

From Path Dependency to Path Creation: Finland as a Case in Point

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Abstract

There is wide agreement that we are currently living through a period of fundamental and rapid economic and social transformation. The fact that the way the whole economic system is organised is changing also has major implications for research on economic systems and techno-economic development. While up to now research on economic systems has concentrated very much on the aspect of path dependency where the dominant feedback loops are self-reinforcing, in the current period research needs to focus more on the processes of unlocking and path creation. The aim of this paper is to contribute to the reframing of economic research. In the second part of the paper I apply the new approach, analysing how Finland managed its transformation process from a resource-based to a knowledge-based economy.

Introduction

There is wide agreement that we are currently living through a period of fundamental and rapid economic and social transformation. Not only are single elements of national economies becoming the target of restructuring, but also the way the whole economic system is organised is changing; the established best practices of designing intra- and inter-organisational production processes as well as the existing institutional support structures, the functioning of the political system and even national cultures are fundamentally changing. The ICT revolution is being given an important role in this transformation process (Castells 2000).

Naturally the fact of fundamental change also has major implications for research on economic systems and techno-economic development. While up to now research on economic systems has concentrated very much on the aspect of path dependency where the dominant feedback loops are self-reinforcing, in the current period research needs to focus more on processes

of unlocking and path creation (Garud & Karnoe 2000). The aim of this paper is to contribute to the reframing of economic research. I first briefly discuss the traditional path dependency perspective. I then focus on developing a conceptual framework within which to analyse processes of path creation. In the second part of the paper I apply this approach, analysing how Finland managed its transformation process from a resource-based to a knowledge-based economy.

The path dependency perspective

The strength of the path dependency perspective is that it does not separate technological innovation from past developments but assumes some kind of continuity in the process of technological change, which is best studied on the industrial level. New innovations line up with earlier technological change within an industry; they have historical antecedents of novelty (David 1985, 332). Today's technological advantage, as Foray argues, lays the foundation for succeeding rounds of progress (1997, 65). The more a specific kind of knowledge has been produced and is embodied in new product and/or process technologies, the easier it becomes to produce even more related knowledge, a phenomenon which is characterised as the 'increasing returns logic' (Arthur 1996).

Continuous accumulation of knowledge leads to the formation of a technological trajectory, which delimits the options for further development. The concept of trajectory expresses the idea of channelled change, a change limited by constrained technological opportunities (Metcalf 1997). In this respect we can speak of the path dependency of technological development (David 1985). There is, however, evidence that institutional differences across countries play a crucial role in shaping technological change (Lundvall 1992; Nelson 1993). While the cumulative nature of the process of technological development narrows down the range of potential directions of change, national trajectories increase differentiation and diversification as offshoots from the main development path (OECD 1992). The concept of path dependency therefore provides us with a way of viewing technological change as being temporally located and socially embedded (Garud & Karnoe 2000).

The concept of path dependency is often accused of being too technology oriented. As countries also differ in their organisational arrangements, which tend to persist for a long time (Kogut 1991), it seems to be useful to consider—parallel to the notion of technological trajectory—the development of different organisational trajectories, namely specific arrangements of means oriented towards increasing productivity and competitiveness (Castells 2000). Organisational change is channelled in the same way by the national institutional framework as technological innovations. One can actually talk about a national techno-organisational development path within specific industries as technology and organisation co-evolve.

A well-established techno-organisational paradigm tends to form a synergistic combination with an economy's institutional structures, providing a sound basis for long-term economic growth (Perez 1983). As the prevailing norms, values and policies are continuously reinforced by the positive experiences and feedback that stem from the evolutionary phases of technological, organisational and institutional development, people tend to have internally consistent mental sets similar to each other. One can speak of an established mental paradigm shared by most economic actors (Hämäläinen 2004), stabilising the technological, organisational and institutional development.

Path dependency, however, always carries the risk of turning into a situation which is termed a lock-in (Grabher 1993; Johnson 1992). An old technology as well as a traditional organisational model can lock the economy of a country into an inferior option of development and may in the long run result in a loss of competitiveness and in a retarding economic growth. Economic actors may have developed a degree of commitment to the setting up of learning mechanisms with the aim of exploiting existing technological and organisational opportunities. Sticking to those learning mechanisms may allow adaptive but not innovative learning (Argyris 1992). This means that they are not capable of adjusting to an emerging new design configuration based on a different knowledge paradigm.

Under the conditions of a shift in the techno-organisational paradigm one can no longer talk about a channelled change, as the institutional setting as well as the dominant mental sets in which the traditional national trajectory was embedded become themselves increasingly fragile. The un-

folding of a new technological paradigm can only take place together with not only fundamental organisational, but also institutional and cultural changes. The negative socio-economic consequences of a technological and/or organisational lock-in suggest giving more attention to the problem of unlocking and path creation (Garud & Karnoe 2000; Schienstock 2004).

The perspective of path creation: New opportunities, economic pressures and change events

The emergence of a new techno-organisational development path cannot be explained by referring to single factors or simple models. One can identify at least five factors that are decisive in this respect: a window of new opportunities opened up by a new knowledge paradigm, a market that promises long-term profits, economic pressures to adapt to the new paradigm, change events that trigger and support the transformation process as well as courses of action that steer techno-economic development into a new direction.

Concerning the technological aspect, the emergence of the digital paradigm in the IC technology represents a fundamental change that opens up new opportunities even for newcomers, as the knowledge accumulated in the electro-mechanical paradigm is of little use. And concerning the organisational aspect, the network model focusing on intra- and inter-organisational knowledge flows represents a new logic of organising businesses more effectively, while management knowledge accumulated in the Fordist paradigm becomes outdated. When combined, the new technological and organisational paradigm can become the basis of a new national trajectory incorporating a production logic that is much more effective than the old Fordist control paradigm.

Companies as well as countries will not automatically make use of the window of new opportunities associated with the new ICT-based network paradigm, because it is associated with high uncertainty and generally entails nothing more than a promise. In particular companies will hesitate to get involved in radical innovations as long as they cannot identify new profitable market opportunities. Governments will also

hardly establish new institutions that support the creation of a new development path, if they cannot foresee economic growth and new jobs to emerge.

Leadership in the old techno-organisational paradigm may become a serious obstacle to the swift diffusion of the new one due to structural, political and cognitive lock-ins (Dosi, Pavitt & Soete 1990). Countries that have fallen behind in the old techno-organisational paradigm, on the other hand, may take up the new opportunities more eagerly to catch up with the old leaders. Globalisation can be seen as the most important economic factor that pressures companies and countries to adapt to the new paradigm, even those that hesitate to do so because of their earlier successes in the old paradigm. Globalisation establishes innovation as a new competition factor; as radical, growth enhancing innovations become increasingly difficult to make in the established techno-organisational paradigm, companies as well as countries have no choice but to turn to the new paradigm and create a new techno-organisational trajectory. The later they do so, the higher the costs of adaptation, as the needed transformation will then become increasingly destructive.

But even strong economic pressures may not trigger transformation processes as long as they are not perceived by the key economic actors as damaging. Often cognitive blockades that hinder companies or countries in adapting to the new paradigms can only be overcome when major change events occur. A serious economic crisis can be seen as a major change event that is most likely to trigger the change to a new techno-organisational paradigm. In an economic crisis it is generally more risky to stay put than to move, even if it is in the wrong direction (Sabel 1995).

To explain the development of a new national techno-organisational trajectory one cannot only refer to objective factors such as new opportunities, economic pressures, or change events. Instead, we have to emphasise the importance of the human will (Bassanini & Dosi 2001). The path creation perspective, rather than treating economic actors as passive observers within a stream of events, sees them as knowledgeable agents with a capacity to reflect and act in ways other than those prescribed by the existing social rules and taken-for-granted technological artefacts. People

who have an understanding of the specific options the new paradigm offers see path creation as a process of mindful deviation. The transformation process thus depends to a great extent on the engagement of certain people being particularly good at imaginative exploration and creation. Social pioneers, among them scientists, politicians and entrepreneurs prepared to initiate and conduct anticipatory institutional change have a crucial role to play. It is important to re-establish a good match between the new techno-organisational paradigm and the institutions that facilitate and also regulate its full deployment through the economy by unleashing a multitude of social and institutional innovations (Teubal 1998). As long as the underlying problems of the old institutional framework are not recognised and admitted by a great number of economic actors, the mismatch between the new techno-organisational paradigm and the stagnant institutional framework will continue to grow (Perez 1997).

The transformation process, however, cannot be conceptualised as a rational decision-making process; instead, it involves vested interests and power games. The transformation period is a period of trial-and-error experimentation and confrontation not only between the forces of change and persistence, but also between different groups of modernisers, because it is widely indeterminate in which direction a new national techno-organisational trajectory emerges. The development of a new trajectory therefore has to be conceived of as a 'contested terrain' (Schienstock 2004).

The new role of the state

The transformation process puts not only the economy, but also the political system under enormous pressure for change. Traditional direct technology policy saw the state as a sovereign economic actor exercising control over the dynamics of technological progress either through the setting of specific incentives or by regulation (Braun 1994). However, in a period of fundamental change, uncertainty becomes a key issue for policy makers, as for all other participants in the transformation process. We cannot assume, however, that policy makers have a superior understanding

of market circumstances or technological information; rather what they do enjoy is the superior coordinating ability across a diverse range of institutions (Metcalf 1997, 274).

This means that while the significance of technological macro-economic management may decrease, the role of the state can remain very strong (Hirst & Thompson 1992). The new role of the state can be described as a catalyst for innovation processes, a supporter of research and innovation activities in the new techno-organisational paradigm, a moderator of diverging perspectives and interests, an organiser of a dialogue between various economic actors on future developments and as an initiator of questions and new programmes (Schienstock 1994). The creation of a new vision and the establishment of social discourses may be seen as forming the framework for connecting existing knowledge stocks and competencies, for creating learning opportunities through the exchange of information and experiences, and for opening up new communication channels between the various actors involved in the transformation process (Schienstock 2004).

The changing role of the state reflects the fact that a growing number of organisations have knowledge relevant for the transformation process. The state therefore becomes more and more dependent upon other collective actors such as large companies, research institutes, employer associations and unions, and is forced to let these organisations participate in the process of policy conceptualisation and to integrate them into the process of policy implementation. Because of the growing integration of private and public actors in the process of policy formation and implementation, policy networks become a new form of governance in the field of technology and innovation policy. They successively replace top-down policy making in the form of state intervention, as well as businesslike market-oriented governance (Kickert, Klijn & Koppenjan 1999; Mayntz 1996, 471).

Policy formation within policy networks cannot be understood as strictly rational decision-making consisting of clearly separated stages: setting goals, developing programmes, and implementing projects (Klijn 1999). Instead we have to conceive of policy processes as a process of trial and error, there is a strong case for policy experimenting. Based on the above arguments, we can characterise technology and innovation policy as a process of policy learning (Lundvall & Johnson 1993, 18). Policy

based on reflexive learning can be supported by a set of instruments allowing for continuous self-observation and monitoring the external environment, such as benchmarking, technology assessment, and technology foresight. However, in a period of fundamental change, benchmarking is not about deciding what is best or what universal truth can be derived from comparison. Instead the aim is to be able to gain a better understanding of one's own solutions, their strengths and weaknesses, when seen in the light of what others do and what options they see (Toulmin 1990). The framework presented above will now be used for analysing the transformation of the Finnish economy from a resources-based to a knowledge-based economy. But first let us have a look at the development of competitiveness in Finland in the 1980s and 1990s.

The development of structural competitiveness in Finland

There are clear indications that the economic growth and social welfare of a nation are closely connected to its competitiveness, particularly in a globalising economy (Nelson 1993). But besides the fact that competitiveness has become so prominent in economic analyses, no general agreement on how to define competitiveness has been reached so far (Hämäläinen 2003). Some scholars even doubt that the concept is applicable on the level of regional or national entities (Krugman 1994). Although they do not compete on the market like companies, territories still compete for the limited funds of direct investment by creating supportive environments (Cooke & Schienstock 2000).

Different concepts of competitiveness focus either on input factors, output factors, or factors that influence the effectiveness of the transformation process, organisational or institutional factors in particular (Cooke & Schienstock 2000). The latter can be characterised as structural competitiveness (*ibid.*). As the operationalisation of competitiveness by neither input factors nor output factors is seen as satisfactory, I focus my analysis of Finland's competitiveness on the concept of structural competitiveness (Schienstock & Hämäläinen 2001).

As Table 1 (see annex) shows, Finland's structural competitiveness¹ has changed dramatically over the past decades. At the beginning of the year 1980 Finland had reached the ninth place among the OECD countries with respect to structural competitiveness. During the 1980s until the beginning of the 1990s the country had lost competitiveness and had fallen back to the 14th place. But already in the mid-1990s, shortly after the deepest economic crisis an OECD country has ever been confronted with after the Second World War, Finland had climbed to second place, which the country also managed to hold in the late 1990s. Only Ireland and Denmark have been able to improve their structural competitiveness to the same extent as Finland.

The breakdown of overall competitiveness in the late 1990s into various sub-indicators, as shown in Table 2 (see annex), demonstrates that Finland had particular strengths in the availability of new resources and new technologies, while there were some weaknesses concerning economic internationalisation, the institutional environment and state policy.

The phase of path dependency in Finland's economy

Finland's economic and social development has rested for a long time on the country's 'green gold', its abundant forests. For centuries these forests have dominated the country's international trade. While earlier tar and later on timber were the most important products, pulp and paper have been Finland's key export goods since the late nineteenth century. Thus it is no wonder that Finland has sometimes been characterised as a 'forest society'. However, this may overemphasise the country's dependency on a single factor, as Finnish households relied primarily on agriculture. Until the mid-twentieth century Finland had been an agrarian society with a still growing agrarian sector (Kuisma 1999). And the textile industry also had a very strong position in the Finnish economy in the nineteenth century. Britain's move towards international free trade in the mid-nineteenth century leading to the abolishment of import duties for timber, on the one hand, and the accessibility of the huge Russian market for Finnish paper manufacturers—Finland was part of Russia until its independence in 1917—were the two cornerstones for Finland's turn-of-the century economic dynamics.

Backward starting conditions for industrialisation and raw-material based exports have not led to a monocultural exclave economy, however. Instead Finnish forest firms have been able to create a dynamic growth path with a constantly widening scale of exports after the Second World War. The strength of the Finnish forest industry can be explained by the fact that step by step a forest cluster has emerged including timber production, pulp and paper industry, mechanical engineering firms, several related supplier industries (incl. energy, chemicals, maintenance services) and customer industries (paper converters). In addition, the Finnish forest industry has established a European-wide production and distribution system since the 1960s. More recently the few large companies dominating the Finnish market have also started to pursue a globalisation strategy with new production sites in the USA and in South-East Asia. At the same time they have concentrated on the more high-value-added products and on consulting services, while market shares in the market for standardised products have dropped significantly. From the 1960s onwards Finnish companies have lost market shares in the world pulp and sawn goods exports, while their market share in printing and writing paper has increased (Lilja, Räsänen & Tainio 1992).

To explain the competitive advantage of the Finnish forest industry, Lilja, Räsänen and Tainio (1992) refer to the following factors: corporate specialisation in the forest industry, consorted business operations, patient capital, technological modernisation, resource dependence on farmers as forest owners, paper workers as the labour aristocracy and a dependent state. Up to the 1980s the Finnish industry was highly specialised in forest industry products. In the 1950s, 90 per cent of Finnish exports came from the forest industry, but in the 1980s this dropped to about 40 per cent. The industry is now dominated by a few large paper producing companies, which after a series of mergers also with Swedish companies have become important global players. Some of the supplying firms to the forest industry have also been able to acquire a leading position in their niche markets, one of them being the mechanical engineering company Valmet.

Specialisation in the forest industry in Finland has resulted in a high concentration of internationally competent paper industry corporations whose production sites are close to each other. While local competition

triggered a process of continuous upgrading of products and processes, geographical closeness led to a permanent flow of knowledge and a rapid diffusion of innovation. But besides these informal linkages, forest companies have also engaged in a great number of co-operative projects and joint ventures. Paper and timber producers colluded to reduce mutual competition. And only at the beginning of the 1990s have the key members of the joint sales associations, which had been established already in the 1880s to conquer the Russian market, withdrawn from this institution (Lilja, Räsänen & Tainio 1992).

The forest cluster also profited significantly from strong state intervention during the post-war period. Here the special relationships with the Soviet Union, indicated by strong export figures, played an important role. Under the presidency of Urho Kekkonen the Finnish government gave the development of good economic relationships to its larger neighbour high priority, widely subordinating the development of the economy to external policy. This resulted in the support of huge national programmes, resulting in immense investments. Some scholars actually speak about a planned economy in Finland during that period (Tainio, Pohjola & Lilja 1997). On the other hand, the centralised steering of the Finnish economy through these 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 fact that Finnish pulp and paper-producing companies have been managed by engineers in the first place had a major impact on their modernisation strategies. Investing less intensively in R&D, paper companies have concentrated on cost-cutting by improving the efficiency of their production processes and on integrating production to an ever greater extent. The development of production technology, including continuous improvement of the system in use but also the experimentation with new technologies developed by the mechanical and chemical forest industry, often also triggered incremental product innovations. In general we can argue that companies in the forest industries concentrated more on exploiting existing technological knowledge instead of exploring new knowledge (Palmborg 2001).

Technological modernisation, together with a business culture in which engineers had a formative influence, has supported the establishment of highly bureaucratic organisation structures. Naturally the long-term stable economic environment caused by the central planning system also contributed to the establishment of technology-intensive, highly bureaucratic business structures. Workers on the shop floor, on the other hand, enjoyed some kind of autonomy, as they depended to a great extent upon practical or tacit knowledge accumulated in processes of learning-by-using and problem-solving rather than coded or theoretical knowledge. The fact that an uninterrupted production process very much depended on the tacit knowledge of the workforce and its willingness to cooperate was well recognised by the management (Lilja, Räsänen & Tainio 1992). This and a large membership enabled the unions to pressure for high wages including a share of productivity increases. Unions therefore weakened industry's ability to compete on the world market as a cheap producer; they thereby accelerated the technological shift towards a more efficient, capital-intensive large-scale production (Kuisma 1999). Due to their strong bargaining power, paper workers formed the core of a labour aristocracy in Finland but, contrary to the Finnish workforce in general, workers in the paper industry were less conflict oriented (Lilja 1992).

The specific ownership structure of the Finnish forests also contributed to the fact that the pulp and paper industry had to focus on the high price segment of the global market. The main owners of the forests are the farmers, whose ownership rights were already secured at the beginning of the last century. Even today about 65 percent of the Finnish forests are owned by a group of small farmers, while large companies own only about 8 per cent. The low integration of the whole value chain distinguishes the Finnish forest cluster significantly from the situation in other countries such as Canada and Denmark, for example. The huge pulp and paper producers became dependent on tens of thousands of small farmers who formed their own institutions to secure their strong position in price bargaining on the raw material for pulp and paper production (Schienstock & Tulkki 2001).

Investing heavily in production technology to compensate for high raw material and labour costs, the pulp and paper companies became more vulnerable to market fluctuations. The paper industry faced a number of cost

crises, which prompted the government to devalue the Finnish currency several times to guarantee the global competitiveness of the country's dominant industry. The Finnish government also supported the paper industry by encouraging banks' long-term involvement in the sector through taxation policy and by stimulating personal savings (Lilja, Räsänen & Tainio 1992). As long as the forest cluster dominated the Finnish economy, the finance system could be described as an 'insider system', characterised by a strong influence of national banks in companies' business strategies and practices. Being partly owned by large national banks and depending on 'patient capital' which granted long-term credits, the forest companies have been widely controlled by the banking system. The banking system created a stable environment, which guaranteed preconditions for stable growth (Tainio, Pohjola & Lilja 1997). However, in periods of rapid economic change and dynamic growth, the insider system functions less efficiently because it is more likely to preserve existing industrial structures and to hinder creative destruction of less competitive industries.

Those state activities were seen as indicating the dependency of the nation-state on the forest industry. In fact the forest cluster was supported by strong social groups including the farmers and their interest organisation, the forest workers and their union, and the conservative political party, which could easily convince the government to act in the interest of the forest cluster. Kuisma (1999) argues, however, that a Finnish forest capitalism never fully materialised as the large companies could not become forest owners, which weakened their economic position and they had to some extent rely on the state that tried to mediate between the interests of small farmers and large paper companies. Actually the ownership of the forest is often seen as one of the several roots of the Finnish welfare state (Kuisma 1999).

The economic crisis

There is no doubt that due to the strength of the forest cluster the Finnish economy managed to reach the league of the wealthiest countries in the world by the end of the 1980s (Klinge 1997). The country's catching-up

process was perhaps even more impressive than that of Germany and Japan, because Finland was not an industrialised economy before the Second World War like those two other countries. Some scholars have argued, however, that the success of the Finnish economy during the period of the 1960s to the 1980s was not sustainable due to the inefficient use of capital and labour in the forest cluster, indicated by a comparatively low productivity (Tainio, Pohjola & Lilja 1997). Continuous technicalisation of the production process and the extension of production capacity often took place at the expense of productivity and efficiency (Lilja, Räsänen & Tainio 1992). This became visible when in autumn 1990 the Finnish economy plunged into the most severe depression in the history of independent Finland. The forest cluster was hit particularly hard by the recession because its global competitiveness was limited.

Other factors naturally also contributed to the economic crisis of the early 1990s: the collapse of the Soviet Union, the overheated economy caused by continuously improving terms of trade, sky-high share prices fuelled by huge foreign investments, a bad macro-economic management and a general economic slowdown in the rest of the world. Numerous firms filed for bankruptcy, thousands of over-indebted households defaulted on their debts, the Helsinki Stock Exchange collapsed and the Finnish banking system faced bankruptcy. Industrial production shrank by about 10 per cent and GDP by about 20 per cent, while the unemployment rate topped at about 20 per cent. Due to high unemployment rates and enormous expenditures to save the banking system from collapsing, the state had to run a huge budget deficit of about 7 per cent of GDP. Soon it became clear that the Finnish economy required major structural changes, because the forest cluster with its low productivity did not manage to reduce the high unemployment figures significantly. Finland had to create a new growth path; it could not continue with a path-dependent development.

Although there was wide agreement that only a fundamental economic transformation would help Finland to produce the economic growth needed to overcome the aftermath of the deep crisis, we cannot talk about a clean cut with the past. As early as in the 1980s it was widely argued that Finland could no longer rely on an investment-driven growth strategy; knowledge intensity and technological superiority should become the country's com-

petitive advantage instead (Ormala 1999). This also implied that the country had to reduce its dependence on the forest cluster. Even before the economic crisis, Nokia's CEO Kari Kairamo challenged the forest cluster by launching a campaign which advocated a vision that Finland should become an 'information society' instead of depending on an old-fashioned 'smokestack industry' (Lilja, Räsänen & Tainio 1992). However, Nokia had major economic problems with its consumer electronics acquired in Germany and Sweden, while the forest industry did well at the end of the 1980s and also convinced the public that it was in fact a knowledge-based industry. Therefore by the end of the 1980s it seemed that the forest industry had won the battle between the old and the new.

The path creation perspective: The emergence of the ICT cluster

A few years later, however, the picture looked quite different: Finland had switched to a new development path based on the knowledge-intensive ICT cluster. The rapidity of industrial change in Finland can be demonstrated by the fact that the share of electronics and electronic equipment in total exports grew from one tenth to more than 25 per cent in the 1990s, thus exceeding that of the paper industry, which had dominated Finnish exports for decades. In addition, the ICT cluster showed growth rates of up to 25 per cent each year with the telecommunications industry growing by 35 per cent per year, while the paper industry grew by only 1.6 per cent per year (Alasoini 2004). Within a few years Finland became one of the leading countries in telecommunications.

Again I will refer to some factors that can explain the competitive advantage of the Finnish ICT cluster: corporate specialisation in telecommunications, the core company as a key global player and a network of SMEs associated with the global giant, high R&D intensity and close science-industry cooperation, techno-organisational modernisation, knowledge workers forming the core of the workforce and innovation-enabling state policy.

The business sector as driving force

Finland's transformation from a raw material-based, capital and energy-intensive economy into a knowledge-intensive economy is presented as an example of how companies can trigger a fundamental change in the industrial structure of an economy by reinventing themselves (OECD 2000). And in fact Nokia played a very important role in Finland's economic renewal process. Nokia's development into a key global player in the telecommunications industry parallels Finland's transformation into one of the leading countries in the ICT sector, indicated by its dominant position among industrial countries with respect to ICT value added, ICT employment and R&D in ICT (Ali-Yrkkö et al. 2000; Ali-Yrkkö & Hermans 2004; Pajja & Rouvinen 2004).

It is only at first glance that Nokia appears to be a company totally different from the other large Finnish companies, since it produces consumer goods with a well-known brand name, while Finnish companies in general produce industrial goods such as paper and paper machines, elevators or ice breakers. But like most other Finnish companies, Nokia has its roots in the emerging forest industry of the 19th century. Based on its stronghold in the forest industry, the company diversified into other branches such as rubber, cables, TVs and mobile telephones. During the 1970s and 1980s Nokia developed into a conglomerate with a great number of divisions that produced nearly everything, which caused people to speak about Nokia as a 'junk shop', in which the multitude of divisions hardly allowed for any kind of synergies. And the turnover of the cable and rubber production far exceeded the turnover of the electronic division. The company had the same centralised bureaucratic authority system as other large Finnish companies; the divisions had only little autonomy, they were led and controlled from the top. The company's financial resources were limited as it depended on the Finnish banking system.

Nokia's conglomeration strategy in connection with a centralised organisation model plus an internal power struggle caused serious problems (Castells & Himanen 2001). At the beginning of the 1990s, when Nokia was also hit by the economic recession, the company struggled for survival. The old management was totally replaced, and Jorma Ollila, the leader of the Nokia Mobile Phone Division, was asked together with a group

of young managers to lead the company out of its deep crisis. The new management changed the company from a centrally governed conglomerate operating in saturated markets into a highly specialised telecommunications company with huge growth potential. The de-investment of all unprofitable businesses helped the company to finance its restructuring process.

From Nokia's perspective the 1990s can be characterised as a decade of specialisation, rapid growth and internationalisation. Since the mid-1990s Nokia has grown by about 30 per cent each year, mainly due to its very aggressive internationalisation strategy. The American and particularly the South-East Asian market have become increasingly important, while the European and particularly the Finnish market have lost out. To increase productivity and flexibility Nokia has turned itself into a network organisation by flattening hierarchies and decentralising decision-making, on the one hand, and by establishing a network of supplier firms partly by outsourcing not only production, but also software and even R&D, on the other.

Being the only global player Nokia is definitely the core of the Finnish ICT cluster. But Nokia's national network consists of companies that cover the whole value chain producing information and communication services as final output, including component producers, contract manufacturers, network operators, software and digital content producers, as well as related industries (e.g. banks). While some of these companies have managed to grow as rapidly as Nokia and established themselves in their global niche markets, most of them still very much depend on Nokia's fate. They have to aim at a strong position in Nokia's global supplier network (Paija & Rouvinen 2004). And while the technology-related KIBS sector is doing quite well, no other global player besides Nokia has emerged in the Finnish ICT cluster yet, neither in software nor in digital content production.

Intensive networking within the ICT sector has contributed to the fact that Finland has been characterised as a network economy (Castells & Himanen 2001). In the 1980s insufficient networking within industry and between industry and science has been identified as a major weakness of the Finnish economy. International indices show Finland at or close to the top of any list seeking to measure networking (Prihti et al. 2000). The nature of cooperation has also become deeper and more strategic during the past

decade (Confederation of Finnish Industry and Employers 2001). Still there are industrial differences. The low productivity of traditional industries indicates that there might be some difficulties in introducing organisational innovations and intra-organisational networking in particular, as well as in applying modern ICT in a more sophisticated way. Trans-industrial cooperation between the new high-tech firms and the traditional industries also seems to be rather difficult (PalMBERG 2001).

Institutional adaptation

Behind the evolution of the Finnish ICT cluster there is a complex and self-strengthening development process, the foundations of which were already laid in the mid-nineteenth century. While the business sector had a leading role in the development of a new industrial cluster, the institutional setting and public policy were mostly beneficial to the Finnish ICT cluster. For example, early competition, including strong foreign companies (Ericsson and Siemens) strengthened the competitiveness of Finnish equipment producers. And demanding customers (network operators) pressured them to be state-of-the-art and to continuously improve their products. Furthermore a trans-border standardisation process (Nordic Mobile Telephone standard) created a large Nordic market. And also a culture open to new technologies has contributed significantly to the evolution of the ICT cluster.

We can therefore argue that the development of the knowledge economy in Finland has been a national project. For example, the Finnish education system, which is very much technology oriented, has supported the knowledge-based high road approach by increasingly focusing on higher education, not only by extending universities' education capacity in ICT, but also by establishing the polytechnic system, which boosted tertiary education (Raivola et al. 2001). It is quite common for industrialised countries that more than 80 per cent of the 15–19-year olds go to school, but Finland is unique insofar as the percentage of students in the age group 20–29 is about 40 per cent. While Finland's economic success in the post-war period is associated with a semiskilled workforce, today about 50 per cent of all new entrants into the workforce have tertiary

education. This means that a great number of entrants in the labour market become knowledge workers. For example, some 20 per cent of the Finnish workforce is employed in R&D jobs. And experts expect this trend to continue as new workplaces will only be created in the highly skilled sector.

The Finnish financial system has adapted to the new demands of the economy associated with the evolving ICT cluster by changing from an insider system to an outsider system. The 'outsider system', characterised by broadly distributed ownership and a dominant influence of the market, is better suited to support dynamic change processes as capital always looks for profitable investment and moves more easily from unprofitable stagnating businesses to more profitable businesses promising rapid growth. Together with the rapid growth of the Finnish ICT sector, foreign capital became more interested in Finland and the Helsinki Stock Exchange. In 1993, when the full liberalisation of foreign ownership of shares in Finnish companies was introduced, the Finnish finance market became totally integrated into international capital flows. In the mid-1990s huge sums of foreign capital were pumped into Finland and for some years the Helsinki Stock Exchange was the most internationalised stock exchange in the world (Rouvinen & Ylä-Anttila 2003, 99). It became very easy for Finnish companies to increase their capital resources by issuing new shares. Of course the crash at the end of the millennium made the Helsinki Stock Exchange much more vulnerable, but the large Finnish companies were less affected as their shares were also listed in the US. In the outsider system Nokia in particular had no problem financing the huge investments for its rapid growth without becoming too dependent on the banking system.

Together with the establishment of the outsider system more venture capital also became available in Finland. The absence of a well-functioning venture capital market was often blamed for the low number of newly founded high-tech firms. But of course the dominant forest cluster had comparatively little demand for venture capital. This has changed completely with the evolving ICT cluster and, more recently, the biotech industry. In the beginning, venture capital was mainly provided by state-owned agencies but soon private capital became more involved. In the second half of the 1990s, Finland became one of the most rapidly growing venture capital

markets in Europe; in less than ten years the amount of venture capital available had grown tenfold (Hyytinen & Pajarinen 2002). Increasingly, venture capitalists not only provide money, but also consult the new companies in a lot of other matters.

The Finnish R&D system has also been beneficial to the ICT cluster. Many of the national technology programmes started in the early 1980s and co-ordinated by the then newly founded Technology Development Centre (Tekes) had a focus on the ICT sector. As early as the 1980s, however, the share of the ICT-related programmes was significantly reduced as a result of the struggle between the old and the new industries. While the share of ICT in the national technology programmes was about 62 per cent in 1982, it shrank to 51 per cent in 1985, and to 29 per cent in 1991. Nevertheless R&D funding by Tekes has helped Nokia to develop some of its most important innovations. But while Tekes funding had strategic long-term influences, such as the development of the GSM technology, Nokia itself supported the Finnish economy through education, R&D and diffusion of knowledge within its networks (Ali-Yrkkö & Hermans 2004).

More generally the Finnish science technology and innovation policy has been an important support factor in transforming Finland from a resource-based into a knowledge-based economy (Nieminen & Kaukonen 2004). In respect to the financing of R&D, it is important to mention that Finland has a leading position among the OECD countries, with a share of about 3.5 per cent of R&D expenditure in GDP and a 70 per cent share of the industrial sector in R&D expenditure, being second only to Sweden. The country has already achieved the criteria established by the Barcelona European Council in 2000, which were established to give Europe a leading position in the emerging knowledge economy.

But there are also a number of other institutional factors that are worth mentioning. For example, Finland was the first among the OECD countries to adopt the concept of a national innovation system as a basis of its S&T policy, stressing the importance of a systemic transformation process (Ormala 1999). Besides, when Tekes started its national technology programmes, it placed great emphasis on cooperation between SMEs and large companies and between the industrial and the scientific sector. Finland can be seen as one of the few countries that have developed a consistent approach towards

a network-facilitating innovation policy (Schienstock & Härmäläinen 2001), indicated among others by the great importance of its cluster programmes (Prihti et al. 2000). In addition, Finnish S&T policy focused on further developing its economic stronghold instead of saving its weak industries. The intention of the Centre of Excellence Programme, for example, is to concentrate basic research in specific fields (ICT and more recently biotechnology) to boost knowledge creation and knowledge diffusion. And the development-oriented Centre of Expertise Programme aims at creating strong knowledge-based regional clusters.

More recently Finnish S&T policy has reacted to new challenges (Lemola 1999; 2002). For example, internationalisation 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 S&T Policy has focused too much on technological innovations, widely ignoring social and organisational innovations aiming at supporting the efficient generation, diffusion and use of new knowledge. Technological innovations, as the Science and Technology Policy Council has stated recently, are important in fostering social development, but they have to be supported and embedded in newly created efficient social structures in all sectors of the society (2003).

The fact that traditional industries have increased their productivity by only small margins after the economic crisis, which may lead to a two-speed economic development in the old and in the new industries, and the slow decline of the high unemployment figures motivated the government to establish a National Workplace Development Programme co-ordinated by the Ministry of Labour in the mid-1990s. The main aim of this programme was to stimulate organisational change and human resources development in Finnish companies to increase productivity and innovativeness (Arnkil et al. 2003). Organisational renewal within the policy sector has also been discussed under the heading of organisational and social innovations (Science and Technology Policy Council 2003). The establishment of policy networks between policy-making bodies and with other social actors and the installation of social discourses as new coordination mechanisms can be seen as having high priority (Schienstock & Härmäläinen 2001).

Changes in the Finnish welfare state

The specificity of the Finnish knowledge economy lies in that it emerged together with a welfare state of a high standard. Castells and Himanen (2001) actually argue not only that the well-developed welfare state depends on strong knowledge industries, but also that the emerging Finnish knowledge economy could only develop to its strength due to the integrating and including effects of the welfare state. Welfare policy in Finland was quite successful in achieving its main goals until the early 1990s: keeping unemployment rates low, narrowing down income differentials, and expanding social services. This is based on a fairly egalitarian culture, which worked against social differentiation and segmentation. A small country in which intensive cooperation and collective mobilisation of resources is widespread, Finland provides a good example of a relatively homogeneous 'high-trust' culture.

The high unemployment rate caused by the crisis of the early 1990s has become a great challenge to the Finnish welfare state. Even though the economy started to recover very quickly from the recession and reached the pre-recession growth rate already in 1996, unemployment still remained comparatively high despite the fact that it had started to decrease steadily from 1994 onwards. Although the unemployment rate has recently dropped to under 9 per cent, which is below the EU average, it is still significantly higher than the average of the best-performing countries in the OECD and has not come close to the pre-recession level. The number of social assistance recipients also increased quite significantly in the years after the recession.

Looking at the annual incidence of unemployment, one can get a more comprehensive picture. This figure increased significantly in Finland in the 1990s. While before the economic crisis (1990) only about 10 per cent of the workforce experienced unemployment, this share is now above 20 per cent, having dropped only slightly from its peak in 1993, which indicates an increasing instability in work careers. People with little education are more likely to experience unemployment than highly educated people. In 1998 about 30 per cent of workers with no more than comprehensive school education were unemployed on one or more

occasions. As in many cases the elderly have generally received little education; age is also closely correlated with experiencing unemployment (Suikkanen & Linnakangas 2004).

Youth unemployment in Finland is rather high compared with the situation in most other European countries (OECD 2000). The high unemployment rate, particularly among low-skilled young people, can become a serious problem in the near future, as the workforce in Finland will be shrinking very rapidly during the coming years. It may well be the case that despite the increasing demand for highly qualified workers the unemployment rate will remain high due to the widening skills gap.

Not only the high unemployment rate, but also the structuring of unemployment is becoming worrisome, as long-term unemployment and repeated unemployment are becoming essentially more common (Suikkanen et al. 2001). The added proportion of the long-term and chronically unemployed in 1998 was above 60 per cent of the annual flow of the unemployed, which was significantly higher (41%) than in 1990 before the economic crisis (Lehtonen et al. 2001). Since the demand for low-skilled labour is structurally low in Finland as an increasingly knowledge-based economy, this group of workers, often in combination with high age, is at risk of being pushed to the periphery of the labour market with highly insecure jobs or becoming long-term unemployed and socially excluded.

While the unemployment rate in Finland came down during the 1990s, the share of people in normal employment increased only slightly during that period. In the 1990s jobs in low-pay sectors became increasingly dominated by atypical work contracts. In Finland over half of all new job contracts signed can be characterised as atypical (Lipponen 2000). Atypical employment, we can conclude, cannot be seen as a phenomenon of the economic crisis but it has become more and more common since the 1990s.

Relatively small income differences have been seen as another characteristic of the Finnish welfare system (Förster 2000). Up to the 1980s Finland belonged to the most homogeneous of the advanced industrialised countries, and even the crisis at the beginning of the 1990s did not cause income differentials to increase significantly (Lehtonen et al. 2001). But the period of high economic growth changed the income situation dramatically; the fruits of economic growth in the second half of the 1990s have been dis-

tributed increasingly unequally. This can, on the one hand, be explained by the fact that due to increasing global cost and price competition, wage increases in the second half of the 1990s in Finland remained moderate. The Finnish investment-driven growth strategy has also kept wages from rising more strongly (Lehtonen et al. 2001).

On the other hand, the incomes of the higher-level management and particularly the profit-related incomes increased dramatically during the late 1990s due to the worldwide spreading of Anglo-Saxon management philosophies and principles. Because of the boom at the Helsinki Stock Exchange, property-related incomes have also been growing significantly. These developments have caused increasing income gaps between a relatively small group of rich households and a larger group of poorer households, but in relative terms the middle-income brackets have lost the most. The new developments have also caused increasing regional differences; while growth areas such as Helsinki and Tampere have achieved significant gains, the economic situation has scarcely improved in most rural areas and some old industrialised regions. And there still exists a divide between the highly industrialised triangle in the Southwest between Helsinki, Tampere and Turku and the northern and eastern parts of Finland.

The extremely high unemployment rate in the early 1990s resulted in rapidly growing social security expenditure; total social security expenditure increased from 25 per cent to 35 per cent of GDP. Although these costs declined from that peak, they still remained at a comparatively high level after the economic recovery. The relative decrease in social and unemployment costs is partly related to the decreasing number of benefit recipients but was mainly caused by cuts in benefits and the growth in the relative proportion of minimum benefit recipients (Lehtonen et al. 2001).

Of course the limitation of public debts in the EU put additional pressure on the Finnish government to keep social security expenditure within limits. In summary, we can argue that welfare policy in Finland did not manage to achieve the high standards of the pre-recession level in the late 1990s and early 2000s. The unemployment rate is still comparatively high with a growing part of long-term and chronically unemployed, income differentials between wage and property revenues have increased dramatically and expenditure for social services has been cut significantly

(Lehtonen et al. 2001). Most scholars agree, however, that besides the cuts in the 1990s the Finnish welfare system has kept its basic structures (Niemelä & Salminen 2003).

Conclusion

Finland can be characterised as a knowledge-based economy in the making. This means that the change from the resource-based to the knowledge-based development path has not been completed yet. Besides, we should not interpret the transformation process as the reaching of a stable state. Instead, the knowledge-based economy is continuously produced, reproduced and changed. Nevertheless Finland has taken advantage of the new techno-organisational paradigm that has emerged in the latter part of the last century, earlier than most other industrialised countries. Of course this is partly due to the fact that an unsustainable growth path threatened to put Finland into a lock-in situation. Furthermore, Finland as a small open economy is particularly exposed to global competition pressures and must react quickly. And the deep economic crisis in the 1990s accelerated an already ongoing transformation process. In addition, some people in the business sector taking high risks by rigorously specialising in the new technological paradigm helped their companies to gain global competitiveness with the support of policy makers who created an environment that helped to generate a new development path.

While Finland has been admired by outside observers for its successful turnaround, a number of problems still exist that can threaten further development. First, although the ICT cluster has broadened its basis as new rapidly growing companies have emerged during the past few years, the dependence on Nokia, the core company, is still very high. There are some doubts whether the cluster can keep on track if Nokia happens to fail or leave the country. Nokia itself has some troubles because it faces increasingly tough competition from low cost producers in South-East Asia and from catching up rivals such as Samsung Motorola or Sony/Ericsson.

Second, the Finnish ICT cluster has its strength in telecommunications and here the equipment producers have by far the strongest position. But

software and content production are becoming much more important than equipment production hand-in-hand with the introduction of the third generation mobile phones. In these fields no company has emerged yet that could compare to Nokia. Furthermore, while the establishment of a new ICT sector may be seen as the driving force for the creation of a new development path, economic success in the knowledge-based economy in the long run depends on the diffusion and use of these new technologies in traditional sectors. While Finnish banks are most advanced in the use of modern ICT, some other sectors seem to be lagging behind.

Low productivity and slow growth of the traditional industries in Finland seem to indicate that there are some problems concerning the introduction and intelligent use of modern ICT and their embedding into new organisational models (Alasoini 2004). There is the risk that the Finnish economy will become segmented with the traditional industries lagging behind the dynamic ICT cluster, although the recent slowdown in the ICT sector makes this development less likely to occur. Nevertheless some question marks have to be put behind some kind of 'obsession' with the 'high-road strategy' in Finland. There are some indications that the focus on tertiary education may diminish the growth potential of the traditional industries, as they seem to have difficulties in finding an adequately trained workforce (Palmborg 2001).

It is most important, however, to find out whether the specific national trajectory within the new paradigm is sustainable in the long run. Although Nokia is the leading mobile phone producer and has a strong position in the production of digital networks, the turbulent situation in the ICT sector and the dramatic technological development together with continuous industrial restructuring can easily undermine the position of a front-runner in telecommunications equipment production. The merger of telecommunications and computers may soon lead to major clashes between two philosophies: the desk computer and the mobile phone together with some other digital tools. Which of the two will in the end conquer the world of communication and information exchange remains unanswered for the time being. But the outcome of this struggle may very well affect the success of Finland's national trajectory into the knowledge-based economy (Rouvinen & Ylä-Anttila 2003).

Note

¹ To operationalise structural competitiveness the following factors have been used, which themselves consist of a number of sub-factors:

- (1) new productive resources (venture capital, human capital, scientific knowledge, ICT infrastructure);
- (2) new technologies (R&D inputs, innovations, adoption of ICTs);
- (3) new organisational arrangements (allocative, technical, co-ordination and dynamic efficiency);
- (4) new product market characteristics (sophistication of demand, product market institutions, user-producer co-operation);
- (5) degree of economic internationalisation, (foreign direct investment, international trade, cross-border alliances);
- (6) institutional incentives (taxation, regulation, returns to education; and
- (7) the role of government (expenditures on efficiency and competitiveness vs. equity-related tasks).

Methodological aspects are discussed in Hämäläinen (2000), and an extensive theoretical debate can be found in Hämäläinen (2003).

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Annex

Table 1. Structural competitiveness of nations in the new techno-economic paradigm

Early 1980s		Late 1980s		Early 1990s		Mid-1990s		Late 1990s	
Canada	0.62	USA	1.27	Japan	0.82	Sweden	0.85	USA	1.10
Switzerland	0.46	Switzerland	1.19	USA	0.69	Finland	0.71	Finland	0.88
Australia	0.43	Japan	0.70	Sweden	0.47	USA	0.62	Switzerland	0.72
USA	0.42	Germany	0.65	Netherlands	0.45	Canada	0.59	Canada	0.55
Sweden	0.41	GB	0.62	Canada	0.42	Switzerland	0.56	Netherlands	0.55
Japan	0.23	Sweden	0.60	Switzerland	0.38	GB	0.50	Denmark	0.42
Germany	0.20	Canada	0.52	Denmark	0.34	Japan	0.44	Australia	0.41
Netherlands	0.18	Netherlands	0.52	Germany	0.29	Norway	0.41	Sweden	0.36
Finland	0.15	Belgium	0.14	GB	0.27	Denmark	0.34	Ireland	0.28
GB	0.11	Australia	0.08	New Zealand	0.20	Netherlands	0.32	Norway	0.24
New Zealand	0.10	France	0.01	Belgium	0.16	Australia	0.22	Japan	0.23
France	0.01	Finland	-0.02	Australia	-0.04	New Zealand	0.21	GB	0.22
Norway	0.01	Denmark	-0.06	Norway	-0.05	Germany	0.10	Belgium	0.11
Austria	-0.01	Austria	-0.12	Finland	-0.08	France	0.01	Germany	0.06
Denmark	-0.02	New Zealand	-0.17	Austria	-0.12	Belgium	-0.02	New Zealand	-0.09
Belgium	-0.06	Norway	-0.24	France	-0.13	Ireland	-0.04	Austria	-0.28
Greece	-0.27	Ireland	-0.30	Ireland	-0.18	Austria	-0.09	France	-0.38
Ireland	-0.27	Portugal	-0.79	Portugal	-0.63	Portugal	-0.75	Portugal	-0.46
Spain	-0.38	Italy	-0.80	Turkey	-0.63	Spain	-0.83	Spain	-0.62
Portugal	-0.62	Spain	-1.00	Greece	-0.66	Italy	-1.06	Turkey	-1.33
Italy	-0.63	Greece	-1.18	Spain	-0.90	Greece	-1.47	Italy	-1.34
Turkey	-1.05	Turkey	-1.60	Italy	-1.10	Turkey	-1.62	Greece	-1.64

Source: Schienstock & Hämmäläinen (2001, 35).

These figures represent average standard deviations. Calculations were made by Timo Hämmäläinen.

Table 2. Overall competitiveness of economic systems in the late 1990s

Country	Standardised competitiveness factors								
	Resources	Technology	Organisation	Product market	International business activities	Institutions	Government	Overall (average)	
Australia	0.83	0.28	0.44	0.41	-0.62	0.39	1.15	0.41	
Austria	-0.98	-0.26	-0.16	-0.08	-0.12	0.30	-0.67	-0.28	
Belgium	-0.13	-0.29	0.10	-0.18	1.90	-0.37	-0.24	0.11	
Canada	1.59	-0.18	0.59	0.47	0.05	0.55	0.76	0.55	
Denmark	0.66	0.54	1.12	0.51	-0.18	-0.65	0.96	0.42	
Finland	1.49	1.53	0.77	0.93	0.26	0.46	0.74	0.88	
France	-0.39	0.00	-0.80	-0.15	-0.65	-0.49	-0.18	-0.38	
Germany	-0.44	0.31	0.17	0.53	-0.63	0.90	-0.40	0.06	
Greece	-0.87	-1.51	-1.93	-1.72	-1.21	-1.42	-2.80	-1.64	
Ireland	-0.54	-0.62	-0.55	-0.03	1.83	1.25	0.63	0.28	
Italy	-1.08	-0.86	-2.22	-1.07	-1.00	-2.20	-0.97	-1.34	
Japan	-0.34	1.85	0.13	1.12	-1.34	0.51	-0.29	0.23	
Netherlands	0.32	0.34	1.07	0.62	1.42	-0.53	0.56	0.55	
New Zealand	0.17	-0.39	0.64	-0.13	0.27	-0.06	-1.12	-0.09	
Norway	0.88	0.63	-0.19	0.10	-0.33	-0.70	1.33	0.24	
Portugal	-1.31	-1.25	-1.30	-1.82	2.05	-0.17	0.58	-0.46	
Spain	-0.68	-1.20	-1.10	-1.04	-0.41	0.02	0.08	-0.62	
Sweden	0.92	1.70	0.68	0.57	0.53	-1.36	-0.54	0.36	
Switzerland	0.49	0.66	0.68	0.07	0.07	1.35	0.38	0.72	
Turkey	-2.29	-1.84	-0.45	-0.64	-0.64	-0.83	-1.15	-1.33	
UK	0.30	-0.32	0.60	-0.17	-0.17	1.23	-0.28	0.22	
USA	1.49	0.87	1.71	-1.08	-1.08	1.81	1.46	1.10	
Rank of Finland	2	2	4	4	7	8	9	2	

Source: Schienstock & Hämmäläinen (2001, 39).