

# Spatial turns of manufacturing since 1970

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In this article, the geographical transformation of the Finnish manufacturing sector since the 1970s is analysed. Changes in manufacturing employment by municipalities are used as central indicators of the transformation. The urban–rural shift, deindustrialisation, and emergence of the new economy have all occurred during the last three decades.

A trend surface analysis indicates that manufacturing employment increased all over the country in the 1970s. The growth was higher the more northern and eastern the municipality's location. This pattern was conformable to the goals of the Finnish regional policy of the 1970s. Deindustrialisation plagued the economy from the early 1980s to the mid-1990s, and its negative labour force impacts were focused especially on the southern mature industrial cities. The industrial policy of the 1980s was without much result. Finally, the crisis of the early 1990s ruined a considerable part of industrial performance everywhere in the country. The era of telecommunications-driven economic growth in the 1990s led to the geographical pattern of growing employment in few urban areas and some localities adjacent to cities. The long, vigorous growth period (up to the year 2001), comparable with the growth of the late 1960s and early 1970s, diffused to rural municipalities, but the geographical pattern of this boom was oriented more towards the west and south than in the 1970s.

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## Background

External factors, such as export demand, trade agreements, and wars, have strongly regulated the Finnish economy. Since 1917, Finland has been a sovereign actor in Europe. Until the mid-1990s, the only doctrine of the economic policy was to emphasise the nation-state as the prime regulative actor in the economy. The advantages of the economic integration for the specialised and export-oriented economy led to a search for economic integration after the post-World War II regulative period. As a corollary, the Finnish economy has been integrated gradually into the core of the European economic market area: first as an associated member of the EFTA in 1961, then as a full member in 1986 and, finally, as a member of the EU in 1995. Nowadays Finland is part of the euro and the Schengen Treaty areas.

The turbulent eras of Europe had radical impacts on the structures and geography of econom-

ic activities in Finland (Hjerppe 1989). Forest-based production was the main source of export revenue for long after World War II. Finland was a sparsely populated country where the scattered settlement pattern was maintained by forestry (and agriculture). The logistics of the resource-based sector determined a great deal of the regional structures, especially outside a few industrial centres (Tykkyläinen 1988: 343). Gradually, transformation from low-value products to high value-added wood and paper products and diversification to the metal industry began to take place.

The nurturing of basic industries was part of the Finnish economic policy, leading to the growth of the manufacturing of metals, metal products and machinery, oil refining, and the production of chemicals over decades after World War II. The investors were largish companies, and many of them were in the state ownership, such as Kemira, Neste (now Fortum), Outokumpu, Rautaruukki, and Valmet (now Metso) (see [www.kemira.fi](http://www.kemira.fi);

*www.fortum.com*; *www.outokumpu.com*; *www.rautaruukki.com*; *www.metso.com*). The exports to the Soviet Union and other CMEA (Council for Mutual Economic Assistance) countries consisted of machines, ships and, later on, many consumer goods. The trade in consumer goods boosted the expansion of the light industry especially in the 1970s and 1980s. The industrial basis became more diversified, but the national economy was more controlled than it is today. For instance, industrial companies were Finnish-owned with only a few exceptions until the early 1990s. Rationalisation led the spatial restructuring of industry to fewer units and, on the other hand, to the globalisation of Finnish industry.

The current socio-economic landscape of Finland is the result of these economic transformations. Finland has traditionally been divided into developed, urban southern and less-developed eastern and northern parts (Yli-Jokipii & Koski 1995). Furthermore, the western parts of the country are considered more developed than the eastern forestry-based hinterlands (Siirilä et al. 1990). During the period 2000–2006, the vast less-developed areas of northern and eastern Finland constitute an EU Objective 1 area where GDP per capita is clearly less than the EU average (Hede-gaard 1999).

The aim of this article is to depict the main trends in the sectoral transformation of the Finnish economy during the past decades. The study elaborates on the geographical manifestations of regional policy, the deindustrialisation of the 1980s, the economic depression of the early 1990s, and the growth of the Information and Communication Technology (ICT) cluster in the 1990s. The patterns of the geographical transformation of the Finnish manufacturing employment are analysed by municipality from 1970 through 1998 in terms of the trend surface analysis.

Employment data in all maps and analyses are extracted from *Official Statistics of Finland* compiled by the Statistics Finland in Helsinki. Part of the data has been used earlier in studying changes in the manufacturing employment in Finland in the early 1980s (Tykkyläinen 1987). Employment data from 1970 through 1990 by municipality are based on the volumes of *Industrial Statistics* (Official Statistics... 1973–1992) and later data on electronic submissions from Altika and StatFin Service by Statistics Finland. All data are on file (Teollisuusaineisto 2001).

## Geographical impacts of regional policy up to 1980

Except for a few major industrial centres, the geographical pattern of the Finnish industry was for a long time determined by the location of natural resources (Tykkyläinen 1988: 343), the impacts of colonisation (1922–1965) (Tykkyläinen 1996), and regional policy. The first wave of colonisation took place before World War II when land was allocated to landless people. The second wave followed after the war when refugees and veterans were resettled. The first regional policy law concerning underdeveloped regions went into effect in 1966 (Palomäki 1980: 197).

When the first post-war generation entered the labour market and the post-war settlement policy came to an end in the 1960s, the industrialisation of the rural areas and peripheral parts of the country was established as the goal of the industrial policy. The expansion of industry was promoted in regional policy explicitly from 1966 onwards. Industrial location to less-developed areas was thus supported by the state (Palomäki 1980). The net impact of regional policy on the employment increase in manufacturing in less-developed areas has been estimated to be 18,000 jobs in 1966–1980, or, taking into account the multiplicatory effects, 26,000 jobs (Tervo 1983: 170–174). Nationally, the growth period of the early 1970s was damaged when the first oil crisis led to the decline of the export demand of the Finnish industries; both production and industrial employment declined in the manufacturing sector in 1975 (Fig. 1).

The Finnish economy recovered gradually from the first oil crisis and the growth rate peaked in 1980. The number of personnel in the manufacturing sector reached its culmination, 568,000 people. This remained the record for the twentieth century. Proportionally, this number corresponds to 26.3 percent of the economically active population in Finland in 1980 (STV 1982: 46). The spatial pattern of the growth of the 1970s comprised the growth of employment in less-developed areas. Industrial premises and estates were built in remote localities. The state supported this rural industrialisation with loans, grants, and tax relief. The highest support was directed to the most remote areas, Lapland and North Karelia (Palomäki 1980). The declining localities were industrial cities, such as Helsinki, Tampere, Turku, and Lahti. The winners of the 1970s were

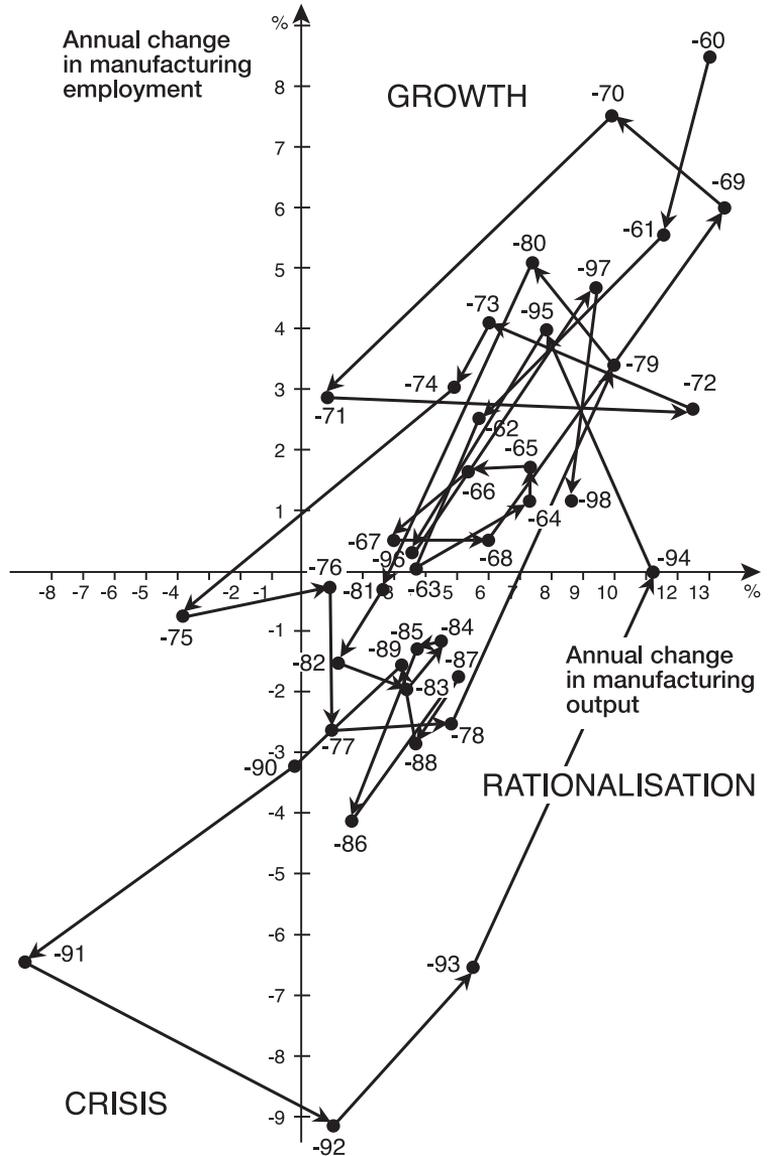


Fig. 1. Growth of production and employment in the manufacturing sector in Finland, 1960-1998 (Official statistics... 1973-1992).

provincial centres, towns and rural communities (CD-Fig. 1).

The explanations for this expansion of rural industrialisation were the opening up of the Finnish economy, an abundant young labour force in the peripheries, and the implementation of regional policy. The pattern of rural industrialisation operated partly according to the globally-known production cycle model: advanced industry originated in the core and late-stage, low-wage production was shifted to the periphery (e.g., Nor-

ton & Rees 1979). Nevertheless, the Finnish data demonstrate that new industries grew in the peripheries and that the shift of existing (and mature-stage) activities from the south was in a minor role (Jatila 2001: 149). The spill-over effect took place in the surroundings of most cities. More precisely, the growth of the new industries emerged in new relatively small localities outside the industrial cores. This expansion of the manufacturing sector could not prevent the considerable migration of people to cities and the neigh-

bouring Sweden. Migration to Sweden peaked in 1969–1970, when more than 80,000 people left Finland (Korkiasaari & Söderling 1994: 249). Since 1981 net immigration has been positive (STV 2000: 106).

## Rationalisation and deindustrialisation in the 1980s

The years from 1981 to 1993 were years of decline in the manufacturing employment (Fig. 1). Industrial employment declined in almost all localities. Only some suburban local districts were expansive, such as Espoo and Vantaa in the Greater Helsinki area. In addition, some outlying communities succeeded in attracting new jobs, but the increase was small in absolute numbers. The volume of production grew until 1990, however. The average annual growth of manufacturing output remained below the level of the growth period 1960–1974, but the relatively smaller growth rate does not fully explain the decline in the number of jobs. An additional factor, the growth of productivity, had a negative impact on employment as well. Rationalisation in traditional manufacturing industries took place in the 1980s. This rationalisation, combined with moderate growth, maintained the decline of labour in the manufacturing sector.

The spatial pattern of the 1980s' deindustrialisation was not a withdrawal from the new remote emplacements that resulted from the booming growth period of the 1960s and early 1970s. The stronger growth of productivity than that of production reduced employment in major industrial cities and, to a lesser extent, in smaller localities and rural areas (CD-Fig. 1). Urban areas lost two-tenths of their manufacturing jobs and rural areas only one-tenth. The number of manufacturing jobs lost during the 1980s was 102,000, of which 89,000 (87%) were in cities and the rest in rural municipalities (for the urban–rural classification of the municipalities according to the type of municipality, see Municipalities... 1998: 22–23, 63–68).

The proportion of the manufacturing sector in GDP declined from 28.1 percent in 1980 to 23.3 percent in 1990 (Kansantalouden... 2000: 28–29). This proportion was relatively small compared with other industrialised countries. The competitiveness of the Finnish manufacturing sector was low, but credit expansion maintained the growth

of domestic demand and import and the increase of asset prices. The opening up of the economy made it possible to increase foreign loans and accelerated speculation. The Finnish economy was showing more and more characteristics of *Casino Economy*: share prices tripled and housing prices doubled in the second half of the 1980s (Kiander & Vartia 1998: 69).

## The crisis of the early 1990s

Share and housing prices peaked in 1989. Inflation dogged the economy. An increasing number of companies could not compete profitably in the market. The economic crisis led to a decline in both production and employment (Fig. 1). The proportion of the manufacturing sector in GDP dropped to 20.3 percent in 1991 (Kansantalouden... 2000: 29). The number of closed enterprises exceeded the openings by 2,250 in 1991 and by 1,548 in 1992 (STV 2000: 169). Bankruptcy proceedings tripled in 1992 compared with the numbers of the late 1980s. The end of barter trade with the Soviet Union at the end of 1990 exacerbated the economic recession. In the late 1980s the proportion of the Finnish foreign trade to the Soviet Union had been about 15 percent, but suddenly it decreased to around 5 percent in 1991. This brought about the loss of 30,000–40,000 jobs in Finland in 1991 (Rautava & Hukkinen 1992: 5). Multiplier effects have been taken into account in this calculation.

The devaluation of the Finnish mark in 1991 and the decision in 1992 to float the mark improved the competitiveness of the economy, but the decline in the value of the Finnish currency led to problems in the financial markets. The foreign debt in Finnish marks increased. The state fell deeper and deeper into debt during the economic depression and even after it. Central government debt was only EUR 9 billion in 1986, but it increased to EUR 29 billion in 1992 and peaked to EUR 71 billion in 1998 (STV 2000: 304). Indebtedness increased for years after the economic depression. Nevertheless, public debt is not high in Finland compared with other OECD-countries (OECD... 2001: 262).

Lowered values of assets worsened the economic situation in the early 1990s. The number of bankruptcies was at an all-time high, and employment, real incomes, and demand declined. The economic decline was as deep as the decline

in the countries in East Central Europe. The industrial output decreased one-tenth, but started to recover from 1992 on. The decline of employment in the manufacturing sector continued in the early years of the 1990s. The number of employed bottomed out to 357,000 in 1993 (in enterprises with a personnel of five or more) (STV 1997: 160). The drop was 24 percent from 1990 through 1993. The economic depression of the early 1990s, "the Great Depression II," was even worse than that of the 1930s in Finland, but milder in relative terms than the economic depression of the 1930s in the USA (Kiander & Vartia 1998: 11). The export recovered in 1992 and manufacturing employment has grown since 1993, bringing about a long growth period until the beginning of 2001.

The value of production has increased significantly in the long run in spite of the decline in the manufacturing employment. From 1980 to 1996, the output in the manufacturing sector increased by 60 percent. The recovery of the economy took place in the high-tech sectors. The losers were traditional labour-intensive sectors, such as the manufacturing of wearing apparel, footwear, furniture, some metal products, and transport equipment, many of which exported goods to the CMEA countries in the 1970s and 1980s. The fastest-growing sector was the manufacture of electronic equipment, which produces communications equipment, computers, and mobile phones and related equipment (Table 1).

Structural adjustment in manufacturing reflects the loss of the Soviet market and the declining demand for some consumer goods and construction materials. The industrial decline was especially severe in labour-intensive sectors that employed low-skilled labour. On the other hand, the impacts of the growing Information Society are clearly visible in the figures.

### The geographical pattern of the crisis and the recovery of the early 1990s

The spatial outcome of the crisis of the early 1990s was the decline in employment in most localities (CD-Fig. 1). The recession hit cities and rural areas hard. The net change in manufacturing jobs was negative both in urban (–12%) and rural (–11%) municipalities. The crisis of the early 1990s spread geographically more evenly than the deindustrialisation of the 1980s.

The total net decrease was 52,600 jobs, 41,000 of which in urban areas. The decrease in manufacturing jobs in Helsinki, Vantaa, Lahti, Pori, Tampere, and Turku was to 21,000 from 1990 to 1995. Pori suffered most as 24.0 percent of jobs disappeared. The reductions in manufacturing jobs were 21.9 percent in Vantaa, 21.1 percent in Lahti, 16.7 percent in Helsinki, 11.4 percent in Tampere, and 11.3 percent in Turku. Unemployment grew rapidly and real estate prices plunged. Manufacturing employment grew only

Table 1. The change of production in the Finnish manufacturing industries in 1990–1996 and their contribution to employment, total output, and exports in 1990 (STV 1997: 176–177; Yearbook... 1992: 74–93, 196–117; Tykkyläinen 1999).

SIC code	Industry (SIC 1988)	%-change, production 1990–96	Personnel as % of mfg. total, in 1990	Output as % of mfg. total, in 1990	Exports as % of mfg. total, in 1990
261–263	Electrical equipment	194.6	7.7	6.2	8.5
23	Basic metal industries	42.8	3.9	6.8	7.8
264	Instruments and fine mechanical apparatus	32.8	1.3	0.9	1.8
19	Petroleum and coal products	31.4	0.9	4.2	1.7
D	Manufacturing (total)	21.3	100.0	100.0	100.0
15	Pulp, paper and paper products	17.9	10.1	15.6	31.5
25	Machinery and equipment	13.9	12.1	9.8	14.4
18	Chemicals and chemical products	12.3	4.6	6.0	5.6
11	Food, beverage and tobacco	8.1	12.4	17.9	4.6
14	Wood and wood products	7.4	7.1	6.1	7.0
21	Rubber and plastics products	7.3	3.3	2.5	2.1
24	Fabricated metal products	6.4	5.8	4.2	2.7
27	Transport equipment	3.3	5.9	4.6	6.3
29	Other manufacturing industries	3.1	1.5	0.8	0.7
12	Textiles	-9.3	2.8	1.3	1.3
16	Publishing and printing	-11.2	8.6	6.3	0.7
17	Furniture	-11.7	2.9	1.6	0.5
22	Glass, clay and stone products	-21.7	4.6	3.6	1.1
13	Wearing apparel, leather and footwear	-46.4	4.4	1.6	1.7

in some localities, such as Salo (near Turku), by a net increase of 2,375 jobs, and Espoo (west of Helsinki), by 1,725. The employment growth was much due to the telecommunications-driven recovery. The increase in research and development funding and the establishment of science parks and technopolies were responses to the transformation, but there is no clear evidence of the visible impacts of these inputs in the geographical pattern of industrial employment, as the map of 1990–1995 indicates (CD-Fig. 1).

The loss of employment in the basic industry was bigger than the positive impacts of the dawn of the new economy that was based on the electronics industry. The profitability of the basic industry improved gradually and the Helsinki Stock Exchange recovered. Its annual HEX share index exceeded the level of 1990 in 1994 (STV 1995: 245).

## Towards the new economy

The transformation of the Finnish industry continued towards the end of the 1990s. The number of manufacturing jobs grew, as did the output (Fig. 1). The return to the growth rates of the 1960s, early 1970s, and the peak years of 1979–1980 was a fact (Fig. 1). The leading growth sectors were the manufacture of electronic equipment and the industries attached to it (Table 2).

The scope of the growth industries is relatively narrow. The manufacturing of mobile phones and related industries were the growth engine of the economy in the latter half of the 1990s. This Information and Communication Technology (ICT) cluster consists of the Nokia Company and industries supplying semi-finished products, complementary production, and investment goods and services. According to the calculations of Ali-Yrkkö et al. (2000: 10), Nokia accounted for a little over 4 percent of the Finnish GDP and 23 percent of the total Finnish exports in 1999. These calculations do not take into account multiplier effects. Thus, the total impacts on GDP are even greater, because Nokia engages in a great deal of subcontracting.

Nokia has specialised in electronics since the early 1980s, but found its success in the telecommunications business as late as in the 1990s. The rapid expansion of Nokia lasted the entire decade. In February of 1998, Nokia's proportion of the total shares in the Helsinki Stock Exchange was 34 percent. On March 30, 2000, even after the backslide of ICT shares in global stock markets, the proportion of Nokia was 62 percent. On August 15, 2001, the total value of Nokia shares was still 57 percent in Helsinki. Nokia has thus become the core asset of industrial capital in Finland. This development has a risky side, because the Finnish economy is now very dependent on the global demand for ICT products (Table 2).

SIC code	Industry (SIC 1995)	%-change in output, 1995–99	%-change in output, 1995–2000	Output as % of mfg. total, in 2000	Exports as % of mfg. total, in 2000
32	Communication equipment and apparatus	220.4	371.1	19.2	30.7
33	Medical, precision and optical instruments	39.4	54.5	1.6	1.9
D	Manufacturing (total)	31.0	47.2	100.0	100.0
34	Motor vehicles, trailers and semi-trailers	29.8	42.2	1.0	0.8
31	Electronic machinery and apparatus	30.0	42.1	2.7	2.8
25	Rubber and plastics products	21.7	40.3	2.5	1.9
28	Fabricated metal products	25.5	40.0	4.5	2.0
20	Wood and wood products	30.0	35.8	5.4	5.4
26	Non-metallic mineral products	25.0	32.1	2.3	2.0
27	Processing of metals	22.8	30.0	6.8	6.1
24	Chemicals and chemical products	18.0	23.8	5.1	4.7
36	Furniture, manufacture of n.e.c.	16.4	22.0	1.6	0.7
21	Pulp, paper and paper products	16.5	21.6	16.2	21.4
29	Machinery and equipment	9.0	16.8	10.8	11.4
22	Publishing and printing	9.4	14.5	4.2	0.6
17	Textiles	9.6	11.6	0.7	0.5
15	Food products and beverages	9.9	11.1	7.9	1.7
23	Coke and refined petroleum products	12.8	10.6	4.2	3.0
35	Other transport equipment	-9.9	-8.1	2.1	2.3
19	Tanning and dressing of leather	-9.8	-11.5	0.2	0.2
18	Wearing apparel	-10.9	-17.8	0.5	0.3

Table 2. Changes in industrial output (Bulletin... 2001: 18–20) and the contribution of each industry to output and exports (Ennakkotietoja... 2001: 25–34).

The success of Nokia has boosted attached industries, such as the production of printed circuit boards, manufacturing of mobile phone enclosures, assembling industry and manufacturing services, and suppliers of production automation (see [www.nokia.com](http://www.nokia.com); [www.elcoteq.com](http://www.elcoteq.com); [www.pellos.com](http://www.pellos.com); [www.aspocomp.com](http://www.aspocomp.com); [www.elektrobit.com](http://www.elektrobit.com); [www.eimo.com](http://www.eimo.com)).

The entire Information and Communication Technology cluster in Finland consists of Nokia (21,000 employees in 1998), other ICT equipment, network and related service producers (30,000 employees), components and contract manufacturers (5,000 employees), and telecom services (18,600 employees). Nokia's contribution to the cluster's sales was 50 percent in 1998 (Ali-Yrkkö et al. 2000: 27). The ICT cluster has been very profitable, but its contribution to investments negligible (Ali-Yrkkö et al. 2000: 13).

The booming economy of the late 1990s increased industrial employment in most localities (CD-Fig. 1). Urban municipalities, such as Espoo, Salo, and Oulu, have been mentioned often as examples of the telecommunications-driven economic growth. The ICT cluster requires R&D inputs. Spending on research and development per capita is thus very high in these growth areas (Tutkimus- ja kehittämistoiminta... 1999: 7–9). Developers of communications equipment, many subcontractors, and companies providing automation technology and software have been located in advanced metropolitan environments and some localities adjacent to major cities in Finland, but having their manufacturing activities dispersed all over the world at the same time.

The geographical pattern of the emergence of the new economy in Finland in the late 1990s indicates geographical clustering. Such a pattern is found in the high-tech sector where industries in their growth or innovative stages remain close to sources of skilled labour and specialised inputs as, for instance, Barkley's 1988 study on the US American economy indicates. Moreover, the reason of spatial clustering can also be argued in a simple way: only a rather limited number of companies have expanded greatly, which results in an uneven spatial pattern. Both arguments can be supported empirically.

The winners during the growth period 1995–1998 in Finland were the city of Oulu (with a net increase of 3,896 jobs, or 48 %), the surrounding areas of Helsinki (including Espoo, Vantaa, Tuusula, Vihti, Nurmijärvi, and Järvenpää, with a net in-

crease of 4,087 jobs, or 12%), the industrial communities of Central Finland (Jyväskylän maalaiskunta and Suolahti, 1,366/63%), Ylöjärvi–Tampere–Pirkkala conurbanisation (1,288/5%), Uusikaupunki (731/33%), and Salo (584/8%). The first four cases indicate that growth took place in the largest urban areas, which comprise versatile learning environments (e.g., have universities and technical research) and largish travel-to-work areas. The population in these four locations ranges from 134,000 to 1.12 million inhabitants (STV 2000: 82). To generalise, Finland has a new, 650-kilometre-long development axis from the south to the north, from Helsinki to Oulu via Tampere and Jyväskylä. The state has promoted development in these environments, as the main "centres of excellence" related to ICT are located in these cities and their surroundings (Osaamiskeskukset 2001). Uusikaupunki on the west coast is known for car manufacturing and Salo in the southwest for mobile phones.

Some communities adjacent to the larger urban agglomerations were winners as well, such as Nurmo (480 jobs; adjacent to Seinäjoki), Hollola (422 jobs; adjacent to Lahti), Mustasaari (356 jobs; adjacent to Vaasa), and Raisio (387 jobs; adjacent to Turku). The industrial growth of Hollola is based on the expansion of the ICT cluster, but the localities have been boosted by other manufacturing sectors. These smaller growth communities are located in regions outside the traditionally less-developed areas in Finland.

The spatial expansion of the manufacturing sector, and especially the ICT industry, has favoured urban and semi-urban areas in a selective way. This result can be understood in the light of many high-tech industry studies which make it known that the spatial organisation of the ICT industry is based on company-specific comparative advantage. This advantage is dependent on each product, production process, corporate purchasing policies, and type of final market. All these factors are unique and thus produce specific locational patterns (e.g., Glasmeier 1988). ICT production units were located near skilled labour and in areas close to cities and proper communications networks. The vast less-developed Objective 1 area did not benefit much from the boom of the ICT cluster. The trickling-down effects of the ICT cluster are thus geographically limited and network-like. Growth takes place in suitable geographical pockets (such as technopolies, industrial estates, and otherwise advantageous places) in multi-faceted environments.

## Finland in comparison with other advanced countries

Compared with other European countries and the OECD countries, Finland's growth has been rapid. The volume of industrial output increased by 41 percent from 1995 to May of 2000, whereas the increase in the USA was 26 percent, in the OECD countries 20 percent, and in the EU, 16 percent (Bulletin... 2000: 109). The Finnish economy was booming.

Growth combined with the high rate of automation has not brought about labour-intensive production in manufacturing in Finland. The growth of productivity has been stronger in Finland than in other advanced countries (Table 3), which is largely due to the growth of productivity in telecommunications. Furthermore, investment in research and development increased rapidly in the 1990s, which contributed to the increase in productivity, but in the ICT industry in the main.

The contribution of Nokia and other ICT companies to the increase in the productivity of the entire economy has been significant. The productivity in the telecommunications equipment industry grew 25 percent annually in the 1990s and, in the ICT industry as a whole, about 15 percent annually over the same period (Ali-Yrkkö et al. 2000: 14). This implies that in some industries growth of productivity remained close to zero and definitely below the long-term average growth. Aggregate figures are therefore somewhat misleading.

## Geographical pattern: industrial cities versus rural areas in 1970–1998

Economic development and restructuring reshape Finland's economic landscape all the time. The industrialisation of the late nineteenth century took place in towns and industrial communities near the sources of raw materials and energy and along the rivers (Palmén J 1899; Moberg 1899; Palmén K 1899). Moreover, this industrialisation resulted in some largish industrial centres in the south, such as Helsinki, Tampere, and Turku. Job losses of the late twentieth-century manufacturing took place in these main manufacturing centres (Fig. 2). Nevertheless, most of these industrial cities are very viable centres attracting population from smaller places inasmuch as the service sector in these cities has grown. The manufacturing sector has many of its central administrative functions in the cities, and the growing post-industrial economy and the positive migration balance have been the engines of metropolitan growth. On the other hand, rural industrialisation, or the urban–rural shift, has taken place in Finland as in many other advanced countries (North 1998). The newest wave of industrialisation benefits some metropolitan areas and already developed rural areas.

During the examined three decades (from 1970 to 1998), the greatest winners in the competition for manufacturing jobs were Espoo (with a net increase of 11,497 jobs/291%), Vantaa (5,420/62%), Salo (4,304/110%), and Oulu (3,484/

	1990	1991	1992	1993	1994	1995	1996	1997	1998
FINLAND	100	100	112	125	135	139	142	151	159
SWEDEN	100	100	105	112	122	129	132	141	144
FRANCE	100	104	107	108	116	122	123	132	136
USA	100	101	102	104	111	117	120	125	131
THE NETHERLANDS	100	101	101	103	114	119	121	127	130
GERMANY	100	103	101	102	109	112	116	123	128
BELGIUM	100	102	103	106	112	117	118	126	127
JAPAN	100	104	105	105	107	115	121	127	126
ITALY	100	103	108	111	114	118	119	123	123
GREAT BRITAIN	100	104	113	118	121	119	117	118	119
CANADA	100	100	105	108	111	114	113	116	117
NORWAY	100	101	104	104	105	106	106	105	108

Table 3. Productivity of the manufacturing sector, from 1990 to 1998 (STV 2000: 636).

**Absolute change in manufacturing employment, 1970–1998**

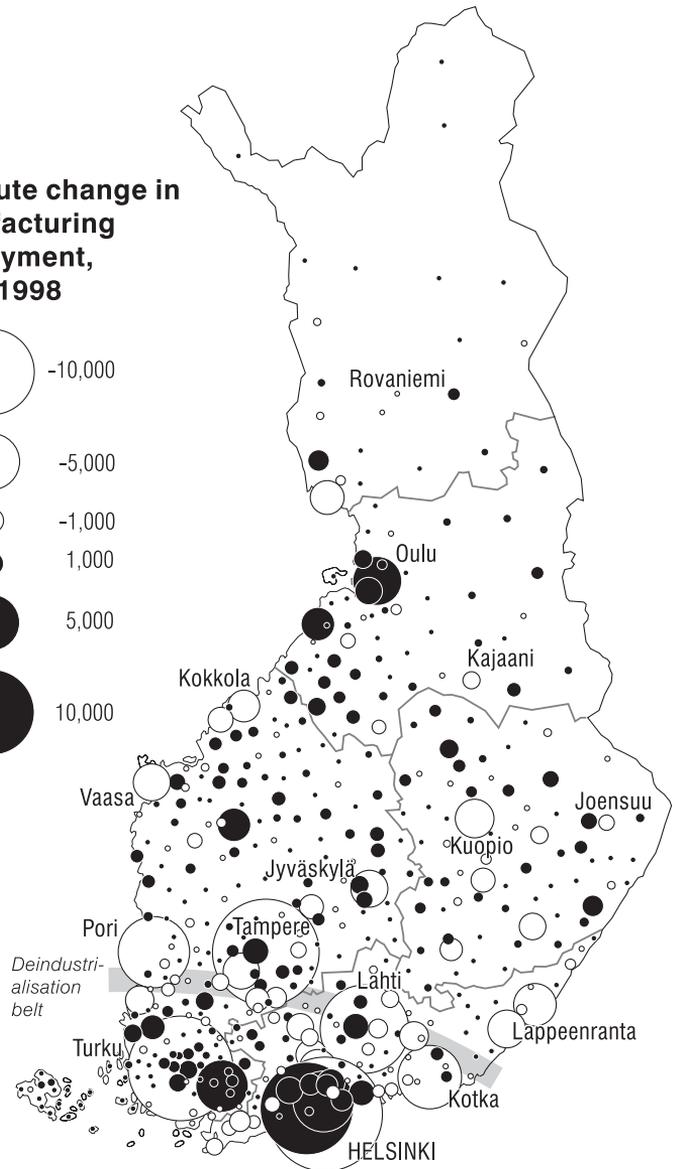
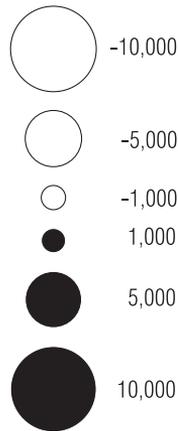


Fig. 2. Changes in the number of employees (including owners) in the Finnish manufacturing sector, in 1970–1998, by municipality. Note that the statistics for 1998 cover all enterprises in the manufacturing sector, whereas the earlier statistics recorded only the establishment of enterprises with a personnel of five or more. These small enterprises represented 5.6 percent of the total manufacturing employment in 1998 (STV 2000: 171) (Official statistics... 1973–1992; Teollisuusaineisto 2001).

41%). The losers were Helsinki (with a net loss of 41,874 jobs/–57%), Tampere (14,693/–41%), Turku (14,024/–46%), Lahti (10,526/–53%), Pori (7,125/–46%), and Kotka (6,128/–55%). Unlike the employment data of 1970, the 1998 figures include the enterprises with less than five employees, which represent 5.6 percent of the total manufacturing employment (STV 2000: 171). The growth is thus a little weaker and the decline deeper than the figures indicate. The restructur-

ing of the manufacturing sector hit the industrial core of Finland, leading to a decline in manufacturing employment in traditional industrial cities. The main boom of rural industrialisation took place in the very late stage of Fordism, in the 1970s. Especially during the last years of technologically-driven growth, new industrial spaces were created in dispersed metropolitan-type areas: Espoo and Vantaa, in the technologically-oriented Oulu, and in Salo, which has a long tradi-

tion of the electronics industry. Some smaller localities succeeded, which proves that a long growth period impacts positively on employment in semi-remote rural areas.

During the entire period 1970–1998, the diversification of the manufacturing sector formed a new economic landscape in Finland. This was first based on the new, light industries in the 1970s and, later, on the ICT industry. The geographical transformation consisted of various tendencies of industrial restructuring and growth, such as

- 1) the deindustrialisation of the major industrial cities in 1970–1998;
- 2) the industrialisation of rural municipalities, especially in the 1970s and late 1990s;
- 3) the spill-over of manufacturing employment from industrial cities to the neighbouring communities in 1970–1990 and 1995–1998;
- 4) the industrial decline in the early 1990s and the growth of employment in a few localities; and
- 5) the growth impacts of the ICT industry on the competitive urban areas and localities adjacent to cities in the late 1990s.

The mapping of the geographical transformation indicates that the growth pattern of the manufacturing sector became spatially selective in the 1990s. The results suggest that low-cost labour force as such is no longer attractive enough as a locational factor as it was in the 1970s. Instead, leading manufacturing branches look for skilled labour and competitive metropolitan environments. How this phenomenon is constructed within the ICT industry, and whether it prevails outside the ICT industry, calls for further studies.

## Analysis of geographical growth patterns

Finland is divided into developed, urban southern and less-developed eastern and northern parts, as stated earlier. Which parts of the country were winners and which losers in the geographical transformation of the manufacturing sector? Public opinion supposes that the spatial concentration of economic activities has shifted towards the south and its urban areas. It has already been proven that the main industrial cities in Finland lost jobs in the manufacturing sector during the last three decades. But what about the

north–south and east–west dimensions? In which areas have decline and growth taken place?

*Trend surface analysis* can be used effectively to remove the local fluctuation that obscures the general spatial trend of the industrial transformation. The x and y coordinates are used in the following way: y indicates the distance from the equator and x indicates the east–west dimension in the way that the parallel of 27 degrees is set to be 3,500 kilometres. The coordinates of the surface are y (min) = 6,646 km and y (max) = 7,730 km and x (min) = 3,089 km and x (max) = 3,703 km. The dependent variable z is the absolute change in numbers of employees in the manufacturing sector during a period. The periods are 1970–1980, 1980–1990, 1990–1995, 1980–1995, 1995–1998, and 1970–1998.

The growth decade of the 1970s favoured peripheral locations. The manufacturing growth diffused to rural peripheries, as happened in many other advanced countries as well (e.g., Haynes & Machunda 1987). Equations 1 and 2 depict the geographical pattern of changes in Finland from 1970 through 1980:

$$(1) \quad z = -545 + 0.056y + 0.097x \\ (1970-1980)$$

$$(2) \quad z = -36302 + 5.27y + 10.58x - 0.0015xy \\ (1970-1980)$$

The first equation represents the simple planar surface which shows that the further north a place is located the higher was the increase in the number of jobs in the 1970s. Similarly, the more eastern the location is the higher was the growth in the manufacturing employment. The surface is steeper towards the east than the north, which indicates that an eastern location was even more beneficial than a northern one. This simple analysis shows that regional development took place in the desired direction. All the z-values of the surface within Finland are positive, indicating that there were no areas larger than single localities in decline.

The bi-linear saddle surface provides additional information. It is more depictive and shows the pattern of the 1970s (Fig. 3). The growth in the manufacturing employment diminishes when approaching the north-eastern corner of the country. In fact, the municipalities in the eastern parts of Lapland and Kainuu were not the most successful in gaining new jobs. They were too remote.

The impacts of the decline of the manufacturing sector in the main industrial cities create a saddle structure that bends up in the northwest and southeast (Fig. 3).

The deindustrialisation of the 1980s and early 1990s, as illustrated by municipalities on the maps in CD-Figure 1, resulted in sharp downward surfaces to the south, depicting job losses in industrial Finland. Industrial cities in the eastern parts of the country declined as well. The surfaces of 1980–1990 and 1990–1995 thus slope gently to the east.

The crisis period of the early 1990s (1990–1995) produces a north–south slope that is a little smoother than the slope in the 1980s (1980–1990), indicating that the manufacturing employment degenerated towards the north as well during “the Great Depression II” (these equations and figures are not included). In the east–west dimension, the eastern parts of the country suffered more in relative terms during “the Great Depression II” than in the 1980s. This indicates that the western parts of the country were more flexible in adapting to new conditions. The Information Society dawned in the west and south.

One planar equation (3) depicts the entire deindustrialisation period of 1980–1995:

$$(3) z = -5807 + 0.914y - 0.200x \quad (1980-1995)$$

Similarly, the bi-linear saddle surface reveals deindustrialisation in the south and southeast (Equation 4):

$$(4) z = 60051 - 8.68y - 19.50x + 0.00281xy \quad (1980-1995)$$

Many industrial cities are located centrally in the country, which slopes the surface to decline towards the southeast (Equation 4; Fig. 3). On the other hand, the surface slopes up to the northeast. More clearly than the saddle surface of 1980–1995 in Figure 3, the 1980s’ surface (not included in this article) demonstrates the impacts of the decline in industrial cities – Pori, Tampere, Lahti, and Kotka – in the formation of a U-shaped valley. This was the belt of deindustrialisation in the 1980s.

The rise of the new economy in the late 1990s favoured southern and western localities as the seedbeds of growth (Equation 5). Western parts of Finland, such as Ostrobothnia, South Ostroboth-

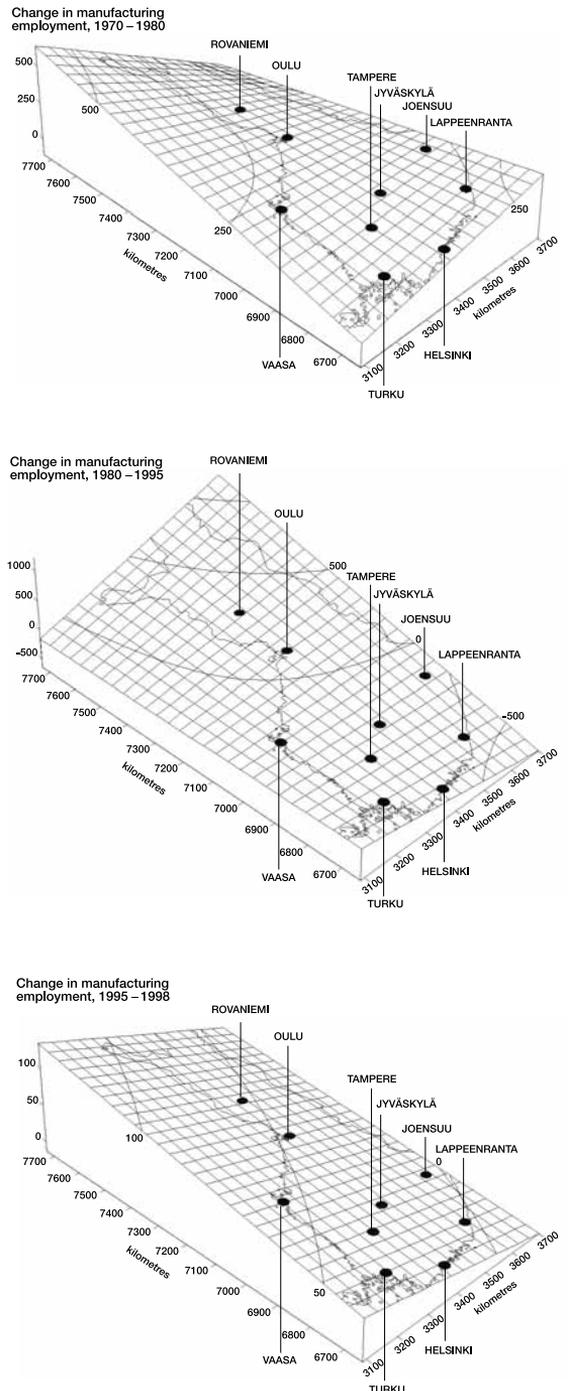


Fig. 3. Bi-linear saddle surface on the employment changes in the manufacturing sector in Finland 1970–1980, 1980–1995, and 1995–1998.

nia, and North Ostrobothnia, grew (CD-Fig. 1). A net increase of industrial jobs in rural areas was 12,300 from 1995 through 1998, being 88 per cent of the total net increase in the country (calculated from the same data file as CD-Fig. 1). The rural re-industrialisation was not necessarily a result of the growth in the ICT industry, but rather a result of the rise in incomes and the growth in demand in other sectors. The growth in rural areas has thus been mainly induced due to the long boom in the Finnish economy. The industrially-diversified economic areas in the west with many small and medium-sized companies have been responsive to these induced growth impacts.

$$(5) z = -74 + 0.066y - 0.103x \\ (1995-1998)$$

The trend surface of 1995–1998 is above the zero-level within Finland, indicating growth all over the country. Nevertheless,  $z$ -values are lower than in the 1970s' surface, but, on the other hand, the period 1995–1998 is short. The surface slopes upwards to the north at an angle similar to that of the 1970s, but in contrast, the surface slopes downwards to the east. The slide toward the east does not differ much from the situation in the 1980s.

The bi-linear saddle surface is almost straight and visually is very similar to the planar surface (Equation 6; Fig. 3).

$$(6) z = -1535 + 0.279y + 0.325x - 0.0000624xy \\ (1995-1998)$$

Although the coefficient of  $x$  is positive, the negative  $xy$ -component in the equation forces the surface to slope downwards to the east. The growth in manufacturing employment thus declines slightly towards the east.

The entire period from 1970 to 1998 is depicted by a planar surface that inclines to the east and climbs to the north (Equation 7). The employment change in manufacturing has been negative in the south and southeast of Finland. The zero-line runs from Central Ostrobothnia to the northern parts of North Karelia, north of Kokkola to Lieksa.

$$(7) z = -5881 + 0.980y - 0.302x \\ (1970-1998)$$

The bi-linear saddle surface of the three decades reveals the dominant effect of the decline

caused by deindustrialisation but, as one can expect, the surface is at a level higher than during the deindustrialisation period (Equation 8; Fig. 4):

$$(8) z = 58515 - 8.40y - 19.16x + 0.00275xy \\ (1970-1998)$$

During the period 1970–1998, the urban municipalities lost a total of 90,000 manufacturing jobs. Rural municipalities gained a net increase of 26,000 jobs during the same period. If the change in the coverage of the industrial statistics is taken into account, the net loss of jobs was even higher. The strong decline in employment explicates the dominance of the deindustrialisation pattern over the entire period.

## Conclusions

The late-Fordist boom of the 1970s, deindustrialisation, and the emergence of the new economy brought about the geographical transformations of the Finnish manufacturing sector. There are competitive factors which explain the changes. For instance, in the 1970s, the boom resulted largely from the growth of the labour-intensive light industry and the expansion of traditional manufacturing. This spatial diffusion of manufacturing appears to be related to the labour advantage of the peripheries, growth of new industrial activities, and regional policy. It was more profitable, with the help of state support, to expand production in the peripheries than in the industrial cores. There was strong political will to utilise the comparative advantage of the country geographically and, thus, to mobilise the production factors of Finland's remote regions. This was part of the planning doctrine of the time (e.g., Jatila 2001: 3–10).

Deindustrialisation consisted of two types of job losses. First, many industrial cities, especially Helsinki, lost their comparative advantage in manufacturing employment to smaller cities, towns and rural municipalities in the late twentieth century. Nevertheless, Helsinki boomed without any expansion of the manufacturing sector. Many structural factors (skills, labour force, rents, congestion, etc.), as well as the economic policy, influenced this decline. The more cyclical deindustrialisation emerged when the global shift to Newly Industrialised Countries (NIC) took place and the old Fordist industrial infrastructure lost its competitiveness. The collapse of the Soviet trade

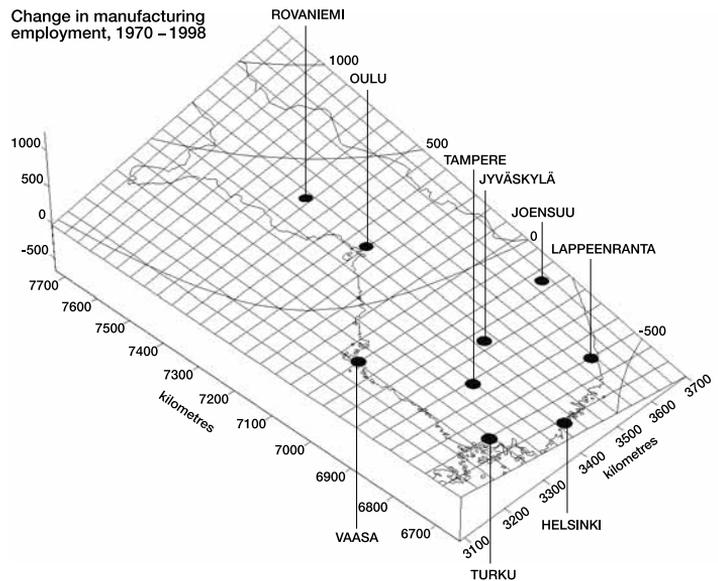


Fig. 4. Bi-linear saddle surface on the employment changes in the manufacturing sector in Finland, 1970–1998.

delivered the final blow in Finland. Traditional production suffered and employment declined. Restructuring took place, and the state funded research and development to an increasing degree to develop new industrial activities.

The growth of output and employment resumed in the late 1990s. The driving forces of growth were different from those in the 1960s and 1970s, however. A relatively narrow section of the economy with specific locational requirements boosted the economy. The late 1990s' geographical growth pattern of the manufacturing sector was clearly bifurcated into two phenomena: first, the R&D-driven ICT-industry which favoured certain urban or semi-urban localities and, second, the growth of the rural manufacturing sector which was a sort of spin-off from the long-lasting industrial growth in Finland.

To sum up the main trends, the manufacturing growth of the peripheries in the early stage of the regional policy era changed gradually into a spatially more selective development of localities in advanced environments. Moreover, the 1970s' growth of manufacturing employment in the east turned to growth in the west in the 1990s. Why it happened and whether this shift is a longer-lasting phenomenon, deserves further research.

## REFERENCES

- Ali-Yrkkö J, L Pajja, C Reilly & P Ylä-Anttila (2000). NOKIA – A big company in a small country. *ETLA B* 162. Helsinki.
- Barkley DL (1988). The decentralization of high-technology manufacturing to nonmetropolitan areas. *Growth and Change* 19, 13–30.
- Bulletin of Statistics* 2000: III. Statistics Finland, Helsinki.
- Bulletin of Statistics* 2001: I. Statistics Finland, Helsinki.
- Ennakkotietoja teollisuudesta 2000 (2001). *Teollisuus* 2001: 7. Statistics Finland, Helsinki.
- Glasmeyer A (1988). Factors governing the development of high tech industry agglomerations: A tale of three cities. *Regional Studies* 22, 287–301.
- Haynes KE & ZB Machunda (1987). Spatial restructuring of manufacturing and employment growth in the rural Midwest: an analysis for Indiana. *Economic Geography* 63, 320–333.
- Hedegaard L (1999). The concentration of the structural funds. *North* 10: 6, 7–10.
- Hjerpe R (1989). *The Finnish economy 1960–1985*. Government Printing Office, Helsinki.
- Jatila U (2001). Yritysten sijaintipaikan valinta päätöksentekoon-ongelmana. Unpublished Phil. Lic. thesis in economic geography. Helsinki School of Economics and Business Administration.
- Kansantalouden tilinpito 1975–1998 (2000). *Kansantalous* 2000: 1. Statistics Finland, Helsinki.

- Kiander J & P Vartia (1998). Suuri lama. *ETLA B* 143. Helsinki.
- Korkiasaari J & I Söderling (1994). Muuttoliike. In Koskinen S, T Martelin, I-L Notkola & K Pitkänen (eds). *Suomen väestö*, 226–264. Gaudeamus, Helsinki.
- Moberg K (1899). Metallindustri och stenbrott. *Atlas öfver Finland, Text* 23, 1–30. Sällskapet för Finlands Geografi, Helsingfors.
- Municipalities 1998. Regional classifications handbook (1998). *Statistics Finland, Handbooks* 28.
- North D (1998). Rural industrialization. In Ilbery B (ed). *The geography of rural change*, 161–188. Longman, Essex.
- Norton RD & J Rees (1979). The product cycle and the spatial decentralization of American manufacturing. *Regional Studies* 13, 141–151.
- OECD Economic outlook 69: 1 (2001). OECD, Paris.
- Official statistics of Finland XVIII. *Industrial statistics 1970–1990* (1973–1992). Statistics Finland, Helsinki.
- Osaamiskeskukset (2001). 13 August 2001. <[www.intermin.fi/suom/oske/fi/osket.html](http://www.intermin.fi/suom/oske/fi/osket.html)>
- Palmén J (1899). Forsar. *Atlas öfver Finland, Text* 22, 1–30. Sällskapet för Finlands Geografi, Helsingfors.
- Palmén K (1899). Industrin. *Atlas öfver Finland, Text* 24, 1–20. Sällskapet för Finlands Geografi, Helsingfors.
- Palomäki M (1980). Industrial development and regional standard of living in Finland. In Walker DF (ed). *Planning industrial development*, 189–213. John Wiley & Sons, Chichester.
- Rautava J & J Hukkinen (1992). Russia's economic reform and trade between Finland and Russia. *Bank of Finland Bulletin* 66: 4.
- Siirilä S, L Hautamäki, J Kuitunen & T Keski-Petäjä (1990). Regional well-being variations in Finland. *Fennia* 168, 179–200.
- STV 1982 = *Statistical yearbook of Finland 1982* (1983). Statistics Finland, Helsinki.
- STV 1995 = *Statistical yearbook of Finland 1995* (1995). Statistics Finland, Helsinki.
- STV 1997 = *Statistical yearbook of Finland 1997* (1997). Statistics Finland, Helsinki.
- STV 2000 = *Statistical yearbook of Finland 2000* (2000). Statistics Finland, Helsinki.
- Teollisuusaineisto (2001). Markku Tykkyläisen arkisto, Kansio 97. Maakunta-arkisto, Joensuu.
- Tervo H (1983). Tuotantotoimintaan suunnatun aluepolitiikan työllistävä vaikutus kehitysalueilla 1966–1980. *Jyväskylän yliopisto, Taloustieteen laitos, Keski-Suomen taloudellinen tutkimuskeskus, julkaisuja* 57/1983.
- Tutkimus- ja kehittämistoiminta Suomessa 1998 (1999). *Official statistics of Finland. Tiede, teknologia ja tutkimus 1999: 2*. Statistics Finland, Helsinki.
- Tykkyläinen M (1987). Teollisuuden työvoimamuu- tokset 1980-luvun alkupuoliskolla Suomessa. *Terra* 99, 49–56.
- Tykkyläinen M (1988). Periphery syndrome – a re- interpretation of regional development theory in a resource periphery. *Fennia* 166, 295–411.
- Tykkyläinen M (1996). The legacy of post-war set- tlement policy. *Finnish Journal of Rural Research and Policy* 3 (English Supplement), 85–93.
- Tykkyläinen M (1999). Metsästä elektroniikkateolli- suuteen. In Westerholm J & P Raento (eds). *Suo- men kartasto*, 96–99. Suomen Maantieteellinen Seura & WSOY, Helsinki.
- Yearbook of industrial statistics, Volume 1 1992 (1992). *Official statistics of Finland XVIII. Manu- facturing 1992: 7*. Statistics Finland, Helsinki.
- Yli-Jokipii P & A Koski (1995). The changing pattern of Finnish regional policies. *Fennia* 173, 53–67.