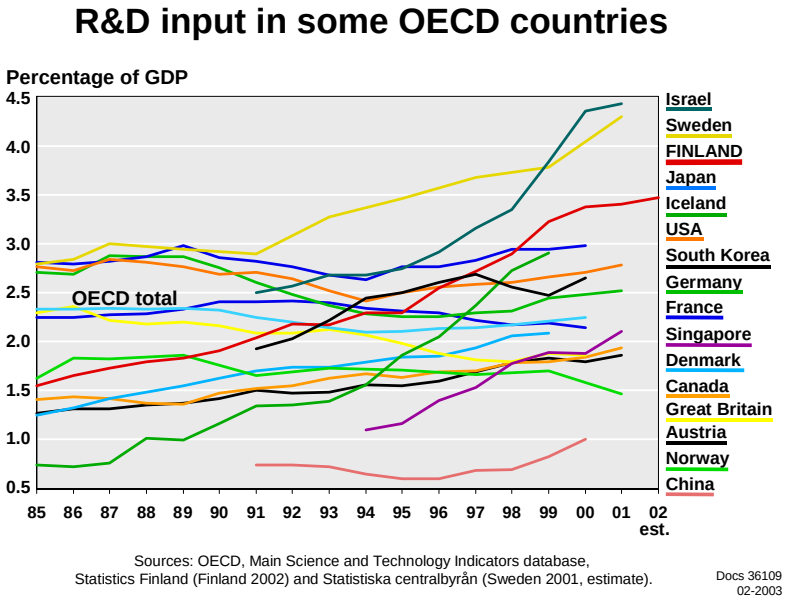
Knowledge economy is based upon creation of new knowledge by scientific research and technological development. However, access to this knowledge is only a necessary condition but not yet sufficient for the success of transforming it to economic and social benefit. Large differences are found in this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

3.1. 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 % while European Union level is about 1.9 % but actually decreasing due to the enlargement process bringing into EU new member countries with lower R&D investment levels. On the other hand, the ambitious goals set forth by the Lisbon Summit in 2000 call for significant increases reaching about 3 % level by 2010 and contributing to the goal of improving the competitiveness and dynamism of the EU as a whole.

The European Commission proposal for the next five years calls for major structural changes in the budgets and the financial perspective reducing the agricultural subsidies currently accounting for about 40 % of **EU budgets** and increasing the research investments significantly – all the way from the current €17.5 Billion of the 6th Framework Program to **€54 Billion of the next 7th Framework Program** whose length would be also extended to seven years.

While the numbers referred to above give average investments, large variations between countries occur as illustrated below.



USA, Japan and Germany have traditionally been heavy investors in R&D while recently Israel and Sweden have surpassed their levels. So has Finland whose investments have risen at a record rate from 1.5 % level in 1985, and from less than 1 % level earlier, to the current investments amounting to 3.6 % of GDP.

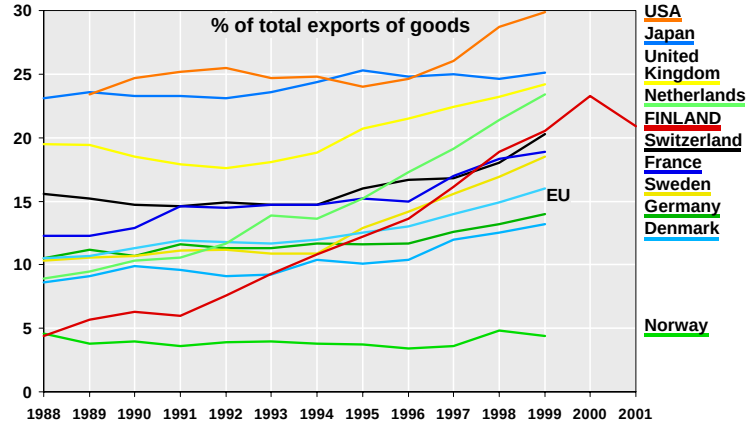
What is the **result of R&D investments and how to measure them**? Classical indicators include publication and citation records, advanced degrees and international rewards, patenting activities and

creation of new industries. But one would like to see the impact on the national level measured by **structural changes of the economy**.

Such a change is clearly illustrated below by the **share of high technology** part of the exports. The share expressed on percentage scale up to 30 % would typically be larger for a large country when comparing countries of similar technological developments. For instance the United States has a rather closed economy where foreign trade represents a smaller share than in a small country that needs to trade also basic materials, such as food, textiles and construction materials. The US exports are to a larger extent high technology products, such as computers and software, pharmaceuticals and aircraft leading to a high percentage.

The share of high tech exports in some OECD countries 1988-2001

Exports of Finnish high tech products totalled 9.9 billion euros in 2001, i.e. 21 % of total exports of goods.



Source: Statistics Finland, according to the OECD product catalogue defined in 1995

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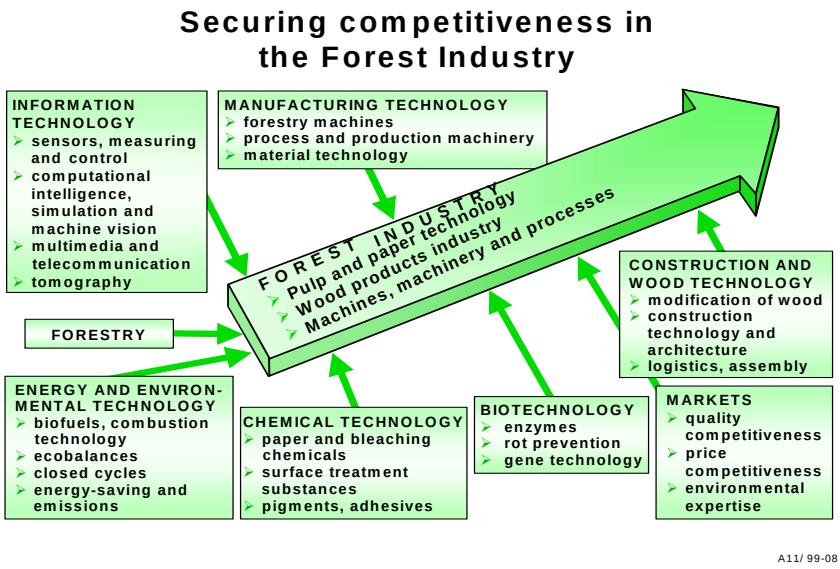
High technology exports accounted for about 5 % in Finland fifteen years ago. Exports were largely dominated by forest industries, which still play a major role in the economy, and today at the global level. However, dependence on the cyclical forest industry made the Finnish economy vulnerable and required frequent devaluations of the currency. Today this is not possible due to common Euro currency regime.

The increase in the share of high technology exports to the levels of over 20 % has diversified exports as a whole and reduced dependence on a single industrial sector. It has also brought a significant positive balance to the high technology trade where exports are about double compared to imports. This achievement of major structural change is of world record magnitude, largely based on telecommunications industries, new high-tech companies and knowledge industries.

3.2. Traditional Versus High Tech Industries

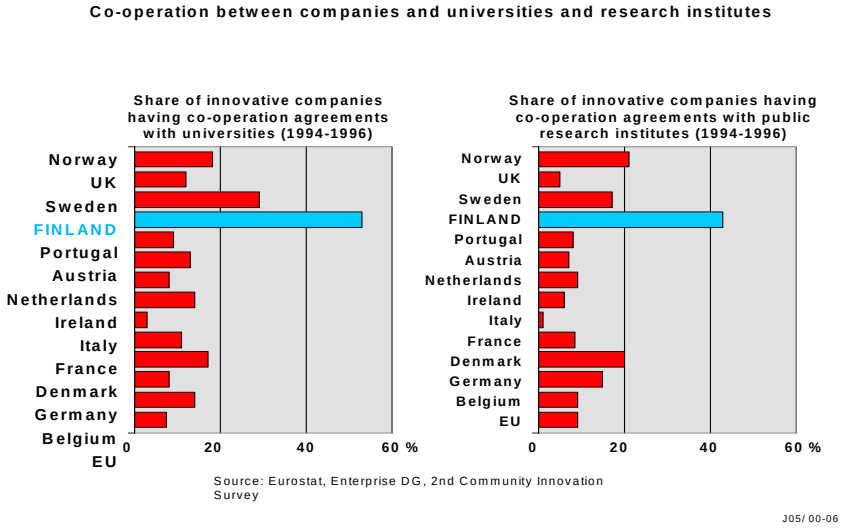
The division of industries into low and high technology categories can be very misleading. Today **all industries need to employ high technology** contributions to maintain their competitiveness.

For instance pulp and paper industries are today very high-tech industries. Paper machines run at speeds of 120 km/h in manufacturing multicoated papers. Much of the development work for forest industries has been done in other industrial sectors and the results have then been injected into the forest industry sector. Thus the forest industries have maintained their competitiveness and profitability, and have grown into the world dominance.



The situation is very similar in other traditional industries and also in agriculture. The erosion of employment cannot be compensated by creation of new industries if the traditional sectors are left in decline.

It is also very important to secure the **competitiveness of small and medium size companies.** 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.



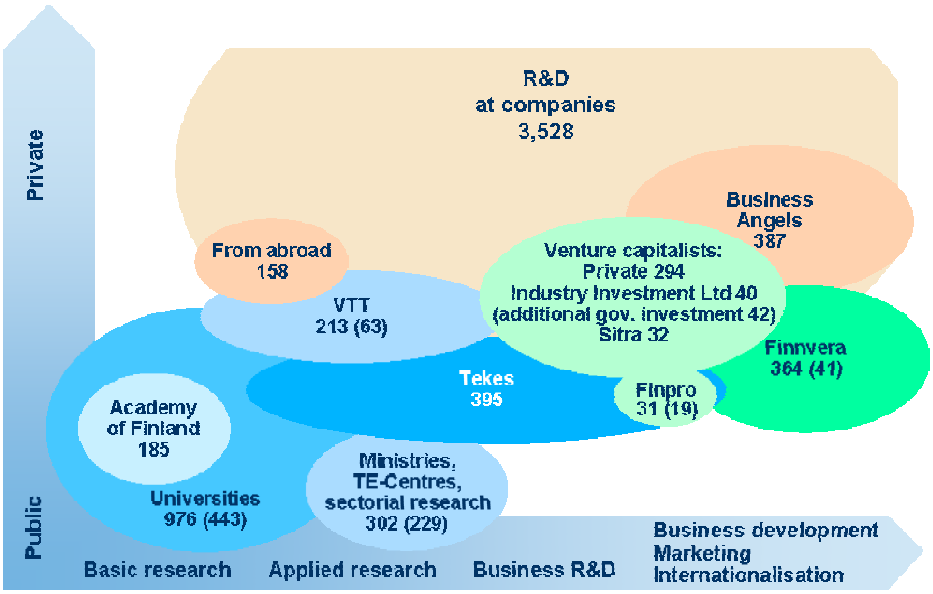
3.3. Competitive Funding and Integrated Innovation System

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 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. In many countries the **institutional funding** still plays the leading role in innovation funding. In such a system money diffuses down the system and an individual researcher has to be content with the success of his bosses in securing resources. 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, it is easier to reorient funding than institutions. Thus 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. Thirdly, it is easier to set up **multidisciplinary projects** and **university-industry partnerships** to assure the utility of 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.

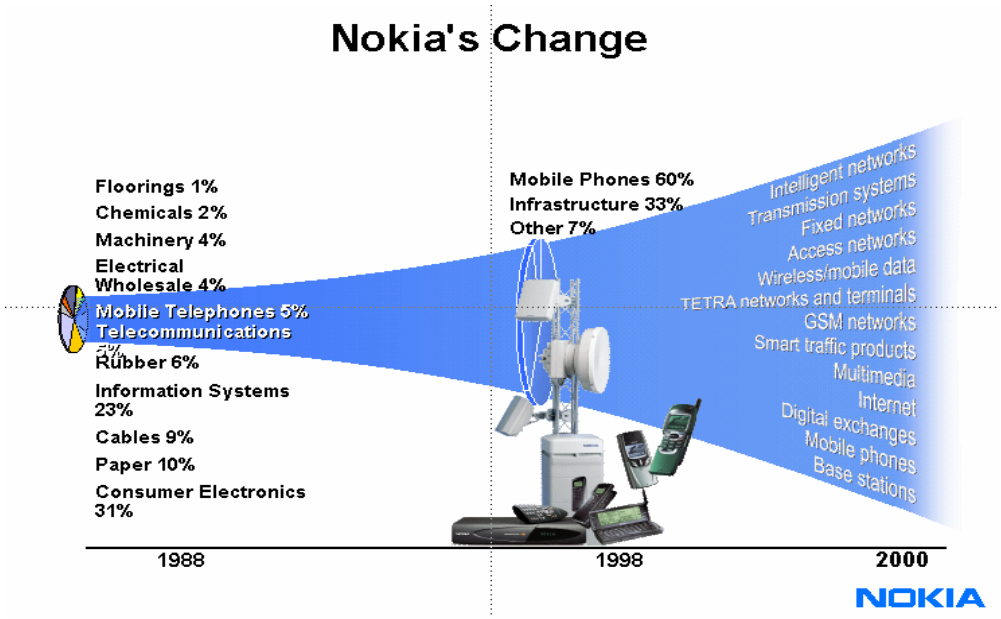
Innovation funding systems also need to fully integrated so that no gaps are left in the support systems. Here again, funding agencies have a much better chance for success including public-private partnerships than sector-based schemes. Such an **integrated funding system** is shown below for Finland being result of already several decades of planning and development of innovation polices.



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 most importantly also the Minister of Finance.

4. INFORMATION AND COMMUNICATION SOCIETY

In **Finland** the move to knowledge-driven growth was closely linked to the **emergence of ICT and Nokia success in mobile telecommunication** in the late 1980s and emergence as the leading mobile telephone company in the world with some 35 % market share.



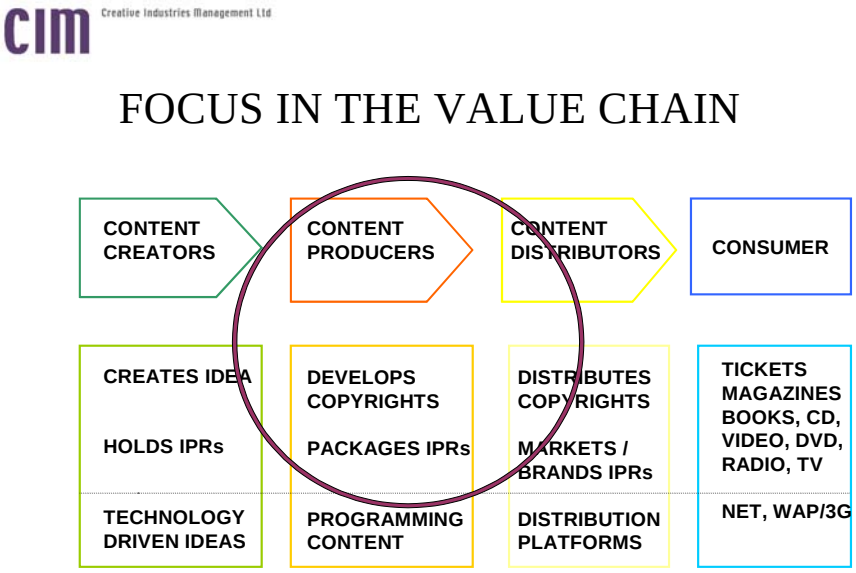
However, ICT industry had started already in the 1960s by supplying process control, factory automation, and information technologies to the key export industries. An important aspect of this stage of industrialization was also the opening up of the economy, when the internationalization of production really took off. The role of policies changed dramatically during this time. **Innovation and technology policies** became the focus of overall industry and economic policies. The basic policy orientation shifted from traditional market interventions toward upgrading and creating sophisticated production factors and improving the overall business environment.

In the future we will 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.

Knowledge economies are evolving towards network systems where small research studios can be in collaboration with large international corporations. The evolution towards **network economies** is accelerated by modern telecommunications linking scientists, industrialists and policy makers all around the world.

The explosion of the number of new communication channels has created a great demand for new content, for instance in the mobile information society. **Creative content industries** represent the next wave of evolution after technologies. The very paradigm of value chains is changing rapidly. The monopoly of distribution companies is disappearing and the focus of investments is changing from distribution to content production. Entrepreneurial companies seeking channel-independent distribution will do increasingly content production.



The content industries require local presence and global access. Not every country can have global information and communication giants, but they all need to be active in content creation based on **local needs, languages and cultures**.

4. CONSENSUS PROGRAMS AND NATIONAL STRATEGIES

Economic Policy and National Strategy programs organized for key decision makers in Finland have contributed in an important way towards knowledge economy by building consensus in domestic economic and social policies and in wider international areas. Today many countries are expressing an interest in sharing these experiences.

Reaching consensus on economic and social policies is not easy nor desirable unless based on open debates. Policy objectives related on one hand to economic growth and employment and on the other hand to budget and trade balances and low inflation are often conflicting. In the short term, growth and employment gains can be obtained at the expense of balance and inflation while in the longer run such perceived benefits are quickly lost. Furthermore, the priorities attached to these different objectives is a matter of political preference. A young person entering the labor market prefers growth and employment while a retired person with fixed income favors stability and small inflation. One of the principal lessons is that economic policy is a policy of trade-offs and one important result is the emphasis on long-term structural investments.

Programs in economic policy management and national strategies have been organized by Sitra, the Finnish National Fund for Research and Development since 1977. More than 1500 policy makers have attended these programs. The participants include most members of the Parliament during their first term, other decision makers in public sector, and industrial,economic, labor and media leaders.

The length of the management programs is one to two weeks including visits to relevant organizations. Programs are structured to define the policy objectives and to choose the policy instruments, such as taxation structures, distribution of resources in different sectors, investments and incentives, and interest and currency policies that before the recent euro currency regime were of great importance on national level.

Some 20-30 lectures are given by the best domestic and international experts, each followed by a thorough discussion. They start with fiscal and monetary policies, then proceeds to structural questions in different sectors and end up with discussion of long-term development options.

The most important part of the program is the common exercise of defining the policy objectives and the budgetary and other instruments to reach them. Participants take a role in the government with a shadow cabinet where they play the roles of the different ministers. The exercise is supported by competent economists and the best simulation models for the national economy, typically the same models as used by the Ministry of Finance and the Bank of Finland. Participants can request briefings by the different government agencies, just as would a parliamentary commission.

The above objectives are only means of ensuring more general societal goals, such as quality of life, equal and fair opportunities, wealth generation and its distribution, balance between competitiveness and social security, environmental aspects and sustainability. Here legitimate differences in opinions remain and are encouraged, but it is important that there is a reasonable common understanding or consensus of causes and consequences of different policies.

Since Finland joined the European Union many policy issues have become more international and the horizons of Finnish corporate world have become global. The economic policy management programs have hence been complemented by distinctively internationally-oriented programs. Issues of European integration and currency regime, international organizations, World Trade Organization and World Bank issues, and developments in China, Japan, Russia and United States have been brought to focus. The program includes international speakers and includes studies and visits to the organizations and countries mentioned.

The interest of the Parliament of Finland in future studies and policy formulation is exemplified also by the establisment of the Committee for the future as one of 15 standing committees that today is still the only of its kind in the world. Its task is to conduct active and initiative-generating dialogue with the government on major future challenges. The committee has been given also the special task of following and using the results of research on future trends (see www.parliament.fi).

The beneficial experiences of the economic policy and national strategy programs in Finland are of interest to many other countries. These questions are today in the focus of good governance issues in public and private sector in efforts to advance the best practices around the world.

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Academy of Finland
http://www.aka.fi

www.research.fi

http://virtual.finland.fi/

CIM Creative Industries Management
http://www.cimfunds.com

Etla, the Research Institute of the Finnish Economy
http://www.etla.fi

European Union Research Programmes
http://www.cordis.lu/en/home.html
http://europa.eu.int/comm/research/

European Venture Capital Association
http://www.evca.com

Finnish Venture Capital Association
http://www.fvca.fi

Information Society Programme of Finland
http://www.infosoc.fi

Institute for Strategy and Competitiveness, Harvard Business School
http://www.isc.hsb.edu

Parliament of Finland, Committee for the Future
http://www.parliament.fi

Sitra, Finnish National Fund for Research and Development
http://www.sitra.fi

Tekes, National Technology Agency of Finland
http://www.tekes.fi

World Bank and World Bank Institute
http://www.worldbank.org

World Economic Forum
http://www.weforum.org