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Economic policy from an evolutionary perspective: the case of Finland

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Abstract (max. 150 words)

In the last decade, the Finnish economy has shown an unprecedented recovery, after being hit by a deep crisis in the early 1990s. The paper views and interprets this successful transformation process based on ICT from an evolutionary perspective. Although the rapid pace of the restructuring of the Finnish economy suggests a break with the past, this remarkable recovery was firmly rooted in its economic history. In addition, Finnish public policy played its role in turning Finland into a knowledge economy. Although a master plan for the Finnish economy was lacking, many policies worked out quite well together over an extended period. Building on education, research and technology policy initiatives taken in the 1970s and 1980s, the deep economic crisis in the early 1990s paved the way for new policy directions, with a focus on network-facilitating innovation policies.

1 Introduction

In the 1990s Finland went through an economic transformation not seen before in any of the Western European or OECD states in the post-World War II era (Rouvinen & Ylä-Anttila 2003). The 90's was a watershed in the evolution of the Finnish economy: the country began the decade with a severe economic depression, marked its middle by joining the European Union, and found itself in the end of the decade as one of the most competitive economies not only in Europe but in the world (Werner, 2003, 1). At least for now, restructuring has resulted in significant increases in growth rates, high-tech exports and national wealth. In international comparisons, Finland's economy steadily emerges as innovative and highly competitive. Its recovery is in considerable part attributable to developments in the information and communication technology (ICT) sector (Rouvinen & Ylä-Anttila, 2003, 87).

In this paper we discuss the Finnish economic transformation from an evolutionary point of view. Evolutionary economists put efforts to describe and analyze structural change in economic systems (Saviotti, 1996). They show that the long-term evolution of economies is characterized by rather stable patterns that may, now and then, be subject to unexpected and quite dramatic changes. The evolution of the Finnish economy during the last decades seems to reflect exactly those features. What makes Finland an interesting case from an evolutionary policy point of view is that it has been able to break out to a new path and dissociate itself from its previous path, from its strong economic dependence upon natural resources. But how did Finland become a success story in ICT? Did this process of structural change in the Finnish economy really mean a radical break with its past? And have deliberate government policies contributed to this remarkable recovery process, as often suggested? If so, does the Finnish experience hold lessons for evolutionary innovation policy?

In Section 2, we describe in a brief way what the main features of an evolutionary innovation policy may look like. This exercise provides a framework that will be used to describe and interpret the evolution of the Finnish economy and the role public policy has played during the last couple of decades. In Section 3, the long-term evolution of the Finnish economy is described in detail. We sketch how new ICT developments have transformed the Finnish economy into a knowledge-based economy, especially after the deep economic crisis of the early 1990s. In Section 4, we devote attention to the evolution of Finnish public policy. How did it respond to this economic crisis, to what extent did Finnish public policy change and adapt, and to what extent was it able to overcome rigidities of the Finnish system and steer the Finnish economy in new directions? In Section 5, we bring together insights from evolutionary theory and the Finnish experience to present and discuss a few implications for innovation policy.

2 Evolutionary policy

Evolutionary economists claim it is a rule that nations and regions sooner or later will be confronted with processes of decline in their economies. For instance, their knowledge base will eventually become codified and, therefore, may lose its rareness and unique value for firms (Maskell & Malmberg, 1999). Therefore, the long-term competitiveness of countries and regions depends on their ability to upgrade their economic base by creating new variety, in order to offset variety-destroying processes due to exits and imitation (Boschma, 2004). As history tells, some countries or regions are more capable of coping with this Schumpeterian process of creative destruction, but it remains unclear why.

Evolutionary theory reasons that the emergence of new basic variety (such as new key sectors) is quite hard to predict. History has shown over and over again that new development paths cannot be planned and foreseen, emerging quite spontaneously and unexpectedly in space (Boschma & Lambooy, 1999). In fact, there is no example in economic history that public policy has determined, at least not consciously, the place where new growth paths took place. This is, of course, a rather unpleasant message for policy-makers. It implies policy-makers have to cope with fundamental uncertainty when promoting economic renewal and restructuring in their countries and regions: their ability to influence and direct the evolution of economies is strongly limited (Moreau, 2004).

This does not, however, deny the role of human purpose and strategic action as forces influencing the evolution of organizations, regions and nations. On the contrary, the capacity to deal with change is characteristic of resilient regions, and consequently, the crucial question is whether the mind-sets of people and key institutions are flexible and responsive to change. Having said that, the history of countries and regions will affect to a considerable degree available options and probable outcomes of policies that focus on developing new growth paths (Boschma, 2005). Consequently, new growth trajectories will not come out of the blue, but will reveal patterns of historical continuity.

Evolutionary theory suggests that in policy-making we should be more sensitive to recognising the potential of emergent developments and possible routes to the future, and to finding the best possible policy-making approaches to each situation, location and time in question, recognising the emerging processes and not creating totally new invented policies from scratch. In practice this suggests that policy-makers ought to know much better what is going in their own region to build on existing strengths and capabilities in regions to stimulate innovation (Lambooy & Boschma, 2001). To adapt to selection environment, with its global tendencies, policy-makers ought to less chase the latest global buzz words and best practices to be imitated directly, and focus more on actual local issues and capabilities, and aim that way to adapt to the global economy. This has also consequences for the ways regional scientists deal with policy-making. Rather than looking for universal optimal policy models, they need to develop a better understanding of how policy intentionality and emergent developments coevolve in time. This might lead us to new insights on the roles of innovation policies too (see Sotarauta & Srinivas, forth.).

A key objective of evolutionary innovation policy is to enhance the capacity of organizations and institutions to change. Regions tend to develop rigidities, as embodied in routinized behaviour of organizations, specialized resources, inward-looking networks and

lasting institutions. This often leads to excessive lock-in situations that prevent regions to upgrade, transform and restructure their economies and adapt to changing selection environments (Boschma, 2004). Promotion of knowledge-based economic development requires better understanding of how regions generate development from within; here flexibility of existing institutions, structures and mind-sets emerges as crucial. Policy-making has not traditionally been keen on flexibility, but it may be essential in stimulating innovation and creating truly innovation-supporting local environments with strong global pipelines. At the same time we need to acknowledge that organizations and institutions usually do not adapt spontaneously, due to inertial forces. Consequently, restructuring old organizations and institutions, creating new ones, and making new connections emerge as crucial targets for evolutionary policy-making. According to Freeman & Perez (1988), economic crises may be quite helpful in achieving those targets: deep crises break down old obsolete structures (e.g. through bankruptcies and the falling apart of strong coalitions of vested interests), and make local agents aware that time is ripe to do new things.

Another key objective of evolutionary innovation policy is to enhance connectivity between agents with the purpose of facilitating knowledge transfer. Since agents face incomplete information, evolutionary policy should aim at providing access to information. This may be achieved through increasing the variety of knowledge sources available in a region. Access to variety is crucial for innovations, because it triggers new ideas, but it also provides complementary capabilities that are needed for the development of innovations. In addition, policy should focus on facilitating connectivity with non-local agents. The higher the number of connections with the outside world, the more information and the more variety is brought into the region through extra-territorial linkages (Boschma 2004). Thus, having access to variety and information flows, internal and external to the respective region, is central in future development.

The importance of establishing connectivity is evident for another reason. The innovation system literature (Edquist, 1997; Fischer et al., 2001) has claimed that, beyond firms, other organizations (e.g. research institutes, educational system, financial organizations) provide complementary inputs essential to the innovation process. For instance, firms may be highly creative, but as long as the financial and educational systems do not provide the required resources (i.e. investment capital and specialized skilled labour), firms will be unable to commercialize their new ideas and produce their innovations. In other words, it is not sufficient to have key organizations like research institutes around, but these organizations should actually be interconnected to ensure their complementary roles in the innovation process. This suggests a need for policy-makers to coordinate actions in a wide range of policy fields, such as education and research policy. By enabling connectivity, policy-makers can create new platforms for new unexpected things to happen, but it is good to realise they cannot influence what will actually happen.

In sum, in evolutionary innovation policy, focus is on directing local emergence, on upgrading local environment and responding to local bottlenecks, on enhancing organizational and institutional flexibility, and on strengthening connectivity between actors both internal and external to respective region. In the remaining part of the paper, we describe and interpret the economic and policy paths followed by Finland in the last

couple of decades, using evolutionary vocabulary. We argue that institutional flexibility has been one of the key factors in Finnish economic transformation, but we also argue that it has not been as proactive as it may appear but it is quite largely based on adaptation to external shocks. What also has been important has been a gradual reinvention of an entire nation, and hence a new interpretation of the country, its institutions, relationships and capabilities has proven crucial. This also points to that fact that due to globalization the variety in a small and remote country has increased and provided many actors with new spaces of possibility. Hand in hand with variety also competition has become fierce, and it may sound paradoxical but competition has increased co-operation and co-operation has strengthened competitiveness. Perhaps most importantly, a whole new set of capabilities has emerged in Finland in the course of time. Next we elaborate on these arguments more in detail, and we aim to show that even if many things happened very rapidly in the 90's, the transformation process of Finland has been a long cumulative process.

3 A tale of a small nation in the upper right corner of Europe

3.1 Catching up

In the early 90's, Finland went into economic depression as one of the least information and communication technologies (ICT) specialized countries, and in the late 90's emerged as the single most specialized one (Rouvinen & Ylä-Anttila 2003, 87). ICT plays a big role in the economic evolution of Finland, and we discuss it here quite extensively, but as the Finnish story is more versatile, and as its roots are in a "green gold", it is not possible to fully grasp the evolutionary forces in play without understanding the role of forestry. Hence we go way back to the 19th century.

In the middle of the 19th century Finland was among the poorest countries in Europe. At that time it was ruled as a relatively independent Grand Duchy under Russia having been till 1809 under Swedish rule. Industrialisation and division of labour came fairly late to Finland. As Schienstock (2005) points out, Britain's move towards international free trade in the mid 19th century lead to abolishment of import duties for timber, and that in concert with the accessibility of the Russian market for Finnish paper manufacturers were the driving forces in the economic dynamics of late 19th and early 20th centuries. Forestry and related metal industry have indeed for long dominated its industrial scene and international trade (Raumolin 1984; Schienstock 2005). The quick advancement in prosperity already towards the end of the 1800s and the early 1900s was based on rapidly growing exports of forest-related products, first timber and tar, and later pulp and paper. The growth was accelerated in the late 1950s to the late 1970s when the Finnish forest industry carried out massive investments and transformed it gradually into a global technology leader with the most modern and efficient production capacity in the world (see Raumolin 1992; Schienstock 2005). The forest economy also influenced the development of a range of other businesses (i.e., electricity, waterways for transport, machine industry for forestry and paper production, chemical industry, electronic industry, consulting, etc.). Consequently, by

the late 1980s, the forest sector had developed into a globally competitive industrial cluster that today provides high value-added paper grades, as well as forestry technologies and consulting services. (see more Hernesniemi et al. 1996; Ojainmaa 1994; Lilja 1992)

The acquisition of foreign machinery and equipment played a key role in the technological catching up process. Equally important was the determination with which the national education system was developed, learning especially from Sweden and other countries seen as role-models. The growth strategy was also supported by tightly regulated capital markets (low interest rates), generous tax exemptions for investments, flexible exchange rate policies and the highly profitable barter trade with the Soviet Union (Schienstock 2005; Schienstock & Hämäläinen 2001). The forest cluster also profited significantly from strong state intervention during the post-war period. The development of the economy was often subordinated to foreign policy giving the development of good economic relationships to USSR high priority (Tainio et al. 1997). The centralized steering of the Finnish economy through various national projects triggered mergers and acquisitions in the forest cluster, as large companies could better exploit the advantages of a planned economy such as stable demand, low prices, long-term planning periods, and a stable economic environment. The period of modernisation also led to the birth and expansion of the Finnish welfare state (replicated largely from Sweden), including an expanding public sector, high investments in a regionally balanced university system, and a rapid growth of urban centres in southern Finland. (Schienstock 2005.)

The strong economic growth in the 1980s was strengthened by booming international market, improving terms of trade, and deregulation of the financial market. In spite of the growing international market, exports grew considerably slower than domestic demand. The economy descended into severe structural problems. The export capacity was simply too small to support the late 1980s standard of living. Manufacturing and exports in relation to total output had dropped dramatically throughout the 1980s leading to huge external imbalance (Georghiou et al. 2003), and for these and other reasons the Finnish economy took a plunge in the early 1990s.

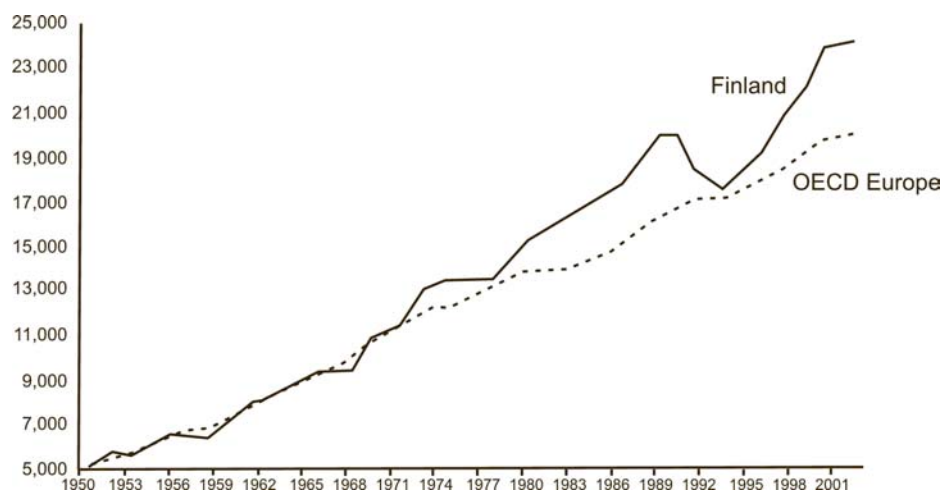


Figure 1. GDP volume in Finland and OECD Europe (in 1995 prices and purchasing power parity exchange rates) (Source: OECD and Penn World Tables, adopted from Rouvinen & Ylä-Anttila 2003, 88)

3.2 Depression and emergence of a new path

Gloomy figures and causes for depression

In the early 1990s, Finland's prospects seemed gloomy indeed. It was hit by the deep economic crisis: Industrial production shrank by over 10% and real GDP dropped by over 10 percent in just three years. Unemployment rose to nearly 20 percent by 1994 having been below 4 % few years earlier (Honkapohja & Koskela 1999). Prior to the depression GDP per capita had been about 5% above that of the EU15 countries, and after the depression it was 13% below (EuroStat, structural indicators). As Schienstock and Hämäläinen states, all this resulted, of course, also in micro level difficulties: Numerous firms filed for bankruptcy, thousands of over-borrowed households defaulted on their debts, the Helsinki Stock Exchange faced major difficulties and some banks faced bankruptcy. Due to high unemployment rates and enormous expenditures to save the banking system from collapsing, the state had to run a huge budget deficit. Soon it became obvious at all spheres of the society that without major structural changes Finland could not escape its economic destiny in a low-road. The forest cluster with its low productivity could not manage to reduce high unemployment figures significantly and macro-level economic policy with devaluation of the currency was not an option anymore. Finland had to find a new growth path; continuing with the old one simply was not an option. (Schienstock & Hämäläinen 2001, 34.)

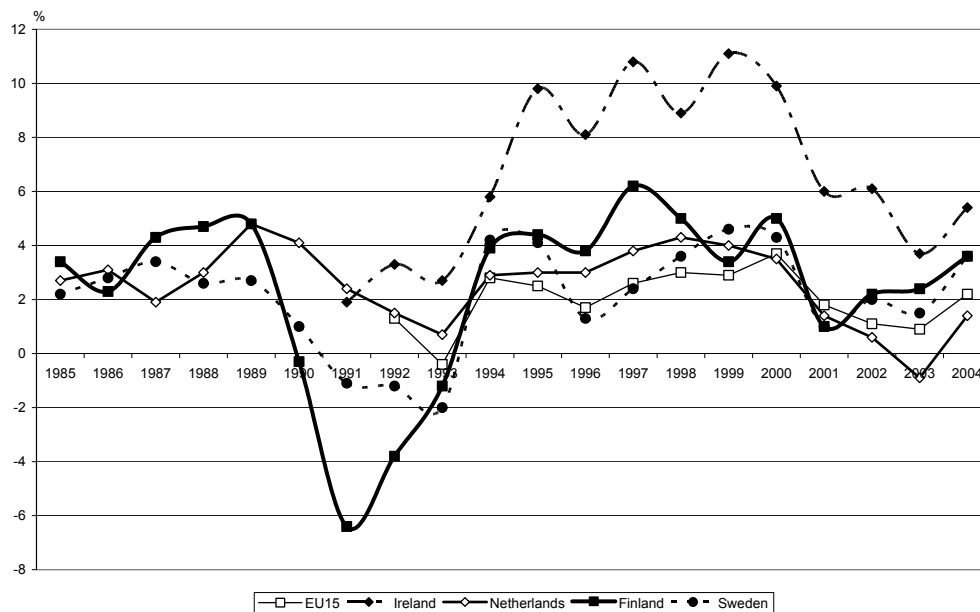


Figure 2. Growth rate of GDP at constant prices (1995=100) - Percentage change on previous year (Source: EuroStat, Structural indicators)

The explanations for such a deep and sudden depression have been well-documented and researched. Kiander and Vartia (1996) have stated that the explanations range from pure external shocks (the collapse of a leading trade partner, the USSR) to mistaken reactions to the beginning of the depression itself. It took too long a time to realize how severe the situation was. Among the other factors contributing to the crisis were a general economic slowdown in the rest of the world, a downturn in the nationally vital forest-related industries, a speculative bubble in the domestic securities and real estate markets fuelled by uncontrolled credit expansion and favourable terms of trade of the 80's, and mismanaged financial liberalization, which eventually led to credit crunch and excessive private sector indebtedness (Kiander & Vartia 1996; Rouvinen & Ylä-Anttila 2003). In addition to these reasons, also long-term rigidities in economic and political systems and corporatist structures have been found underlying the crisis. The depression led to a clear shift in dominant policy thinking, even though the need for reorientation in economic policies was identified already earlier, and also the seeds for future policies were planted earlier. At all events, greater emphasis was put on long-term microeconomic oriented policies, as opposed to earlier short-term macroeconomic policies. It was acknowledged that sustained national competitiveness is largely created at the micro level, in firms, financial institutions, and various innovation oriented policy agencies (Honkapohja & Koskela 1999, 400; Rouvinen & Ylä-Anttila 2003).

Recovery

In Finland, the recession of the early 1990s has often been referred as a watershed between the investment- and innovation-driven phases of national development. The Finnish economy was increasingly exposed to foreign competition, and it was obvious that without as strong national buffers as earlier the competitive advantage was to be based on world-class innovation capacity, efficiency, and value-adding capacity. Having a strong engineering orientation, the Finnish value-adding strategy was quite naturally oriented towards technological innovation. (Schienstock & Hämäläinen 2001; see about engineer education Tulkki 1999; 2001). It is worth noting that even if the state faced a huge fiscal crisis and was forced to make cuts almost in everything, overall R&D investment remained high and public R&D support even rose during the depression. (Georghiou et al. 2003.) Finland's overall R&D intensity grew rapidly as the business sector increased expenditures on innovative activity. Nokia played an important role in this growth (see more about Nokia and its role in Finland Ali-Yrkkö & Hermans 2002; Ali-Yrkkö et al. 2000; Ali-Yrkkö & Hermans 2004; Häikiö 2001a; 2001b and 2001c).

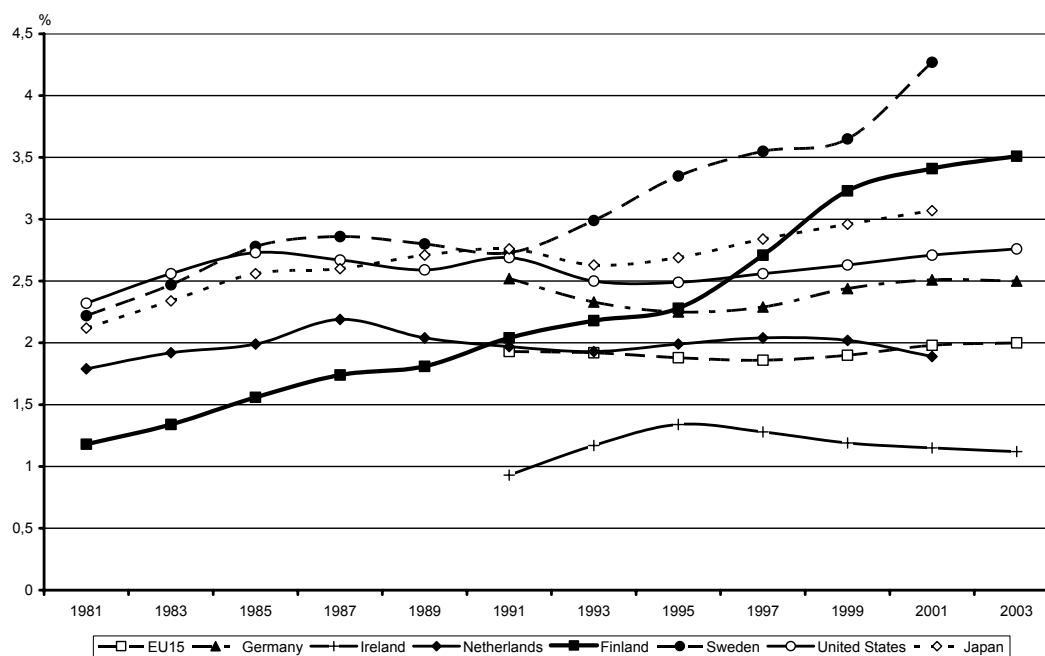


Figure 3. Gross domestic expenditure on R&D (GERD) - as a percentage of GDP (Source: EuroStat, Innovation and Research Data)

Finland joined the European Union in 1995, and this also fuelled the shift in policy. Unlike the other Nordic countries Finland adopted the euro from the outset. However, all this also meant that the scope for national macroeconomic policies was considerably reduced. (Rouvinen & Ylä-Anttila 2003.) Because of expanding globalization Finnish companies gained access to new markets, and hence earlier dependency on domestic banks for finance was reduced, and also capital constraints were relaxed, and as a consequence of this and rapidly growing ICT cluster, there was an influx of capital to Finland in the mid 1990s. (Hyytinen & Pajarinen 2002). Survival mode of the entire nation, supported by new policies and corporate strategies produced results, and the 1990s was then both an era of re-industrialization and rapid structural change towards a knowledge-driven economy. In addition to new public policies and changes in the corporate strategies also individual citizens changed their behavioral patterns people beginning to pay back their debts, working harder and seeking new training opportunities to upgrade their skills. In a way the economic crisis had a silver lining; it reduced the entire society's mental rigidities to adjustment. (Schienstock & Hämäläinen 2001, 36.)

By the end of the 90's situation began to improve: Average annual GDP growth rate increased from -3.5 percent in 1991-1993 to 4.7 percent between 1994 and 2000. Open unemployment went down from nearly 20 percent in 1993-94 to 9 percent in 2000. While raw material based industry had traditionally dominated the manufacturing sector, growth now became concentrated to high-technology products. (Blomström et al. 2002.) The rapidity of the industrial change in Finland is reflected in how electronics and electronic equipment exports grew from one tenth to more than 25% during the 1990s. They exceeded even the exports of the earlier dominant paper industry. In addition, the ICT

cluster showed growth rates of up to 25% each year with the telecommunications industry growing by 35% per year, while the paper industry grew by only 1.6% per year (Alasoini 2004). During the 1990s Finland became a major exporter of electronics and other high-tech products, which by the year 2000 accounted for over 30 % of exports. As a result of the increasing specialization in high-tech sectors, Finland's trade balance in high-tech products turned from a large deficit in the early 1990s to a significant surplus by the year 2000. (Blomström et al. 2002.)

The structural change in production, exports and R&D were, indeed, very strong in international comparison. The Finnish transition to a knowledge-driven economy was however a longer process, both the institutional foundations and capabilities were laid in the course of several decades. The key factors were raising investment in R&D and commitment to education. In the early 21st century Finnish research and development expenditures relative to the gross domestic product has been among highest in the world. The high R&D intensity in Finland is largely based on the private sector's research and development investments (Third European... 2003). The share of public sector of the total research and development activity is smaller than in most other countries. Nokia's impact on Finland's high R&D intensity is significant. If Nokia's R&D activity is deducted from the overall figures, Finland's R&D expenditures relative to GDP are only 2.4 percent in 2000. Even this share is well above the EU average but reflects quite well the major role Nokia plays. (Ali-Yrkkö & Hermans 2002, 27)

Within a few years Finland became the most specialized country in telecommunications in the world. Although there was a shift in policy-making, it is not a clean cut with the past. Already in the 1980s it was widely argued that Finland could no longer rely on an investment-driven growth strategy; it was already at that time stressed that knowledge intensity and technological superiority should become the countries competitive advantage instead (Ormala 1999). For example, already before the economic crisis Nokia's CEO at that time Kari Kairamo advocated a vision that Finland should become an "information society" instead of depending on an old-fashioned "smokestack industry" (Lilja et al. 1992).

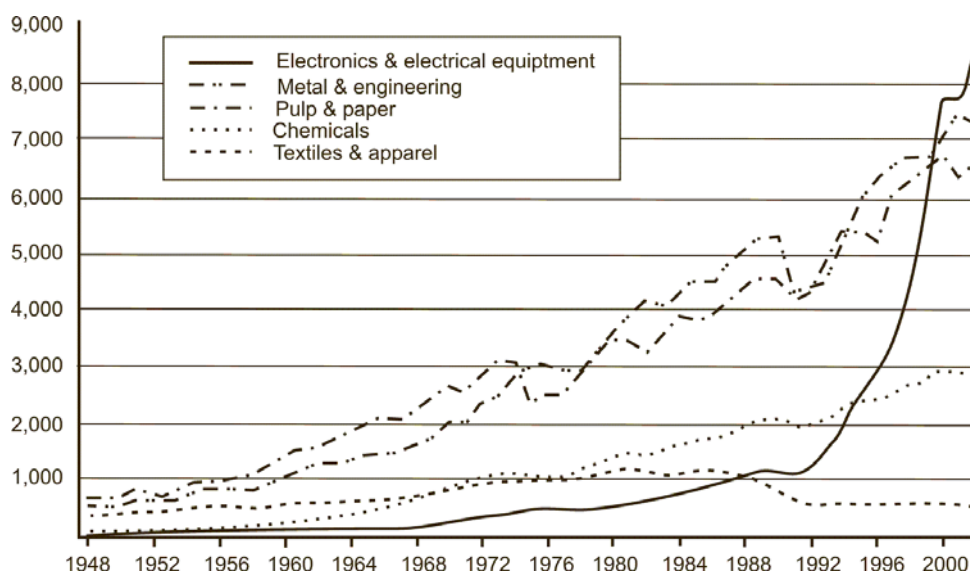


Figure 4. Finnish manufacturing production volume by industry (€ billions in 2000 prices) (Sources ETLA database, Hjerpe et al. 1976, Statistics Finland, adopted from Rouvinen et. al. 2003, 89)

4 Emergence of ICT cluster

As described above, in a less than a decade Finland moved from being one of the least ICT (information and communication technology) -specialised countries to one of the most specialised ones in terms of exports, production, and R&D. The broadly understood Finnish ICT cluster is comprised of approximately 6,000 firms (Paija & Rouvinen 2003). The impact of the ICT cluster on the Finnish economy is very significant. In the 1990s its GDP share rose from 4 to 10 percent. ICT has indeed become the country's third industrial pillar to complement the traditional metal and engineering, and forest-based sectors. (Rouvinen & Ylä-Anttila 2003, 96.)

The Finnish story of rapid technological development is based on constantly increasing specialization and raising levels of education. Increasing specialization in production, exports and R&D applies to the manufacturing sector as a whole and to some extent to services as well. The general trend in R&D specialisation has been away from low-tech industries to high-tech. Even though the emergence of the Finnish ICT cluster appears as a rapid one, seeds for its development were planted in the course of history, quite largely unconsciously, but nevertheless as something to be built on later.

For long time now Finland has been one of the most competitive telecommunications operators and equipment markets in the world, and the government has had a large role especially in opening the market for competition. The origins of this can be traced back to the Telephony Decree of the Finnish Senate in 1886. It distributed numerous private operator licenses in order to circumvent Russian telegraph regulations, and hence to create an obstacle to Russian efforts to nationalize the telephone system. The Finnish telephone network operations actually were never monopolized by the state and this has proven important for later developments. The newly independent Finland (1917) established its own national public telecommunications operator that managed eventually to set up a monopoly in long-distance and international calls. Finland remained, however, one of the few European countries where private operators competed with the state in local operations. As important was that Finnish telecommunications equipment markets were open to foreign suppliers, and due to its small multi-operator market, Finland became already at that time a test market for the latest technology. (Rouvinen & Ylä-Anttila 2003; Blomström et al. 2002.)

According to Blomström et al. (2002, 11) the existence of several telephone network operators had two important effects on the development of the Finnish telecommunications market:

1. The competition for customers contributed to rapid technological change in the industry, and thus the private operators were forced to demonstrate that they were technically competent, and new solutions were therefore introduced faster than in many other countries. Consumers also grew accustomed to relatively frequent changes in technology.

2. The multioperator market attracted several foreign manufacturers of telecommunications equipment, and foreign firms like Ericsson, ITT, and Siemens set up production facilities in Finland. In addition to a profound understanding of telecommunications, emerging expertise in radio technology was one of the prerequisites for building a mobile telephone system. University-level education in radio technology had started in the early 1920s.

(Blomström et al. 2002, 11)

As Rouvinen and Ylä-Anttila (2003, 100) suggest, expertise in radio technology “lurked in the shadows” in many Finnish firms well before it had commercial applications. This was partly driven by the fact that amateur radio was a popular hobby in Finland. Applications of radio technology were developed in three companies around 1920: Salora (a Finnish consumer electronics company), Suomen Kaapelitehdas (Finnish Cable Works), and Radio Laboratory (under the Ministry of Defense). Fervent engineers, often objects of suspicion and opposition by conservative colleagues and managers, worked on applications of radio technology on the sidelines of main business activities. In 1963, a call for tenders by the Finnish army for a battlefield radio spurred companies to capitalize their accumulated expertise. Ultimately the army did not have the resources to purchase the system, but the prototypes served as the forerunners of commercial handsets. The Auto Radio Puhelin (ARP, Car Radio Telephone) network was introduced in 1971 as the country’s first mobile telephone network providing nationwide service. (Rouvinen & Ylä-Anttila 2003, 92.)

It is quite commonly seen that telecommunications standardization in the Nordic and European contexts may be the most important factor in the later Finnish ICT success. Finland was an early adopter of NMT in the 70’s (Nordic Mobile Telephone) and later GSM (Groupe Spécial Mobile). Nokia and Swedish company Ericsson were among the first to adopt GSM, which eventually became almost universally accepted. What was, once again, important was that NMT was open to third-country suppliers as well. Openness and variety promoted competition in network equipment and handsets. Both GSM and NMT turned out to be the “winning technologies” in their eras. Nokia, and also Ericsson managed to capitalize on its early lead in both GSM networks and handsets. In the early 1980s, even though being small countries the Nordic countries formed the largest mobile communication market worldwide in terms of the number of subscribers. (Palmberg 2002; quoted in Rouvinen & Ylä-Anttila 2003). The size alone is not important but the fact that for some reason, new generations of phones always cause quite a stir and many users are tempted to shop for an upgrade. Scandinavians seem to be accustomed and therefore quite willing, to test new technologies. Consequently, customer needs in the Nordic countries preceded those elsewhere and that perhaps has provided Nokia and Ericsson especially, but other firms as well, with a first-mover advantage. One might conclude that the Nordic market has been a rather fruitful combination of technological competence in both production and use. (Blomström et al. 2002.)

It is clear that ICT’s and more specifically Nokia’s initial breakthrough in the telecommunications sector was made possible by the availability of specialized skills, largely built up as a result of the mix of technical solutions chosen by the many competing telecom operators, and as result of this Finnish telecommunications engineers were recognized as leading experts in interface technology. By the 1980s, however, there was already a shortage of the labour skills needed by Nokia and other high-tech firms, and the

companies invested substantial funds on specialized in-house training programs, sometimes in collaboration with Finnish universities. (Blomström et al. 2002). By the early 1990s, this was reflected also in national educational policy and government initiated broad expansion in higher education. The total intake in universities nearly doubled in the five years between 1993 and 1998, and the number of students in polytechnics tripled over the same period. By the end of the 1990s, 12 postgraduate schools in information technology had been established and thus also doctoral education in the field multiplied (Paija 2001, 33). This increase in the supply of labour was a prerequisite for the expansion of the ICT cluster in the 90s.

5 Finnish innovation policy

As Lemola (2001) states, there is always an interaction between industrial, economic and social structure and public policy orientation that influences the structure of the innovation system and policies. The evolution of Finnish innovation policies and system is a good example of this kind of interplay. Although there has been a certain built-in inertia in the Finnish policy institutions, it can also be shown that they have adapted to changes in policy environment by deliberate learning and they also have reacted to experiences of other countries and reinterpreted foreign models and initiatives for Finnish needs. As Georghiou et al. state, the circle is closed. If earlier the Finnish policies were designed through imitating policy doctrines originating from OECD, and particularly from Sweden, today the Finnish innovation system is looked upon as a viable and relevant model to be learnt from. (Georghiou et al. 2003.)

The basic pillars of technology and science policies of the 90's were built partly in the 1960s, but mostly in the 1970s and 1980s. The goal was to lift the technological level of Finnish industries and to reduce the dependence on raw material-driven production and exports. The one-sided structure of exports was regarded as a problem. Even if there were some changes in policy thinking, at the end of the 1970s Finland's research and development (R&D) expenditure relative to gross domestic product (GDP) was one of the lowest in the industrialized countries. (Hermans et al. 2005, 136.) A key aspect in the beginning of the 1980s was to make technology policy increasingly target-orientated and systematic. To fulfill these tasks, Tekes (The National Technology Agency) was founded and some of the tasks of the Ministry of Trade and Industry (R&D loans and grants, appropriations to technical target research) were transferred to Tekes. One of the focuses of Tekes' operations in the 1980s was information technology. In addition, towards the end of the 1980s the need for (technology) policy actions on a broad sectoral basis was recognized, and the development of technology programs for traditional industries was started. Another trend in the 1980s was technology transfer and the commercialization of research results. A number of mechanisms for technology diffusion and commercialization were created including local technology centers. (Georghiou et al. 2003, 59.) In Oulu, for example, the first technology center of the Nordic Countries was established in 1984 (see Männistö 2002; Tervo 2004). The initiative and funding in the process of founding technology centers in major cities were quite largely based on local activity.

During the 1990s there was a clear shift of emphasis in innovation and industrial policies. While in the 1980s policy thinking was more or less based on the idea of picking the winner's, policies adopted in the 1990s can be labeled as enabling policies. The emphasis moved towards indirect measures in influencing firm behavior, avoiding direct interventions in the product market, promoting competition, and providing a stable macroeconomic environment. (Hermans et al. 2005, 135.) In 1990 the concept of a national innovation system as a framework for science and technology policies was introduced to accentuate the systemic nature of innovation. That reflected the idea of looking at the innovation process and policies from a broad perspective spanning from education and science to innovative activities of firms and commercialization of technological innovations (Miettinen 2002). Cluster-based industrial policies also fit well to this kind of policy emphasis. Finland can be seen as one of the few countries that have developed a consistent approach towards a network and cluster facilitating innovation policy (Schienstock and Hämäläinen 2001).

Finnish policymakers have indeed fully embraced Porter's cluster-based approach both at national, regional and local levels. Finland's cluster-based strategy was first outlined in the Ministry of Industry and Trade's National Industrial Strategy of 1993. Finnish public R&D policy had prior to that been focused primarily upon individual enterprises, and not so much on their contexts (Romanainen 2001, 381). However, because of the economic situation of that time, the government recognized that it needed to both foster the international competitiveness of its industries and to do this as inexpensively as possible. (Schienstock and Hämäläinen 2001). A cluster-based policy, in concert with national innovation system thinking, fit quite well network and framework condition oriented policy the main goal being to diversify the economy away from the resource dependency towards new high-technology industries (Romanainen 2001, 378). The role of government changed to be facilitator rather than a driver. This kind of innovation policy has been accompanied by the government's highly solution-oriented, pragmatic attitude, reflected in a close cooperation between the private and political sectors as well as the universities. In spite of all the changes in policy thinking and practices, there was no master plan to restructure the Finnish economy and industry; rather, an array of policy measures were working to the same end over an extended period of time (see Georghiou et al. 2003).

More recently Finnish science, technology and innovation policies have once again forced to react to new challenges. For example, internationalization and global networking have become a key aspect in Finnish technology programmes conducted by Tekes and the Academy of Finland. It has also been acknowledged that Finnish policies have focused too much on technology, being almost blind to social and organizational innovations aiming at supporting the efficient generation, diffusion and use of new knowledge. (Lemola 1999, 2002; Stähle & Sotarauta 2003) In addition, it has been stressed that if measured by GDP per capita Finland is far from the vanguard of OECD countries in position 15. The rate of employment is only 67,2 % (2004) while in Denmark, for example, it is more than 75 %. (Making Finland... 2005, 6-7.) The population of Finland is ageing rapidly and the dependency ratio is weakening more steeply than in the OECD countries in average, and what makes situation worse is that the country is not attracting foreign talents (see

Forsander et al. 2004; Raunio & Sotarauta 2005). Immigrants represent only about 1.7 % of the population, while the proportion in Sweden, the Netherlands and United States is at least 10 %. This fact is reflected at the universities too, for example, foreign students represent about 6 % of all doctoral students in Finland, while their share is more than 15 % in the UK, Belgium, the USA, Sweden, Australia and Sweden (Making Finland... 2005, 6-7.) There indeed are many issues challenging the “Finnish model”, and only time will tell how resilient Finland will be in the near future. What is sure is that the new challenges, only few being raised here, are enough to turn policy-makers’ hair grey once again.

6 Conclusion - what is to be learned for evolutionary innovation policy

The evolution of the Finnish economy in the 1990s has shown that the long-term competitiveness of countries and regions depends on their ability to create new basic variety, in order to compensate for losses in other parts of the economic structure. The Finnish case has provided a lot of information of how this may be achieved, and how policy-making and structural changes in the Finnish economy have co-evolved in the course of time.

The extremely rapid shift of Finland to a knowledge-based economy involved many coincidental factors and good timing. Although the pace of change accelerated in the 1990s, the foundations for the emergence of the ICT cluster were laid already in the 1990s. Early and strong competition (including the presence of foreign companies like Ericsson and Siemens), demanding customers (network operators), standardization (Nordic Mobile Telephone Standard), and a culture open to new technologies contributed significantly to the evolution of the ICT cluster. The business sector, of course, played a key role in its development, but the institutional setting and public policies have mostly been beneficial too.

Public involvement started already many decades ago. Since the 1960s, education policy was already focused on securing a sufficient supply of specialized skills in ICT. The basic pillars of research policy were established in the 1970s and 1980s, aiming at lifting the technological level of industries and reducing its dependency on raw-material driven production. In the 1980s, technology policy was implemented on a large scale: national technology programs were set up, and technology transfer and commercialization of research became key objectives. As a result, Finnish public policy gradually laid the foundations of the strong recovery in the 1990s.

What the Finnish experience has made clear is that to make a difference, innovation policy should adapt to changes in the selection environment on the one hand, and aim to change it to a favorable direction on the other hand. Policies should take into account lessons learned from experiences elsewhere, but they have more strength if they build on national and regional strengths, rather than being swayed by wishful thinking and worldwide buzzword chase. It is also clear that innovation policy ought to have a long-term strategic perspective. Hence, policies must be consistent over the long term and not dictated by short-term cyclical or political considerations.

The long-term economic evolution of Finland suggests that a deep crisis often precedes considerable and lasting shifts in economic and social structures. People, in business,

policy-making and basically in all walks of life, do not usually desire to take great leaps forward into the unknown. A deep crisis, however, often forces people to accept the fact that something new must be implemented. All this usually results, and requires, major changes in mental models, in dominant interpretations of a country, its institutions and major players.

The Finnish response to the crisis of the early 1990s was to open up the economy, increase variety, modernize social structures, and strengthen public finance. Innovation policy shifted its focus in the 1990s, for instance, from direct business involvement to an 'enabling' mode, i.e. to building framework conditions for private business. On the other hand, these new policy directions strengthened and reconfirmed policies already developed in the 1980s¹. This is, for instance, true for its science, technology and innovation policies, that were inspired by the concept of national innovation system, with its emphasis on establishing connectivity between research, education and business organizations.

All in all, the Finnish experience shows how public policy can play a key role in restructuring economies. The chances of being successful most likely increase when policies aimed at stimulating new growth paths build on economic and institutional structures laid down in the past. For the rest, a bit of luck is needed.

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¹ A fine example of how history matters and influences the way countries respond to economic crises or external shocks is the case of the Netherlands. As shown above, the main stakeholders of the Finnish economy developed a strategy based on 'strong competition' that was more or less in line with education, research and technology policies established in the past. By contrast, the main players (national government, employer organisations, labour unions) in the Netherlands decided in 1982 (so-called Treaty of Wassenaar) to pursue a (labour) cost-minimization strategy in response to the deep economic crisis in the late 1970s/early 1980s. This 'weak competition' strategy based on static price competition (instead of innovation) was much in line with the low-tech and service-oriented nature of the Dutch economy. This 'low cost' strategy still persists today, although innovation policies have become more important. What is interesting in this latter respect is that the Dutch national government has only recently made efforts to take on board some features of the Finnish policy model, as illustrated, for instance, by the establishment of the Innovation Platform headed by the Dutch prime minister.

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