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TECHNOLOGY POLICY AND INDUSTRIAL CLUSTERS IN A SMALL OPEN ECONOMY

- The Case of Finland

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ABSTRACT: The 1980s saw a global surge of foreign direct investment and rapid internationalization of business seems to have continued in the 1990s, although at a somewhat slower pace. Inward and outward direct investments in advanced industrial countries have, in general, become increasingly more balanced. However, Finland has a large imbalance between outward and inward investments: The stock of outward investment is as much as 3 times higher than the stock of inward investment. Internationalization of industrial firms is, to a large extent, based on firm-specific knowledge (or ownership advantage), which is created in the framework of the national innovation system involving - explicit or implicit - co-operation of the state, labour and national firms. Internationalization has, however, proceeded so far that firms are no longer dependent on the national government or labour. Is the role of the national framework becoming weaker and even futile and what is the role of technology policy? It is likely that some of the national institutions will be replaced by international ones, notably at the European level, as the economic integration is deepening. On the other hand learning and networking are always, to a large extent, local processes. Regional systems will be of particular importance for the diffusion of technological knowledge. The internationalization of firms and free factor mobility mean that the competitive advantages of companies and nations can no longer be equated. Differences in production costs in different regions will lead firms to relocate. For this reason, price competitiveness, too, is still of great importance. For the same reason there is a tendency for social institutions and policies as well as tax rates to harmonize, at least at the European level. This restricts the scope for national economic and industrial policies. An important question for national industrial policies has thus become, how to attract competitive domestic and foreign firms.
KEY WORDS: Technology policies, national innovation system, industrial cluster, internationalization of business, small open economies.

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Yritysten suorat sijoitukset kasvoivat maailmanlaajuisesti tarkastellen hyvin nopeasti 1980-luvulla: vuotuinen kasvuvauhti oli noin 30 %. Kasvu on jatkunut myös 1990-luvulla vuosikymmenen alun pienen taantuman jälkeen. Pohjoismaista erityisesti Ruotsin ja Suomen teollisuusyritykset ovat pitkälle kansainvälistyneitä. Näihin maihin suuntautuneiden suorien sijoitusten määrä on tuntuvasti pienempi kuin näistä maista ulospäin suuntautuneiden investointien määrä. Teknologiaintensiiviset yritykset ovat kummassakin maassa kansainvälistyneempiä kuin yritykset keskimäärin. Voidaankin kysyä, mikä vaikutus yritysten kansainvälistymisellä on kansallisiin innovaatiojärjestelmiin ja kansalliseen teknologiseen perustaan sekä teollisuuden kasvuun. Ovatko innovaatiojärjestelmät muuttumassa ylikansallisiksi ja millaiseksi muodostuu teollisuuspolitiikan rooli? On ilmeistä, että innovaatiojärjestelmät ja teolliset klusterit ovat kansainvälistymisen seurauksena muuttumassa kahteen suuntaan: alueelliseen ja ylikansalliseen. Teollisuuspolitiikan rooli on ylläpitää hyvää infrastruktuuria ja tehokasta julkista sektoria sekä tukea maan kannalta kiinteiden tuotannontekijöiden esimerkiksi koulutuksen ja tutkimuksen kehitystä. Yksi teollisuuspolitiikan keskeinen kysymys on: kuinka houkutella kilpailukykyisiä yrityksiä Suomeen?
AVAINSANAT: Teknologiapolitiikka, kansallinen innovaatiojärjestelmä, teollinen klusteri, yritysten kansainvälistyminen, pieni avotalous.

CONTENTS

SUMMARY

The 1980s saw a surge of foreign direct investment (FDI) reaching an annual growth rate of some 30 %. The trend of rapid internationalization of business seems to have continued in the 1990s, although at a somewhat slower pace.

Some interesting changes in the patterns of FDI flows have taken place during the last 10 - 15 years. First, the FDIs have been growing much faster amongst the developed than between developed and developing countries - with the exception of the last few years, when the FDIs to the developing countries and the post-communist countries have been growing fast. Second, inward and outward direct investments in advanced industrial countries have, in general, become increasingly more balanced. In this second point, however, there are some exceptions. The small open Nordic economies (notably Sweden and Finland) exhibit a large and growing imbalance between outward and inward investments: In Finland and Sweden the stock of outward investment is as much as 3-4 times higher than the stock of inward investment.

Internationalization of industrial firms is, to a large extent, based on firm-specific knowledge (or ownership advantage), which is created in the framework of the national innovation system involving - explicit or implicit - co-operation of the state, labour and national firms. Internationalization has, however, proceeded so far that firms are no longer dependent on the national government or labour. The nation as a central concept or unit of analysis has become problematic - and so has the role of national industrial and technology policies. Nevertheless, multinational enterprises (MNEs) are still an essential part of national innovation systems, but their role has changed in many important ways.

There is some evidence that in the 1980s - following the internationalization of production, marketing, finance and logistics operations - also the R&D activities of MNEs started to internationalize rapidly. R&D has traditionally been much less internationalized than other activities of MNEs. Now, a crucial part of the national innovation system - the innovative activities of industrial firms - has become more and more transnational. Related to this, there are several important questions to be raised.

Is the role of the national framework becoming weaker and even futile? Or is it just the other way round: have the closed national systems reached their peak, and will only decline if they do not get stronger support from foreign influences and connections?

It has been argued that the industrial base, on which the welfare of a country is founded, may be eroded as a consequence of the kind of rapid internationalization some small economies have experienced during the last 10 - 15 years. Internationalization means, at least to some extent, that domestic resources are employed to generate value abroad. This is of no concern to the firms. And, as long as there are positive feed-back effects on the home economy, it is also of advantage to the home country welfare. However, if the employment of domestic resources to be engaged in foreign production also implies - as some recent studies seem to indicate - that: 1) firms increasingly move R&D and other competitiveness promoting activities abroad, 2) foreign subsidiaries of MNEs increasingly compete with home country units for third-country exports, and 3) domestic subcontractors have to follow in the footsteps of the large multinationals to stay in business, the home country economy is likely to suffer. The industrial and technological base of its welfare dwindles. In this case the use of taxpayers' money to speed up technological progress in domestic firms and the subsequent internationalization would not be justified.

On the other hand, science and technology are and have always been international. The ongoing process of internationalization and economic integration can also be seen as a

process of learning and institutional innovation. Many of the national institutions will be replaced by transnational ones, for example at the European level.

How will all this - and in particular the rapid internationalization of business - affect the performance of the national innovation systems and national technology policies? What is the appropriate theoretical and conceptual approach to tackle the issues raised above? To what extent have the firms of small countries like Finland actually internationalized? Have the firms been moving their R&D departments abroad?

The paper shows that the rate of internationalization of industrial firms in small open economies is very high: about half of the employment of the large firms in Finland is outside the national borders. In Sweden the corresponding figure is two thirds. In the Finnish industry some 30 % of all industrial R&D is carried out by foreign subsidiaries of large MNEs.

The locational patterns of knowledge-intensive firms seems to be different from those of low-tech firms. High-tech firms are more internationalized and tend to locate in regions where high-tech industries already exist.

In the long run economic growth depends crucially on the capacities of economies to use and produce scientific and technological knowledge. Approaches based on innovation systems, technology systems and industrial clusters increase our understanding about the innovation performance suggesting that both creation and diffusion of technological knowledge occur through interactions between different economic agents and institutions.

From the point of view of industrial and technology policies it is important to recognize the innovation activity as a process of a systemic nature. As technological knowledge is to a large extent tacit, much of the communication and technology transfer takes place in various kinds of networks. It is the task of technology policies to enhance the kind of institutional set-up that promotes the formation of networks, whether regional, national or international.

The nature of national systems of innovation is changing into two directions: regional and international. Some of the national institutions will be replaced by international ones, notably at the European level, as the economic integration is deepening. On the other hand, the role of regional systems will increase, since learning and networking are always, to a large extent, local processes. Regional systems will be of particular importance for the diffusion of technological knowledge. In public policies much more attention will be given to the processes of knowledge access and distribution.

Pentti Vartia and Pekka Ylä-Anttila

TECHNOLOGY POLICY AND INDUSTRIAL CLUSTERS IN A SMALL OPEN ECONOMY - THE CASE OF FINLAND

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1. INTRODUCTION - POSING THE QUESTIONS

Participation in the international division of labour is particularly important for small countries. Specialization and international trade have meant a great opportunity for these countries to benefit from the expanding world markets. It is important to stress not only the static, but also the dynamic aspects of participating in the international division of labour. Trade and international contacts not only make imports of foreign goods possible, but also allow citizens and firms to follow technological, scientific and cultural developments in other countries.

International trade is typically followed by international direct investment, meaning even deeper involvement in foreign economies, societies and cultures. The 1980s saw a surge of foreign direct investment reaching globally an annual growth rate of some 30 %. The trend of rapid internationalization seems to have continued in the 1990s, although at a somewhat slower pace.

Some interesting changes in the patterns of FDI flows have taken place during the last 10 - 15 years. First, the FDIs have been growing much faster amongst the developed than between developed and developing countries. Second, inward and outward direct investments in advanced industrial countries have, in general, become increasingly more balanced (see Dunning, 1993 and Heum and Ylä-Anttila, 1993a). In this second point, however, there are some exceptions. The small open Nordic economies (notably Sweden and Finland) exhibit a large imbalance between outward and inward investments: In Finland and Sweden the stock of outward investment is as much as 3-4 times higher than the stock of inward investment (see Heum and Ylä-Anttila, 1993a and Table 2).

Internationalization of industrial firms is, to a large extent, based on firm-specific knowledge (or ownership advantage), which is created in the framework of the national innovation system involving - explicit or implicit - co-operation of state, labour and national firms (capital). Internationalization has, however, proceeded so far that firms are no longer dependent on the national government or labour. The nation as a central concept or unit of analysis has become problematic - and so has the role of national industrial and technology policies. However, multinational enterprises (MNEs) are an essential part of national innovation systems, but their role has changed in many important ways.

It has been argued that the industrial base on which the welfare of a country is founded may be eroded as a consequence of the kind of rapid internationalization some small economies have experienced during the last 10 - 15 years. Internationalization means, at least to some extent, that domestic resources are employed to generate value abroad. This is of no concern to the firms. And, as long as there are positive feed-back effects on the home economy, it is also of advantage to the home country welfare. However, if the employment of domestic resources to be engaged in foreign production also implies - as some recent studies seem to indicate - that: 1) firms increasingly move R&D and other competitiveness promoting activities abroad, 2) foreign subsidiaries of MNEs increasingly compete with home country units for third country exports, and 3) domestic subcontractors have to follow in the footsteps of the large multinationals to stay in business, the home country economy is likely to suffer - the industrial and technological base of its welfare dwindles (see Heum and Ylä-Anttila, 1993a). In this case the use of taxpayers' money to speed up technological progress and the subsequent internationalization would not be justified.

On the other hand, science and technology are and have always been international. The ongoing process of internationalization and economic integration can also be seen as a process of learning and institutional innovation (see Vuori and Vuorinen, 1993). Many of the national institutions will be replaced by transnational ones, for example at the European level.

How all this - and in particular the rapid internationalization of business - will affect the performance of the national innovation systems and national technology policies? What is the appropriate theoretical and conceptual approach to tackle the issues raised above? To what extent have the firms of small countries like Finland actually internationalized? Have the firms been moving their R&D departments abroad? Or is the national framework still important for knowledge creation and learning processes?

The purpose of this paper is to discuss some aspects of these issues and to spur further research on the impacts of outward FDIs on the home economy. Theory and empirical research are far from providing answers to questions on how the domestic growth, industrial structure and the system of innovation are affected by continuously increasing foreign investment of knowledge-intensive firms (see Braunerhjelm - Heum - Ylä-Anttila, 1996).

2. SYSTEMS OF INNOVATION AND NATIONAL TECHNOLOGY POLICIES

21. Systems of innovation, technological systems and industrial clusters: parallel and competing approaches

There are several relatively well-established conceptual frame works which could be adopted to deal with the issues raised above. In what follows, three of them - Porter's model of national competitiveness, technological systems (TS), and systems of innovation (SI) - will be briefly discussed and compared.

Industrial clusters

The extensive Porter (1990) study on the determinants of a nation's international competitiveness suggests that the home country "diamond" is the source of competitive advantage for national firms. The competitive advantage of a firm depends on four key determinants of the nation's international competitiveness: factor conditions; demand conditions; firm strategy, structure and rivalry; and related and supporting industries. At best, these factors constitute an entity, an industrial cluster, in which parts strengthen each other due to positive external economies and technological spillovers. The industry (or a set of industrial activities) is defined by a common knowledge base and customers rather than by resource base or production process.

Porter's model states that an internationally operating firm needs to have a sustainable competitive advantage based on the successful utilization of various components of the home country diamond. Domestic firms build their international success - exports and engagement in foreign direct investment - on this home base.

The national agenda is clearly dominating Porter's cluster analysis. It is the national characteristics and differences that explain the international competitive positions and performance of domestic firms. From the point of view of our study it is interesting to note that in the end of his book Porter takes up an issue of convergence: "*As global competition becomes sharper, nations may increasingly have to make choices between maintaining certain values and continued well-being*" (Porter, 1990). So, there are not only national differences and international divergence, but also, to some extent, tendencies for convergence as noted by Jacobs and de Jong (1992). A shortcoming in Porter's model is that this dialectics between divergence and convergence is not clarified and further elaborated (cf. Jacobs and de Jong, 1992).

The Porter model obviously neglects the importance of multinational firms and the small open economy approach - a feature which has raised a lot of criticism (see, e.g. Dunning, 1993 and Penttinen, 1994). From our point of view the role of multinational corporations is essential.

Technological systems

Carlsson and Stankiewicz (1991) define the technological system as..."*a network of agents interacting in a specific technology area under a particular institutional infrastructure or set of infrastructures and involved in the generation, diffusion, and utilization of technology*".

Technological systems are based on knowledge and competence flows rather than flows of goods and services or FDIs. Technological systems can, but they do not have to be, restricted by national borders. As a matter of fact, Carlsson and Stankiewicz see the technological systems as regional rather than national networks. In a transnational technological system, the locus of development may shift from one country to another, as different countries may follow different development patterns in different areas of technology (see Autio and Hameri, 1994). These differences in development patterns may be due to operations of multinational corporations. However, technological systems do have close connections to national institutions. An interesting issue is whether, after all, truly global technological systems can emerge (for further discussion, see Autio and Hameri, 1994).

Systems of innovation (SI)

Christopher Freeman (1987) defines national innovation system as follows: "*.... the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies*". According to Lundvall's (1992) "broad" definition national system of innovation includes "*all parts and aspects of economic structure and institutional set-up affecting learning as well as searching and exploring...*".

According to Patel and Pavitt (1994) SI is comprised of... "*The national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change-generating activities) in a country.* The narrow definition of SI (see, e.g., Lundvall, 1992) is based only on institutions: R&D departments of firms, universities, technological institutes, education and training. S&T policies and interactions amongst them.

However, according to our view an important feature of the concept of national systems of innovation (NSI) should be that it includes not only technical innovations but also social, organizational and systemic innovations.[1] The NSI approach puts emphasis on national economic interrelations and looks at technical change from this perspective. Technological systems - as well as industrial clusters- can be seen as subsystems of NSIs, but they can also extend beyond NSIs.

22. Evaluation of the alternative approaches

The usefulness of all these approaches lies in the fact that they emphasize the role of clustering of resources and networking leading to intense flows of information and knowledge which tie together the producers, users, and competitors within a technological/innovation system or an industrial cluster. The strength of a well-functioning industrial cluster stems from the existence of positive external economies.

Within an innovation/technological system or a cluster, the transaction costs are reduced due to internalization of the transactions involving the positive externalities. The role of industrial and technology policies is to strengthen the common knowledge base, and to correct market failures implied by the existence of external economies. Actually, innovation and technology systems as well as industrial clusters - all including both private and public agents - could be seen as entities with built-in market failure corrections mechanisms.

The three approaches - all recognising the importance of institutions for the innovation process - can be seen as complementary. All of them should, however, be extended by putting more emphasis on one increasingly important institution, the multinational firm. Internationalization of business is not fully taken into account in any of the three approaches.

There are also other nation state-based institutions - notably social ones - which call for further analysis, when trying to evaluate the performance of the innovation generating systems and the role of technology policies. In the recent discussion the rigidities of the social

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[1] Cf., however, Nelson (1993), where innovation system is restricted to cover only technical innovations.

institutions created in the 1960s and 1970s have been seen as major obstacles for economic and technological development in Europe. Both these issues and the implications of internationalization of business are dealt with below.

3. INTERNATIONALIZATION OF INDUSTRIAL ACTIVITIES

The internationalization of Nordic, and especially Finnish, industrial firms has been very fast during the last ten to fifteen years. Currently, some two thirds of the employment of the large Swedish MNEs is outside the national borders, the corresponding figure for Finland is about 50 % and for Norway about one third (see Heum and Ylä-Anttila 1993a and b). Swedish industry is among the most highly internationalized in the world and Finnish industry has rapidly been approaching the same stage with the highest rate of internationalization within the OECD in the 1980s and early 1990s. From Table 3 it is evident that internationalization in these two countries has been more or less a one-way street. The stocks of outward direct investment in Finland and Sweden are 3 - 4 times higher than the stocks of inward investment. Furthermore, the imbalance between outward and inward FDIs was rapidly growing in the 1980s in both countries (see Table 3). On the other hand, foreign ownership of the firms quoted on the stock exchange has in recent years been on the increase.

Most of the largest firms which originally created their competitive advantages as parts of national industrial clusters have become multinationals and are, in fact, parts of transnational clusters. Internationalization is an important source of competitive advantage if the firms are operating in the highly specialized market segments, like many of the Finnish firms do. Most of the Finnish multinationals still have a foothold in the home country in the form of the location of its headquarters and R&D activities (see Puhakka, 1994).

Table 1. Employment in foreign subsidiaries in per cent of total corporate employment in the largest industrial firms in Finland, Norway and Sweden

	Finland		Norway		Sweden	
	1974	1993	1975	1993	1975	1993
Foreign sales, % of corporate turnover	41	71	49	69	66	82
Employment abroad, % of corporate employment	< 10	40	6	38	37	62

Table 2. Total and foreign employment in the 20 largest Finnish manufacturing companies in 1983 and 1993

	1983			1993		
Company	Total employment	Employment in foreign subsidiaries	%	Total employment	Employment in foreign subsidiaries	%
Repola	18512	1300	7	27215	10886	40
Nokia	23651	4146	17,5	25801	11988	46,5
Kone	13137	8700	66,2	20710	17576	84,9
Kymmene	16087	2426	15,1	16462	4092	24,9
Outokumpu	10089	141	1,4	16073	8179	50,9
Valmet	15371	1969	12,8	15716	5740	36,5
Enso	15315	1500	9,8	14071	2036	14,5
Metsäliitto	7891	590	7,5	13084	2844	21,7
Ahlström	12472	1796	14,4	12863	7019	54,6
Neste	7076	1489	21	12541	5552	44,3
Kemira	8159	200	2,5	11446	5152	45
Huhtamäki	4698	311	6,6	11190	8178	73
Partek	6200	531	8,6	9428	6039	64,1
Rautaruukki	7712	120	1,6	9060	1951	21,5
Asko	3800	1227	32,3	8343	4117	49,3
Amer	2102	454	21,6	5594	4138	74
Cultor	4397	200	4,5	5159	1709	33,1
Orion	4106	290	7,1	5029	341	6,8
Tampella	7611	613	8,1	4592	2717	59,2
Hackman	2006	17	0,8	3432	1646	48
Total	190881	28020	14,7	2447809	1119	45,2

Table 3. Stock of outward FDI in relation to stock of inward FDI in selected countries

Country	1980	1985	1990	1992
Australia	1.89	0.27	0.43	0.37
Austria	0.17	0.31	0.43	0.64
Belgium and Luxemburg	0.83	0.53	0.79	0.81
Canada	0.44	0.62	0.69	0.72
Denmark	0.49	0.5	0.8	0.97
Finland	1.36	3.1	2.3	3.2
France	1.04	1.11	1.27	1.35
Germany	1.18	1.62	1.27	1.38
Great Britain	1.28	1.62	1.12	1.28
Italy	0.78	0.86	0.97	1.1
Japan	0.53	1.27	5.85	6.47
Netherlands	2.2	1.91	1.48	1.57
New Zealand	0.11	0.4	0.88	0.75
Norway	0.35	0.97	1.27	1.45
Portugal	0.23	0.25	0.08	0.16
Spain	0.24	0.23	0.23	0.24
Sweden	1.68	2.6	4.24	3.56
Switzerland	2.53	2.12	2.13	2.27
Turkey	..	0.53	0.12	0.08
USA	2.65	1.36	1.09	1.17

The evidence both from Finland and Sweden shows that the technology-intensive firms have internationalized clearly further than other firms[2] - as the theory of internationalization suggests. So far the R&D activities have internationalized much less than other activities of these firms. However, recent studies seem to show that the growth of foreign located R&D has been fairly rapid in recent years particularly in Finland. As Table 4 displays in the group of largest Finnish manufacturing companies as much as one third of R&D is carried out outside the national borders. The corresponding share for the Swedish manufacturing has been increasing too, and is currently between 15 and 20 per cent (cf. Anderson, 1992). What is interesting in Table 4 is that the share of foreign R&D is much bigger in the group of knowledge-intensive engineering firms than in the whole group.

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2 See, e.g., Säynevirta - Ylä-Anttila (1994) and Braunerhjelm - Svensson (1994)

Table 4. R&D expenditure in a sample of Finnish multinational companies in 1990 and 1992

	(N=28)		Engineering industry (N=15)	
	1990	1992	1990	1992
Turnover (million FIM	84631	87628	37713	40651
R&D expenditure (million FIM	1502	1492	837	858
thereof:				
- domestic (%)	74	69	61	54
- foreign (%)	27	31	39	46

According to conventional wisdom the internationalization of industrial firms contributes positively to the productivity and competitiveness of the domestic units of the multinationals and the growth of the home economy. The effect of internationalization on productivity works through R&D and other efforts to cultivate firm-specific assets promoting competitiveness. Foreign production allows firms to grow larger compared to what otherwise would have been possible. Thus, R&D expenditures and other expenses to promote and upgrade the industrial competence may be distributed over larger sales volumes (see, e.g. Swedenborg 1982 and 1991).

These results have been challenged by some recent studies on the Swedish multinationals. Svensson (1993) shows that there is a clear substitution effect of Swedish firms' foreign production on domestic exports. At the margin this substitution is quite substantial, and it is mainly caused by third country exports of foreign affiliates. A recent study by Fors (1993) suggests that intra-firm technology transfers might have significant effects on firms' home and host countries. In the case of Sweden technology transfer seems to have taken place mainly in one direction only: from Sweden to host countries. These technology flows seem to have contributed clearly to the growth of total factor productivity of foreign subsidiaries, but the effects on parent companies are unclear and need further analysis.

To sum up, there is a risk that the internationalization of national firms may reach the point where the industrial and technological base of the home country is gradually eroding. In fact, in the case of Sweden, the recent evidence indicates that this may be about to happen. In the case of Finland and other small countries the available data is more inconclusive. In any case, this is a major challenge for industrial and technology policies.

4. INDUSTRIAL AND TECHNOLOGY POLICIES

41. Role of social institutions - some remarks on the 'Nordic model' in the context of innovation systems

The role of well-functioning institutions, high quality education system and sound incentive mechanisms are of crucial importance for well-performing innovation system. It has been argued that the tradition of high collective sharing of risks might have had a long lasting effect on the growth performance and innovativeness of, especially, Nordic economies (see e.g., Kanniainen 1993, and Henrekson, Jonung and Stymne 1994). These collective risk sharing mechanisms have been built both for firms and persons. They have distorted incentive structures and thus led to slow rate innovation and economic growth.

Internationalization of the Finnish manufacturing firms has already in many ways affected national institutions, which - as is common in the Nordic countries - have been characterized by more collective risk sharing than in other countries. Thus e.g., the labour market institutions, which in the past have been based on centralized wage bargaining, moving towards a more decentralized direction, where wages are determined more at the branch and at the firm level.

The question is, however, to what an extent it is necessary to dismantle this comprehensive risk sharing system, a part of which is social security. In which areas it would be beneficial to redesign the system in order to favour more risk taking and an incentive structure conducive to more rapid growth, higher productivity and innovativeness? Could the national systems be replaced by international (European level) collective risk sharing system? (cf. Vuori and Vuorinen, 1993). What kind of social innovations are needed in an international context?

The internationalization of firms and free factor mobility means that the competitive advantages and skills of companies and nations can no longer be equated. Differences in production costs in different regions will lead firms to relocate. For this reason, price competitiveness, too, is still of great importance. For the same reason there is a tendency for social institutions and policies as well as tax rates to harmonize, at least at the European level. This restricts the scope for national economic and industrial policies. An important question for national industrial policies has thus become, how to attract competitive domestic and foreign firms.

42. Industrial and technology policies - summary

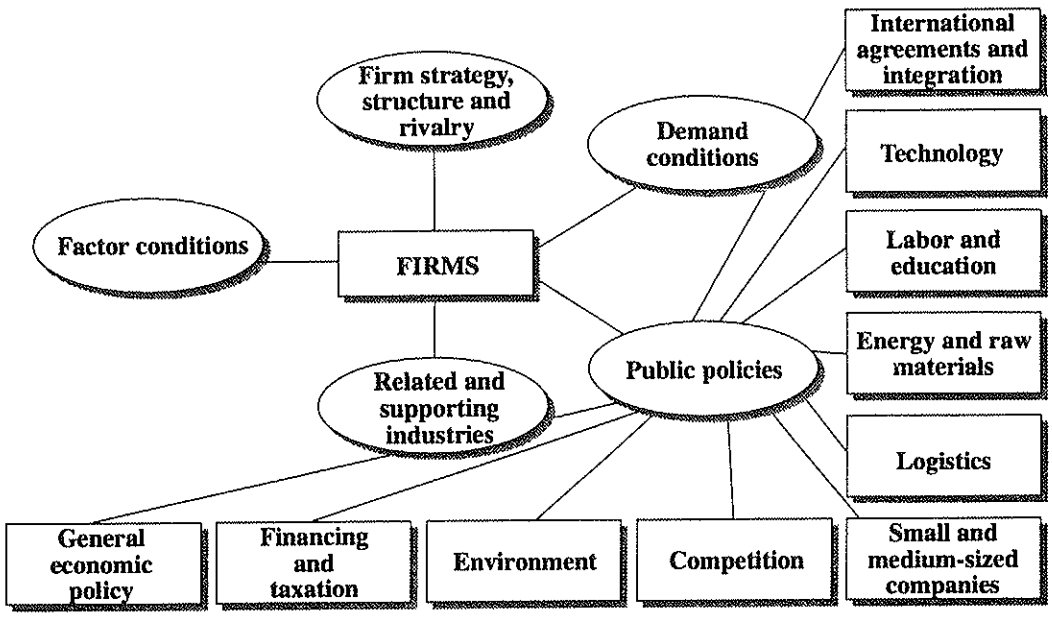
The main conclusion from the TS, SI or cluster approaches is that created factors of production and competitive advantages are more important than inherited ones. The task of economic and industrial policy is to create a favourable environment toward areas with positive externalities, e.g. education and R&D. This also means a sound competition policy, which nevertheless cannot hinder the creation of co-operative linkages in a network economy. Closeknit user-producer relations as well as technological co-operation are often prerequisites for creation of a dynamic development block.

In addition to technical advances and innovative activities, research on economic growth emphasizes the importance of another basic source of growth: specialization associated with a deeper domestic and international division of labour. The deepening of the division of labour,

expansion of world trade and the consequent economic growth are possible only if the economy has well functioning institutions. These institutions - broadly taken to mean the trust in agreements between different parties - reduce the inherent risks involved in specialization and encourage firms to invest. From the standpoint of the economy, the most important institutions are financial, tax and exchange rate systems, labour market institutions as well as international agreements. The supervision of these institutions is one of the public sector's main tasks.

The role of public policies is clarified in Figure 1. It emphasizes the indirect policy effects and systemic nature of the policies. The main economic, industrial and technology policy blocks have been added to the Porter diamond model on the determinants of competitiveness of firms and nations. However, the implications for industrial and technology policies would be more or less the same if we chose the TS or SI approach. Each policy block has links via one or more elements of the diamond to the determination of competitiveness. Education and technological policy define to a great extent what kind of specialized factor base there is in the economy. Competition policy creates competitive conditions and affects the firm structure; the nature of the institutions in the financial system and tax policy affect what forms of commercial activity or co-operation networks are born, etc. The simple idea is to show that public policies matter. In fact, every time when decisions about public expenditures or revenues are made they also have a bearing on industrial competitiveness. The concepts of SI, TS and industrial clusters help to understand the mechanism through which the decisions affect the competitive advantages of firms.

Fig. 1. Determinants of competitive advantages and the components of economic, industrial and technology policies



5. CONCLUDING REMARKS

In the long run, economic growth depend crucially on the capacities of economies to efficiently use and produce scientific and technological knowledge. The innovation system, technology system and industrial clusters approaches increase our understanding about the innovation performance suggesting that both creation and diffusion of technological knowledge occur through interactions between different economic agents and institutions.

From the point of view of industrial and technology policies it is important to recognise the innovation activity as a process with systemic nature. As technological knowledge is to a large extent tacit, much of the communication and technology transfer take place in various kinds of networks. It is the task of technology policies to enhance the kind of institutional set-up that promotes the formation of networks, whether regional, national or international.

The nature of national systems of innovation is changing in two directions: regional and international. Some of the national institutions will be replaced by international ones, notably at the European level, as the economic integration is deepening. On the other hand, the role of regional systems will increase, since learning and networking are always, to a large extent, local processes. Regional systems will be of particular importance for the diffusion of technological knowledge. In public policies much more attention will be given to the processes of knowledge access and distribution.

In spite of the concern that growth effects on the domestic economy are being altered by the recent increase in outward FDIs by high-tech firms, capital controls are no policy alternative for Finland or other small open economies. More important are the dynamic effects of integration on economic growth, which would be dampened if such controls were enforced. Instead policy efforts should promote competitiveness of the domestic industrial base by attracting internationally competitive footloose firms, whether they are of domestic or foreign origin.

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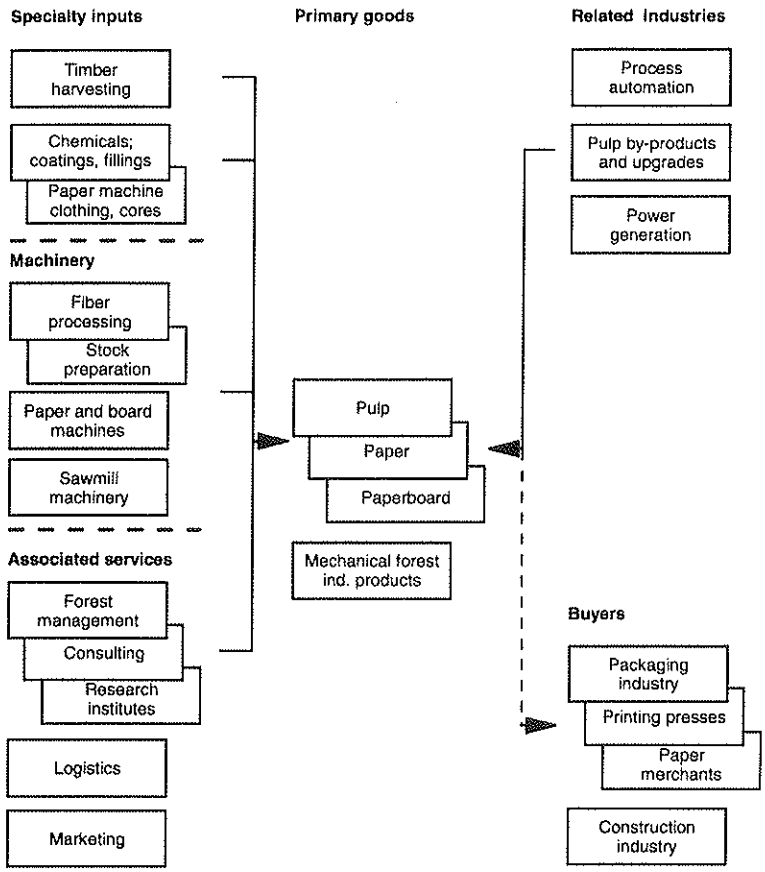
APPENDIX

The Finnish forest cluster

Around the forest industry in Finland has spawned many types of competitive activities. The industry has its roots in the 17th century and the content of the cluster or industry has varied a lot, especially, during recent decades. Originally a raw material-driven cluster has grown to comprise a lot of knowledge-driven engineering and electronics industries as well as services. A rough outline of the current operations is given in Figure A1. Many of the branches have grown into important export industries just during the last couple of decades. About 40 per cent of the exports of the metal and engineering industries are linked in one way or another to the forest sector. The most important products are paper machines and forest harvesters where Finnish producers are world leaders.

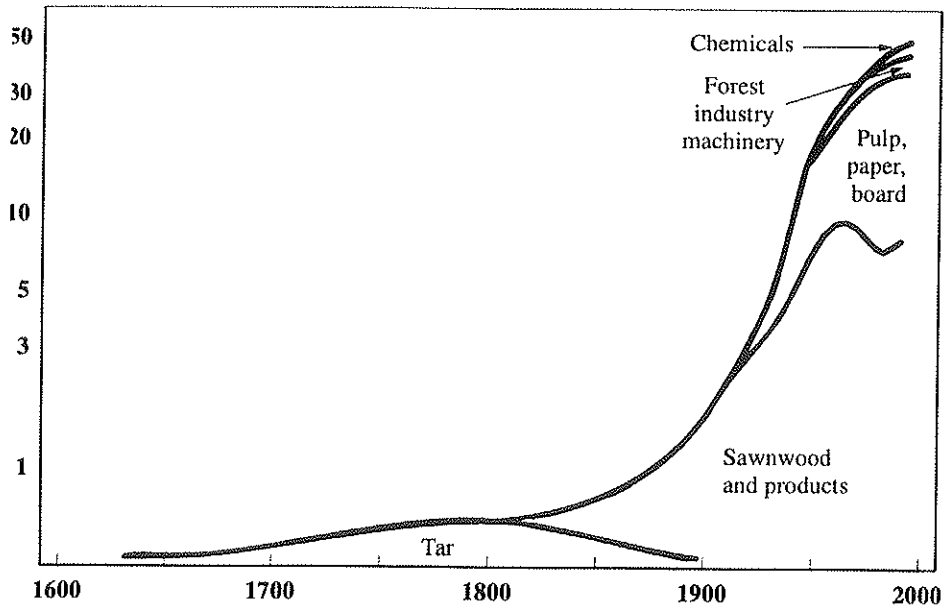
It is precisely in the forest industry machines and equipment, specialized production inputs (chemicals, fillers and coating material etc.) and in services that there are strong growth possibilities (cf. Figure A2). On the basis of the cluster analysis, the strengths of the Finnish manufacturers in many fields of electronics and information technology have their roots in the control systems and advances in automation of pulp and paper and other process industries.

Figure A1. Key parts of the Finnish Forest Cluster



Source: Hernesniemi - Lammi - Ylä-Anttila (1996).

Figure A2. Evolution of the Finnish forest cluster: Exports of the branch since the dawn of the forest cluster, Bill. FIM (at 1993 prices)



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