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FOREIGN DIRECT INVESTMENT AND TECHNOLOGY TRANSFER

Results of a survey in selected branches in Estonia

All comments are welcome

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ABSTRACT: The report explores the role of foreign investors as technology transferers in 20 foreign-owned firms in Estonia in the foodstuff and electronics industries as well as in the technology-intensive services industry. The results of the sample suggest that foreign investors play an important role in providing new production capacities, technology as well as in re-establishing access to Western markets and to cooperation links in R&D activities. Foreign investors and international organisations play a major role in providing know-how through, e.g., training. The technology-intensive firms undertake a significant amount of R&D activities likewise the privatised foreign-owned foodstuff firms. The current R&D activities in newly established foreign owned firms, as a whole, are not very large, meaning that foreign investors are still developing their operations, which have started relatively recently. In addition, many of the investors have centralised R&D activities in the parent firms, particularly in the electronics sector. Furthermore, the Estonian human capital can be considered as a crucial determinant of successful technology transfer, as the labour force at all educational levels is almost 100 per cent Estonian and training costs are after all rather low. This must reflect the existence of viable inherited knowledge. Hence, foreign investors' major role in these sample firms lies in the restructuring and /or the provision of physical production capacities and in providing new international links.

KEY WORDS: FDI, technology transfer, Estonia.

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TIIVISTELMÄ: Raportissa tarkastellaan ulkomaisten sijoittajien roolia teknologian siirrossa 20 ulkomaisomisteisessa yrityksessä Viron elintarvike- ja elektroniikkateollisuudessa sekä teknologia-intensiivisissä palveluyrityksissä. Tulosten mukaan ulkomaiset sijoittajayritykset ovat keskeisiä uusien tuotantovälineiden ja -teknologian maahantuojia. Lisäksi näiden avulla on pystytty luomaan uudet kauppa- ja tiedeyhteydet länteen. Ulkomaiset sijoittajat ja kansainväliset järjestöt vaikuttavat keskeisesti tieto-taidon kehittämiseen mm. koulutuksen kautta. Otoksen teknologia-intensiivisissä yrityksissä ja yksityistetyissä elintarviketeollisuuden ulkomaisomisteisissa yrityksissä on paljon T&K toimintaa. Muissa otoksen yrityksissä T&K toiminta on vaatimatonta luokkaa, koska ulkomaiset sijoittajat vasta organisoivat toimintaansa Virossa. Lisäksi useat sijoittajat ovat keskittäneet T&K toimintansa emoyrityksiin erityisesti elektroniikkateollisuudessa. Viron henkinen pääoma näyttää olevan ratkaiseva tekijä onnistuneen teknologian siirron kannalta, sillä otoksen yritysten henkilökunta on miltei täysin virolainen ja koulutusmenot ovat hyvin alhaisia. Tämä heijastanee perityn tieto-taidon käyttökelpoisuutta. Kaiken kaikkiaan ulkomaiset sijoittajat ovat keskeisesti panostaneet tuotantokapasiteetin rakenneuudistuksiin ja uusien kansainvälisten yhteyksien luomiseen.

AVAINSANAT: Suorat sijoitukset, teknologian siirto, Viro.

1. INTRODUCTION

The transition economies have inherited an over- and misindustrialised structure, in which the techniques of management of production, finance, and sales are largely unsuited to the demands of market economies (Eatwell et al. 1995). Several studies underline the need to replace, adapt and upgrade productive capacities, to acquire new skills in management and the labour force and to develop a framework in which commercial R&D activities can succeed (Radosevic 1993, Hyvärinen and Borsos 1994, Berg et al. 1996, World Bank 1996).

One of the major sources of such transformation is foreign direct investment (FDI), though it has become evident that FDI alone and other foreign financial sources will not provide the amount of investment required for industrial restructuring in transition economies. Nevertheless, transition economies have actively attracted FDIs with the main objective to accelerate industrial transformation, mainly through privatization and capacity restructuring. Within this framework, technology transfer through FDI is viewed as crucial.

Until now, several macroeconomic studies have been conducted on the current innovation systems of transition economies, often dominated by the common belief that scientific and technologic knowledge is superior in these countries. However, it is now clear that the inherited innovation system has major deficiencies in terms of supporting a market economy (see, e.g., Radosevic 1993, Schneider 1994, World Bank 1996). Moreover, it seems that accumulating knowledge has been prioritised over applying it. As a result, the role of and the need for technology transfer (including organisational know-how) through FDIs has accentuated, due to its efficiency as a channel to rapid restructuring and swift economic growth.

This paper aims to fill a gap in the current debate over the role of foreign investors in upgrading present productive capacities in transition economies by focusing on foreign-owned firms in Estonia. The objective of the study is to explore the role of foreign investors as transferers of technology in 20 foreign-owned firms in the foodstuff and electronics industries as well as in the technology-intensive services industry. This study is part of a larger investigation on the ability of Estonian firms to adopt and use foreign technology, i.e. on absorptive capacities in Estonian firms, which covers the following types of firms: Still state-owned firms, privatised firms and newly established Estonian firms in the foodstuff and electronics industries as well as in the technology-intensive services industry[1]. The selection of branches is based on earlier assessments indicating that most of the R&D activities in Estonia are found in these sectors (Hyvärinen and Borsos 1994, Paasi 1996) and they have also attracted the largest share of FDIs in Estonia (except for technology-intensive services firms).

We will first discuss the role of FDI in transition economies, followed by an overview on current FDI activities in Estonia and the general level of technological capacities in Estonia. The latter includes a short discussion of the major characteristics of the current technological capacities

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[1]This part of the study is undertaken by Marianne Paasi at IWH; see forthcoming discussion papers in ETLA and IWH series.

based on a recently published ETLA study (Berg et al. 1996) as well as other studies (Kilvits et al. 1992; Martinson 1995, Radosevic 1993 and 1995). The paper subsequently presents the firm-specific empirical data collected through a survey and certain features related to technology transfer by foreign-owned firms in Estonia. Technology transfer will be looked at in broad terms here, and based on the FDI literature. The study identifies various sources of new knowledge in the firms included in this study. Thus, the paper provides an overview on these firms' production-related factors (such as the modernisation of production facilities), employee-related factors (such as training), R&D activities, international trade and knowledge links and on the current innovative activities of these firms.

The investigation has been funded by TEKES, which is gratefully acknowledged. The investigation has been carried through in cooperation with IWH, where Dr. Marianne Paasi has conducted the three other parts of the investigation on absorptive capacities in Estonian firms. Many thanks to Dr. Marianne Paasi's contribution to this study. Many thanks to Dr. Erik Terk, Director of the Estonian Institute for Future Studies, and his assistants, without whose advice and help in collecting the necessary information the project would not have been carried through successfully. Finally, I am thankful for the invaluable work of assistants Sari Sirviö at ETLA and Dirk Ziegenhausen at IWH in coding the results of the survey and forming a useful database.

2. THE ROLE OF FDI IN TRANSITION ECONOMIES

Some of the main host country benefits of FDI are considered to result from the inflows of new technology to subsidiaries of multinational companies (MNCs), since these flows create a potential for technology spillovers to the host country's local firms (see, e.g., Caves 1974; Blomström 1989; Kokko 1994). Furthermore, FDI is seen as an important vehicle for the transfer of technology, contributing relatively more to economic growth than domestic investment. However, a higher productivity of FDI requires a minimum threshold stock of human capital in the host country (Borensztein et al. 1995), as the application of more advanced technology is determined by the ability of firms (their work force) to adopt and use foreign technology (Benhabib and Spiegel 1992). Hence, the same technology that has worked successfully in a given country may completely fail in another environment unless the host country and its labour force posess adequate prerequisites to adopt, use and maintain new technology. Such prerequisites require substantial research and training activities in order to exploit knowledge. Therefore, the human capital factor is central, and it acts as a major determinant of FDIs. In addition to high human capital, successful transfer of technology requires an appropriate socio-economic environment with a sufficient material and non-material infrastructure (Myllyntaus 1992).

The technological benefits of FDI emerge due to the fact that MNCs, which are active direct investors, posess a large amount of knowledge-based, firm-specific assets. Moreover, empirical evidence shows that a country's industry tends to have a greater proportion of MNCs when the output of that industry is characterized by R&D, marketing expenditures, scientific and technical workers, product newness and complexity, and product differentiation (Markusen 1995, 174). Technology transfer from mother companies to affiliates, then, does not only include flows of

management, engineering, marketing, and financial services, which are based on human capital, but also other firm-specific assets, such as patents and trademarks.

At the country level, the above MNC characteristics emerge in the same way, ie. foreign direct investment and MNCs are associated with the similarity of countries. That is, MNCs are more important between countries that are relatively similar in size, per capita income, and relative factor endowments (see Markusen 1995). This may explain why a greater bulk of FDI activities takes place among the industrialised countries and not between the developed and developing countries (see UN 1995). However, the role of FDI in developing and emerging economies seems to be more crucial, particularly when it comes to technology diffusion and economic growth (see World Bank 1993; Wang 1990). Therefore, the role of foreign investors in upgrading and developing the technological capacities of a transition country and its firms may be crucial in achieving a market-based competitive economy.

In addition to technological benefits of FDI (either through transfer or upgrading of indigenous technological capability, or both), foreign firms can, via their FDIs, benefit host country economies in a number of ways (Dunning 1993), such as: (1) By bringing financial resources to fill the gap between desired investment and locally mobilized capital; (2) by providing new trade links and increased foreign exchange earnings; (3) through the transfer of management techniques and training programmes; (4) through overall economic effects (e.g. the overall tax revenue, employment effects, etc.) and increasing competition as well as other spillover effects (Kokko 1994).

In Estonia and other transition countries, the role of FDI is not only limited to the ones described above, but also to the strong overall need to rapidly re-orient the economy towards a market-based system and even to secure independence in the new European political map (Rumpunen 1995). Industrial transformation in Central and Eastern Europe has centred around two key elements, i.e. privatization and capacity restructuring, the former being prioritised. It was the urgent need for capital necessary in industrial restructuring that was the initial motive behind new policies allowing foreign investment in the former socialist countries (Senior Nello 1991). Other motives were closely associated with the above listed FDI benefits.

It is widely agreed that FDI has already contributed significantly to institutional development in Central and Eastern Europe. For instance, legislative changes have evolved around FDI-specific regulatory needs. Furthermore, technical assistance programmes by multilateral organisations (such as the World Bank, IMF, EBRD) and the European Commission, in which FDI projects are also involved in most cases, are strictly connected to the commitment of these economies to pursue a market-based, democratic system. The transition economies have benefited from FDI primarily through new linkages with Western firms, through the contribution to creating a corporate business culture and increased competition brought by entry (McMillan 1993, Borsos 1994, UN 1995).

Benefits brought by the transfer of technology, management and marketing knowledge, financial resources, etc. are underlined in the transition economics literature as well (see, e.g., McMillan

1993, OECD 1994, Berg et al. 1996). Hunya (1996) reports higher R&D spending in foreign owned firms than in indigenous firms in Hungary. Studies on R&D activities in foreign vs. domestic firms in other transition countries are not available. Some authors would question the role of FDI in upgrading host country technological capacities, due to the strategic behaviour of MNCs, which often entails the centralisation of R&D activities usually situated in the home or main markets of the parent firm and not in the locally acquired foreign unit (see Papánek 1995).

Other drawbacks involved in FDI activities have emerged as well. One of the recognised dangers of large inflows of foreign capital into countries in transition is that they may not only reduce domestic savings but actually become a substitute for efforts to mobilize domestic resources for investment, with damaging effects when foreign investors withdraw their funds (Borsos and Erkkilä 1995b). Therefore, the rapid development of domestic financial resources/instruments for the domestic companies is crucial. Furthermore, problems may arise from the market power of the foreign firm and its ability to use this power in acquiring unusually high profits and in transfering it to its foreign shareholders (Simai 1995). This power may also involve the negotiation of more than favourable conditions, for instance through the protection of their goods produced in the CEECs (EBRD 1994, Simai 1995). Large foreign companies have also been able to crowd out local competitors, for instance in the foodstuff industry in Estonia (Borsos 1994) and in some Hungarian industries (Nachum 1996).

The employment-creation effects of FDI, apart from those stemming from greenfield investments, have been overshadowed by employment-reduction effects related to the modernisation of privatized state companies in the majority of transition countries. However, some studies show that foreign investors have been able to increase productivity and re-establish profitability in these companies more efficiently than domestic investors (see UN 1995; World Bank 1996). Furthermore, foreign investors have invested heavily in technical and management training for their labour force in transition economies, including local suppliers, and foreign firms have also tended to export a larger share of their output than domestically-owned firms in transition economies (Borsos 1994, Borsos and Erkkilä 1995a, UN 1995, OECD 1995, Stankovsky 1995).

Finally, the level of existing FDI seems to play an important role in attracting long-term investments and additional investments. Some degree of FDI 'clustering' can be identified in Hungary and Estonia, for instance, reflecting the credibility of transition policies in these economies.

3. FDI IN ESTONIA

According to national balance of payments data, the net flow of FDI into the transition economies reached a record $10.7 billion in 1995, compared to only $4.3 billion in 1994, while cumulative FDI inflows reached $30 billion in 1995. Privatizations in several countries in the last months of 1995 increased considerably the full year total and the differences between the CEECs, Russia and the CIS as FDI host countries accentuated. The bulk of increase was, again, centralised in two countries, i.e. Hungary and the Czech Republic with an inflow of $4.5 billion and $2.5 billion in

1995, respectively. More than three quarters of the total cumulative inflows have been invested in Eastern Europe[2] and over one third in Hungary alone.

Within the Baltic Rim, Poland experienced a doubling of its FDI inflows, Russia received total inflows of $1.4 billion, which was however overshadowed by continuous capital flights and increasing investments abroad. Flows into Estonia and Latvia declined, and the share of Lithuania remains modest. The latter may be due to a marked difference in statistical methods. Estonia belongs to the few transition countries (Hungary, the Czech Republic, Latvia, Moldova and Albania) having attracted FDIs around 5 per cent of GDP or more, which is high by international standards, and particularly compared to the Nordic countries which have had significantly larger outward FDI flows than inward flows during the 1990s. Furthermore, Estonia outperforms all of the other Baltic Rim countries as well as the majority of other transition countries (except Hungary and the Czech Republic) in FDI per capita terms. However, the ratio of operational to registered FDI projects is very low both in Estonia and the two other Baltics, where the share of unoperating registered firms is estimated to vary between 30 to 50 per cent.

Table 1. Net Foreign direct Investment Flows into Selected Transition Economies, 1990-1995 (Millions of dollars)

	1990	1991	1992	1993	1994	1995	FDI flow per capita 1995	FDI flow/GDP 1995, %	FDI stock per capita 1995
Baltic Rim:									
Estonia			58	160	225	205	138	8.8	420
Latvia			43	49	279	216	87	6.3	227
Lithuania			8	31	31	41	11	1.0	30
Poland	10	117	284	580	542	1134	29	1.2	71
Russia	-400	-100	-112	682	256	920	6	0.3	35
Others:									
Czech Rep.	120	511	947	517*	842*	2500	242	6.9	569
Hungary	311	1459	1471	2328	1097	4410	431	10.7	1107
Slovakia	18	82	100	134*	170*	180	34	1.4	132

** Excluding flows between the Czech Republic and Slovakia. The Czech Republic reported a net inflow of $577 million and a net outflow of $93 million with Slovakia in 1993 and 1994, respectively.*
Source: ECE 1996.

The FDI/value added ratios in table 2 (ECE 1996) show the relative importance of FDI related to the size of the Estonian economy, where FDI penetration is considerable (22.8). Estonia comes second after Hungary (26..3, respectively), followed by Latvia (12.8), Slovenia (12.0), and the Czech Republic (10.5). Following the same pattern throughout the 1990s, industry and particularly engineering, chemicals and food processing have attracted the majority of FDI inflows in Estonia and other 'FDI pioneering' countries such as Hungary and Poland, while the share of services is relatively high in 'FDI latecomer' countries, such as Latvia, Romania, Slovakia (the Czech Republic having attracted the most important industrial FDIs).

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[2] Albania, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia, the FYR of Macedonia.

This may be due to regional strategies of large MNCs establishing their manufacturing operations in one location, wherefrom operations other than manufacturing are governed in transition countries penetrated thereafter. Large direct investments in services or low-technology industries also reflect the uncertain business conditions, as these investments can be withdrawn quickly and capital is not tied up. Such business conditions prevent the optimal allocation of FDIs and it may thus have significant long-term effects, as a country's economy may follow a growth path marked by undeveloped technology and low capital. High FDI penetration in the currently competitive sectors in Estonia reflects the fact that the economy is relatively well endowed with capital of superior quality, which are important potential sources of future growth due to the implied embodied productivity gains.

Table 2. Sectoral breakdown of FDI stocks/value added ratios of selected industries in the transition economies of the Baltic Rim, January 1995.

	Industry					
	Food processing	Chemicals	Metals	Engineering	Light industry	Total, % share of all FDIs
	Sectoral breakdown of FDI					
Estonia	8.7	27.9	0.8	2.5	2.1	52.2
Latvia	11.9	1.0	0.9	3.3	2.7	24.9
Poland	18.3	10.0	4.0	6.8	2.7	64.1
Russia	2.6	19.3	2.3	24.1	1.3	65.5
	FDI/ Value added ratios					
Estonia	13.8	217.5	17.5	16.5	12.8	31.1
Latvia	14.9	4.4	8.9	8.1	10.9	9.4
Poland	7.9	10.4	5.5	6.7	3.6	6.1
Russia	0.7	9.6	0.4	4.2	0.9	2.3
	Others, (continued)					
	Construction	Transport and communications	Services	Total		
	Sectoral breakdown of FDI					
Estonia	0.5	9.9	36.3	100.0		
Latvia	1.4	31.6	41.3	100.0		
Poland	3.3	4.1	28.2	100.0		
Russia	8.5	3.2	28.8	100.0		
	FDI/ Value added ratios					
Estonia	1.3	14.0	23.0	22.8		
Latvia	2.2	14.8	17.2	12.8		
Poland	1.8	2.1	3.5	4.5		
Russia	0.9	0.4	1.1	1.4		

Source: ECE 1996..

Even though EIU predictions (March 1996) suggest a sustained FDI flow of about $20 billion a year in the period 1996-2000 for European transition economies, Estonia and its two Baltic neighbours are expected to experience a lower FDI growth during that five-year-period than other transition economies. Germany, in turn, will increase its role as the main investor and trader in the

region[3]. In contrast, and following the above described pattern, the role of Swedish and Finnish firms as major investors and traders would seem to decrease in the three Baltics, particularly in Estonia, and increase elsewhere in the Eastern Baltic Rim. However, Denmark, Finland and Norway are not likely to become major investors in Russia and Poland, where other foreign investors already play a more important role.

It seems that Estonia can obtain significant amounts of FDIs by following a deliberate export-oriented strategy (Hernesniemi 1996), as the country is a very small and open economy. In the longer-run, particularly Estonia might compete for the same inward FDIs than the Western Baltic Rim countries, as Estonia has already now upgraded some of its industries toward higher technology production (as seen in the increased intraindustry trade) and the general business environment is relatively normal by Western standards. Furthermore, production costs are increasing at a rapid pace.

Nevertheless, though the data on FDI is incomplete and inaccurate, the tendency which emerges is one of rapid inward FDI growth since the re-independence of Estonia (see Borsos 1994). Small and medium sized foreign firms seem to be more active investors than large firms with the exception of Swedish MNCs and a few well known global firms (such as Coca-Cola Co.). The major foreign investor countries in Estonia are Finland, Sweden, Russia and Germany, as the adjacent table indicates. As of January 1996, there were some 8800 fully or partly foreign owned firms registered in Estonia, half of which are considered as operative. The number of firms with foreign capital in newly established firms has decreased slightly, but the value of investments has increased.

Table 3 Major Foreign Investors in Estonia

Home country	Foreign investment in new firms		Total foreign investment		
	Invested capital, millions of EEK 1994	Number of firms 1994	Share of total number of foreign firms, % 1.1.1995	Share of invested capital, % 1.1.1995	Share of invested capital, % 1.1.1996
Finland	118	924	52	22	22
Sweden	101	173	11	28	20
Russia	308	135	13	12	10
USA	66	96	4	7	8
Ireland	238	15			7
United Kingdom					6
Germany	47	106	4	4	
Egypt	273	1			
Form.Yugoslavia	210	1			
Others	121	252	16	27	27
Total	1482	1749	100	100	100

Source: Berg et al. 1996.

[3]Ibid.

All in all, foreign firms make up 16 per cent of all industrial firms, which is already high by international standards. As a contrast, only 5 per cent of Estonian owned firms operate in the industrial sectors, while the share of services has increased sharply. The latter is dominated by newly established firms. Nearly 50 per cent of all investments into industry originate from foreign investors (see table 4). These investments are allocated mainly to the chemical industry, the foodstuff industry and machinery manufacturing industries.

These figures reveal that the role of state-owned firms is still significant, representing one third of industrial output, while the service sector is mainly in the hands of private firms. In terms of technological capacities, this dynamic evolution of the service sector would show significant potential, as these are mostly domestic firms established by personnel flowing out of the state-owned firms. These firms are small, but some of them are already very R&D intensive, with highly educated personnel and 'promising' emerging absorptive capacities (i.e. the ability of firms to adopt and use foreign technology) may arise from this dynamism (see Paasi 1996, 11).

Table 4. Foreign Investment in Newly Established Firms in Estonia by Economic Sector, 1994 and 1996

Sector	Foreign investment in new firms, 1994			Foreign investment in fixed Assets, % 1.1.1996
	Number of firms	Invested capital		
		Millions of EEK	%	
Manufacturing	283	731	49	50
Wholesale and retail trade	958	593	40	24
Finance	22	69	5	5
Transport, logistics and communication	98	30	2	12
Real estate, rent and business services	199	32	2	4
Hotels and restaurants	46	9	1	2
Agriculture and forestry	32	5	0	0
Other	111	13	1	3
Total	1749	1482	100	100

Source: Estonian Ministry of Economic Affairs 1995 and Foreign Investment Agency.

Estonia is considered as the one country in the whole Baltic Rim providing the most favourable investment climate, which is reflected in the previously presented overall FDI figures as well. Survey-based studies and multiple case studies have confirmed this, and the only negative determinant seems to arise from the smallness of the domestic market and increasing criminal activities (Piispanen 1996). Legislative changes are further considered as slow, but otherwise Estonia crowds out all the other Baltic Rim transition countries in every parameter (i.e. infrastructure, political stability, legislation, education of the labour force, international economic position, etc. See Piispanen 1996). In this respect, the prerequisites for providing an adequate

socio-economic and material as well as non-material (including, e.g., a stable functional political system and skilled labour) environment for FDI seem to be the most adequate ones in Estonia, as compared to other transition economies of the Baltic Rim[4] (see Borsos-Torstila 1996, for an overview on the institutional basis of FDI in Estonia).

4. TECHNOLOGICAL CAPACITIES IN ESTONIA

The transition economies have inherited an over- and misindustrialised structure, in which the techniques of management of production, finance, sales and R&D activities are largely unsuited to the demands of market economies (Eatwell et al. 1995). A major concern arises from the current situation; namely, the uncertainty related to the 'destiny' of technological capacities in the conditions of a radically changed macroeconomic environment (see Eliasson 1991, Radosevic 1993). Tombak (1996, 32) stresses the need to develop further existing human capital and prevent it from eroding in Estonia. Several studies on the nature of transition and the necessary changes underline the same prerequisites: the need to replace unviable capabilities, adapt and upgrade viable productive capacities, to acquire new skills in management and the labour force and to develop a framework in which commercial R&D activities can succeed (Radosevic 1993, Berg et al. 1996, World Bank 1996).

It is now clear that the inherited innovation system has major deficiencies in terms of supporting a market economy (see, e.g., Radosevic 1993, Schneider 1994, Berg et al. 1996, World Bank 1996). Moreover, it seems that accumulating knowledge has been prioritised over applying it. According to Radosevic (1993), the potential of innovative activities decreased considerably already during the 1980s in Eastern Europe, followed by a sharp decline in the 1990s, despite heavy R&D investments and the relatively high social absorptive capacity of these economies. McKinnon (1991) finds the cause of this trend in a lack of market incentives, due to which intangible investments and large physical investments were mismatched.

Kilvits et al. (1992) found the same tendency in Estonia throughout the 1970s to the early 1990s. According to them, productive fixed assets in the Estonian industry depreciated considerably during that period and accelerated towards the end of the 1980s and early 1990s. In the latter half of the 1980s, this decrease was about 47 per cent and 52 per cent in 1990. Replacement of fixed assets was almost inexistent and, as a result, this study indicated that a quarter of the machinery and equipment needed immediate replacement. Outdated production technology also led to a mismatching of the labour force's skills, as over a third of the workers were involved in primitive and hard manual labour. Furthermore, productivity turned out to be modest. Production further fell drastically in the early 1990s, followed by a structural crisis in 1992. This was partly due to a shortage of raw materials and partly due to divestments.

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[4]The Visegrad countries are significantly more advanced and can be considered as almost having reached the Western level of investment climate. Estonia as a market is compared to other Baltics and Russia, due to the fact that firms investing in that region clearly have different commercial objectives and market orientations than those based in the Visegrad region. Thus, Estonia is not competing for totally similar FDIs than the Visegrad countries.

Table 5 Structure of Estonian Industrial Output, percentage shares

Industry	1991	1992	1993	1994
Energy production	10	11	11	12.9
Mining	2.9	4.3	4.3	5.7
Food industry	27	30.9	32.7	35.7
Light industries	18.9	17	9.5	10.4
Forestry	9.7	9.3	5.7	7.4
Chemical industry	11.8	8.7	6.9	10.1
Building materials industry	4.6	3.9	2.7	4.3
Engineering and metal industry	11.5	9.7	6.6	4.3
Other	3.6	5.2	6.6	11

Source: Estonian Ministry of Economic Affairs 1995, 'The Estonian Economy 1994-1995'.

Since 1992, insufficient domestic and international demand has been a major cause to the fall in production. (Hyvärinen and Borsos 1994) Thus, the Estonian industry has experienced major structural changes and restructuring is still ongoing. Increases in the share of the foodstuff, light and chemical industries in total output are due to large inflows of FDIs (see table 5).

As to the current technological level of the Estonian industry, Berg et al. (1996, 51) report low research intensity as measured by value added for total manufacturing in 1994, the figure being only 0.68 per cent (while the corresponding figure for Finland is 5.6 per cent). The same indicator measured by gross output results in an equally modest figure, i.e. 0.24 per cent (for Finland 1.95 per cent, respectively). Industry-wide data on current R&D expenditures are not available. However, Berg et al. (1996, 51) underline the currently experienced fast development in this area, i.e. an important (presently unmeasurable) amount of embodied technology has recently been and is being taken into use. Increased import of technology and foreign investments reflect this tendency.

The electronics industry is seen as developing most rapidly in this respect, which can be seen in the increased amount of new firms established in the field, increasing FDIs and the increased number of industrial robots in electronics. In addition, the use of new technology is greatest in the foodstuff industry, the building materials industry, motor vehicles and other transport equipment, wood, paper and paper products, rubber and plastic products (Berg et al. 1996).

Major deficiencies are to be found at the firm level, as firms did not play any central role in the former centrally-planned production system, including the R&D system, and foreign firms were not allowed to enter these markets until 1987 (when it was allowed only through minority joint ventures). Normal networks, including backward and forward linkages, as well as technology transfers from abroad were non-existent and all activities/functions in general were isolated from each other in the former USSR (see Borsos 1994, and Schneider 1995 for a description of the innovation system in the former USSR). Thus, this general pattern was also replicated in the science and technology sector, where production and research were isolated from each other, i.e. R&D was mostly externalised and results were not exploited in production (Schneider 1995). International cooperation both in research and production was lacking. Therefore, since the re-

independence of Estonia, firms have been forced to start from 'scratch' in establishing international networks. Fortunately, this task seems to have been easy due to historical, cultural and previous economic ties with the Nordic countries.

Estonia is well-endowed with human capital, particularly with technological knowledge (Berg et al. 1996). However, the efficient exploitation of this potential is still partial, as firm-specific training is not very common (except in foreign-owned firms), R&D activities of firms are modest (Berg et al. 1996, Paasi 1996), and the inhereted R&D system is rapidly eroding due to a lack of capital (World Bank 1996). Most strikingly, Radosevic (1995) finds that the restructuring of industrial R&D capacities has been totally neglected as an element of industrial restructuring in the Baltic States.

Due to the perceived rapid increase in wages and other production costs (particularly the price of energy), and the appreciation of the Kroon (which in turn affects crucial export activities) a rapid shift towards higher technology production seems to be necessary, as Estonia will not be able to compete with low production costs in the medium term. This renders the urge to liquidate unviable capacities, upgrade viable ones and to encourage transfer of technology as well as in-house R&D, even more topical. In this task, the active role of the state in replacing, creating and upgrading both human and material productive capacities has been underlined, in contrast to the experienced 'hands-off' policy prevailing soon after the re-opening up of Estonia and other Central and Eastern European economies (see Åbel and Bonin 1993, Hyvärinen and Borsos 1994).

5. FDI AND TECHNOLOGY TRANSFER IN FOREIGN OWNED FIRMS IN ESTONIA

5.1 Questionnaire Development

Questionnaire development for this study proceeded in several steps[5]: Firstly, the literature on technology transfer through FDI was reviewed in order to gather the most relevant elements to be analysed. Both wholly-owned and partly-owned foreign firms in Estonia were considered, hereafter referred as to foreign-owned firms. A distinction was made between foreign firms established through the privatization scheme and new foreign owned firms (greenfield investment with a partner or without). Secondly, a major emphasis on the clarity of concepts was made in order to consider a possibly differing business culture or language in Estonia, as the majority of the respondents were expected to be native Estonians. The questionnaire was therefore reviewed by experts at the Estonian Institute for Future Studies. Major modifications were subsequently made based on their comments

[5] The questionnaire for the whole investigation was developed by Julianna Borsos-Torstila at ETLA / Finland and Marianne Paasi at IWH / Germany. This section deals only with this study on foreign-owned firms. The questionnaire for the whole investigation was designed to provide information specifically on absorptive capacities in Estonian firms based on the literature on absorptive capacities (see paasi 1996b). Questions concerning foreign-owned firms coincide with the FDI and technology transfer literature, on which this study is based.

Thirdly, the questionnaire was translated and tested by undertaking a pilot interview following the survey questions in two of the randomly selected firms. The interviewers were chosen by the EIFS and were Estonian nationals, who were trained for undertaking this task. It was later decided to undertake the whole survey by interviewing in the sample companies, as non-response rates are known to be high in Estonia. Furthermore, the postal services were also considered as not reliable enough a channel to undertake the survey. This solution increased the probability that firms would not refuse from participating in the survey and that the concepts and questions were fully understood by respondents. Furthermore, another major problem was related to the high amount of 'shelf' companies or unoperating, but registered companies. The task of the interwievers was to contact the selected firms in the first place and to obtain information on the current status of the firm, in order to verify the existense of the firm and to establish the first contact. The questionnaire is shown in appendix 1.

5.2 The Sample and Firm Characteristics

Two factors determined the sample selection: Firstly, due to financial constraints, 20 firms were initially to be selected in each industry, and secondly, all of the firms had to situate in the capital region, i.e. Tallinn, due to the previously cited difficulties in collecting the data. However, in the case of foreign owned firms, nearly 80 per cent of firms are situated in Tallinn. Furthermore, in order to increase precision of the sample, stratification was used (Moser and Kalton 1996, 85). Thus, the population, i.e. the data received from the Estonian Enterprise Register (EER), was first divided into three categories according to the ownership arrangement of firms in each industry: (1) state owned firms, (2) private firms, and (3) foreign-owned firms. In addition to the ownership parameter, the size of the firms (as measured by the number of employees)[6] was taken into account in order to cover both small, medium-sized and large firms. The sample size was then allocated between these determinants (strata) by proportionate allocation, and the 20 firms in each industry sector were randomly selected for the investigation.

In those cases, where companies were not operational, or turned out not to operate in any of the three sectors, or refused to participate in the survey, firms were replaced by other similar firms. This was a major problem in the group of foreign-owned firms. Therefore, in this phase, quota sampling was used, due to the small amount of remaining potential firms, i.e. the final selection within strata was non-random in the group of foreign owned firms in the three industries, but corresponded to the same characteristics (see Moser and Kalton 1996, 127). As a result, 5 firms were altogether replaced. Table 6 shows the final amount of firms in the whole investigation by sector and type of firm. The firms included in this study are shown in italic. Tables 7 and 8 present the final list of sample firms in the category of foreign owned firms, including key indicators and data.[7]

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[6]The information on firm-specific ownership arrangements and the number of employees was provided by the EER. The number of employees as a measure of firm size was used due to the lack of information on turnovers.

[7]See forthcoming reports by Paasi in ETLA DP series for the sampling frames in each branch. Sampling for the foodstuff sector was made by Borsos-Torstila and the two other sectors were sampled by Paasi.

Table 6 **Sample Firms by Sector and Type of Firm** (based on 1995 data)

Type of Firm	Foodstuff industry	Electronics industry	Services, tech.-intens.	Total no. of firms	Employment average	Variance, Smallest	Largest
State-owned	1	1	1	3	689	120	1708
Privatised	2	2	0	4	483	172	1100
New Estonian	2	8	8	18	171*	1	45
Privatised foreign	*3*	*0*	*0*	*3*	*334***	*150*	*651*
New foreign	*4*	*4*	*9*	*17*	*84****	*4*	*828*
Total	12	15	18	45			

Firms included in this study in italic.

**Contractual workers used; in addition to this number, 40 persons and one firm's whole personnel are contractual. The average difference is 1,1. **Average difference 213 caused by the use of contractual workers. ***No. of average contractual workers is 4 persons / firm; average difference is 4 workers.*

The above table reflects the low share of privatised firms in the initial database of the EER. Foreign investors have not been attracted by existing assets, and the foodstuff industry has attracted the major bulk of FDIs within the privatisation scheme. The reasons to the latter lie firstly in the large market shares of the already established Estonian foodstuff firms (previously state-owned), the low technology involved in this type of production and the need by foreign investors, mainly Nordic investors, to secure their home markets by buying out potential competitors (see Borsos 1994). The needed capital is low[8], but the major contribution of the foreign investor consists of bringing tighter quality control and operational management techniques. These technological problems are easy to solve, as foreign investors can directly transfer their tangible and intangible knowledge from the mother firm.

The share of electronics in the EER database is relatively high for similar reasons, i.e. the needed technology is not that capital-intensive and R&D assets should be easy to transfer as well. The availability of well educated Estonian personnel in this sector may have attracted foreign investors, though it has been underlined not to be a major determinant (see Piispanen 1996). The major contribution of the foreign investor lies in the provided access to foreign markets and new links with users. All in all, these foreign investment characteristics indicate that a relatively cautious investment pattern has taken place in the manufacturing sector in Estonia, as investments have mainly been made in the non-capital intensive sectors with a relatively low R&D level. This is normal in the early phases of transition, following an investment development path closely connected to economic advance.

[8] Unless the production machinery is very outdated. Finnish investors in the foodstuff industry have imported machinery that would otherwise have been unused in Finland due to either its replacement with newer machinery or due to an excess of it as a result of divestment and the like (Based on interviews made for a previous study; see Borsos 1994).

Table 7 Sample of Foreign Owned Firms and Key Indicators (1995)

Foreign, privatised						
Code	**Branch**	**Year of privat./ establ.**	**Foreign ownership, %**	**Home country**	**Turnover millions of EEK**	**Produced products**
1	Foodstuff	1995	100	Afganistan	135	Milk products
2	Foodstuff	1993	100	75 % Finnish 25 % Swedish	170	Bakery products
3	Foodstuff	1995	75	Scandinavian	320	Beer, miner. water
Foreign, new firms						
4	Electronics	1993	70	Sweden	2,6	Manufacturing of elec.
5	Electronics	1994	50	Finland	15	Personal computers
6	Electronics	1992	100	Finland	288	Manufacturing of elec.
7	Electronics	1991	9	Sweden	4,2	Printed circuit boards
8	Foodstuff	1994	50	na.	4	Bakeries, confectionary
9	Foodstuff	1991	70	Finland	70	Alcoholic beverages
10	Foodstuff	1993	50	Germany	1,3	Bakeries, confectionary
11	Foodstuff	1992	>50	United states	259	Soft drinks
12	Services	1993	80	United States	15	Advertising
13	Services	1992	3	Finland	2,7	Audiovisual programs
14	Services	1991	15	Finland	4,2	Programming, pc hard- &software maintenance
15	Services	1992	60	Sweden	0,9	Production and mediation of computer networks, training
16	Services	1989	51	Finland	80	Planning and construction of buildings
17	Services	1993	100	Sweden	0,5	Information services
18	Services	1990	55	Finland	5,5	Technology consulting
19	Services	1993	51	Finland	1,4	Building technology knowledge
20	Services	1989	50	Finland	4,8	Geodesy technology services

na. = not available

Table 7 reflects the relatively important role of Finnish and Swedish investors in Estonia. Partnerships are more common among small firms than large firms, as measured by the number of employees and turnover (see table 8). The larger the foreign investment, the more significant the unit is in terms of controlling production, quality and marketing. For instance, the largest electronics firms of the sample are heavily export-oriented (as will later be indicated), which in turn makes control over production and quality a necessity in order to meet the parent firms' standards. This factor is crucial, as all of the electronics firms are mainly undertaking subcontracting work for their parent companies. Within the foodstuff industry, the beverages

production is export-oriented, entailing that production, quality and marketing factors have to meet international standards. Similarly, control by the foreign investor is more crucial. Typically, technology-intensive services firms are partnerships, which can be explained by the central role of local personal networks in succeeding within consulting-type of activities.

Table 8 Employment and Profitability in the Sample of Foreign Owned Firms (1995)

Foreign, privatised						
Code	**Branch**	**Year of privat./establ.**	**Foreign ownership, %**	**No. of employees**	**Turnover, millions of EEK**	**Profitable since**
1	Foodstuff	1995	100	150	135	1995
2	Foodstuff	1993	100	651*	170	1993
3	Foodstuff	1995	75	200	320	1995
Foreign, new firms						
4	Electronics	1993	70	35*	2.6	1994
5	Electronics	1994	50	12*	15	Not profitable yet
6	Electronics	1992	100	828	288	1992
7	Electronics	1991	9	27*	4.2	1993, =>negat.
8	Foodstuff	1994	50	27	4	Not profitable yet
9	Foodstuff	1991	70	51	70	1991
10	Foodstuff	1993	50	9	1.3	1993, 1995=>negat.
11	Foodstuff	1992	>50	269	259	Not profitable yet
12	Services	1993	80	16	15	1994
13	Services	1992	3	35	2.7	Not profitable yet
14	Services	1991	15	16	4.2	1991
15	Services	1992	60	4	0.9	Not profitable yet
16	Services	1989	51	26*	80	1992
17	Services	1993	100	5	0.5	Not profitable yet
18	Services	1990	55	30	5.5	1994
19	Services	1993	51	11	1.4	Not profitable yet
20	Services	1989	50	25	4.8	na.

**These firms use contractual workers. In Firms No. 2 and 16 the difference is sigificant,depending on projects or seasons, and varies between about less than 300 to 600 contractual workers. In the rest of the firms, the figure varies between 20-30 workers, except for firm No. 5, where less than 10 contractual workers are employed.*

Larger foreign owned firms differ in another dimension as well, i.e. they are more profitable than smaller ones, with the exception of firm No. 11. Surprisingly, all of the privatised firms have been

profitable since establishment. According to the Estonian privatisation scheme, none of the firms were restructured before the sale of these units, meaning that the aquired firms were already 'promising' investment targets. In fact, several studies have indicated that foreign investors do not invest in non-healthy privatised firms, and they are not in general attracted towards the acquisition of former state-owned firms (Piispanen 1996, Estrin and Meyer 1996). The turnovers of electronics firms would be expected to be higher, but as all of these companies are mainly manufacturing for their parent firms, transfer pricing and other intrafirm policies affect the turnover of the foreign units located in Estonia.

As to profitability in general, one must note that transition economies-based foreign units are not expected to be profitable during the first 5 to even 10 years of operation (see Borsos 1994). However, these firms have all achieved a relatively good position in terms of profitability, as more than half of them report profitable operations (or at least profitable at some stage of operation) and 7* out of 20 firms report profitable operations since establishment. All of these 7 firms are majority owned by foreign investors (3 of them being wholly owned by foreign investors). Other studies comparing profitability and productivity between foreign-owned and wholly Estonian owned firms suggest that foreign owned firms outperform indigenous Estonian firms in these terms (see ECE 1995 and UN 1995). Unfortunately, we are not able to make a comparison between the two types of firms here, as the other part of the investigation has not been finished yet[9]. We will now look at the role of foreign investors as tranferers of technology.

5.3 Foreign Investors as Restructurers of Productive Capacities

Foreign investors hold a central role in providing R&D services, new production facilities, new physical capital, financing of personnel training and connections to foreign R&D sources to their Estonian affiliates (see table 9). In contrast, the number of foreign personnel was very low in all of the sample firms and if any, they were all part of the management personnel. One of the three foreign-owned privatised firms did not have any R&D department nor other R&D activities before privatisation, which were then established by the foreign investor. This involved heavy investments of 5 million EEK in development costs in 1995 and another 8 million EEK were planned for the current year. These investments were mainly channeled to the upgrading of existing products, the production and development of totally new products, and to the total restructuring of production facilities and methods. The two other privatised firms were also provided totally new production facilities by their foreign owners, but R&D activities remained similar to the ones prior to privatisation. It seems that previous innovative activities satisfy foreign investors in these two firms, as R&D activities are reported to be similar currently and major developments are being made in order to manufacture new products and brands. Thus, major changes have merely concerned the restructuring of production facilities and increasing productivity.

As the adjacent table indicates, foreign investors are major restructurers of production capacities in privatised firms and providers of Western production technology in all of the foreign owned

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* One firm reports losses for 1995.

[9] See forthcoming Discussion Papers by Paasi in ETLA and IWH series.

firms. In some firms, some of the new physical capital has even been acquired from Eastern Europe. The latter consists of basic machinery.

Table 9 Share of Foreign Owners in Provision of New Production Facilities (NPF) and Origin of Physical Capital[10]

	NPF, %*	Origin of physical capital, %			
		Western Europe	Eastern Europe	United States	Asia
Privatised firms					
Foodstuff	100	100	--	--	--
New firms					
Electronics	100	80	--	20	--
Foodstuff	75	40	10	50	--
Services	78	56	25	--	19

**Provided partly or totally by the foreign investor.*

As table 10 shows, foreign sources of R&D assets are significant in the foodstuff industry and in those technology-intensive services firms where external R&D assets are acquired. The privatised firms are most actively seeking other than parent firm R&D sources abroad, which should enhance not only significant upgrading of absorptive capacities, but also relatively rapid restructuring of production capacities and increasing competitiveness. R&D activities are closely connected to the knowledge of the work force in the technology-intensive services group of firms, therefore externally acquired R&D assets are usually lower than in manufacturing industries and local intangible assets are strategically more important than externally acquired ones for these firms. However, international cooperation and technological information flows are also crucial, in order to absorb modern and up-to-date knowledge. The figures for electronics firms well reflect the overwhelming role of parent firms, who are the primary customers and users of their products.

Table 10 R&D Bought from External Sources in the Sample Firms

Foreign, privatised firms n=3							
		Average number of R&D sources					
	External R&D, %	**Scientific institutions domestic**	**foreign**	**Firms Estonian**	**Parent**	**Other foreign**	**Since**
Foodstuff	67 %	--	--	1 or more	2	5	1993
Foreign, new firms		n=17					
Electronics	50 %	--	--	1	1	--	1994
Foodstuff	25 %	--	1	1	1	2	1991
Services	33 %	1	1	2	2	1	1994

[10]Only a few firms announced the actual financial value of these investments, therefore they are not presented.

The minor role of Estonian institutions (including other public sources) is surprising, considering the otherwise relatively large share of government funds in financing R&D in Estonia, which amounted to about 80 per cent (government funds and institutions) in 1994 (see Martinson 1995, 37). Overall, considering the fact that most of these connections to foreign R&D sources are very recent, they are relatively intense by nature and show a strong absorption of Western innovative knowledge (see also table 9).

5.4 The Labour Force in Foreign Owned Firms

The number of personnel in privatised foreign-owned firms decreased relatively little, with only firm No. 3 laying off radically by 50 per cent. Even in this firm, this took place before the year of privatisation and not after the acquisition of the firm by foreign investors. The low lay off rates are probably due to the nature of acquisition agreements made with the Estonian Government, i.e. layoffs can be undertaken only gradually over a long period. Also, these acquisitions are very recent, therefore more significant personnel restructuring will take place in the longer run. The partial replacement of management personnel has been the major task in the first place in all of the privatised firms. Even though the R&D personnel constituted a small fraction of overall personnel prior privatisation, the nearly doubling of it is a sign of rapid R&D restructuring (see table 11).

Table 11 Personnel and R&D Personnel in Foreign Owned Privatised Firms

Number of personnel in 1989-1995 in foreign owned privatised firms				R&D personnel	
1989	1991	1993	1995	prior to privatisation	1995
1512	1414	1237	1001	6	12

Unfortunately, only one of the foreign owned privatised firms reported (poorly) its turnovers or sales during the period of state ownership, which does not allow for an analysis of productivity development under new ownership.

Currently, only one privatised firm employs a foreign R&D expert and firm No. 3 employs 27 foreign managers. The other two firms report only one foreign employee at the management level each. The pattern among foreign owned new firms is similar, i.e. the number of foreign employees is very low with only 4 firms reporting altogether 11 foreign employees mainly in their management personnel, whith 3 of them in R&D or experts positions. Some of the workers are ethnically Russian (10 per cent in one firm), but more detailed figures are not available. The relatively minor role of foreign permanent personnel signifies that training plays a central role in the transfer of marketing, management and product knowledge. In fact, the role of the foreign owners and foreign organisations in financing and organising training is central, as the following table indicates. Privatised firms received the major bulk of international support from multilateral organisations such as the EU Commission's PHARE and Tempus programs and support from the Estonian as well as foreign governments (Finnish and French, not in the table). All of the firms further record active international cooperation, particularly in the electronics sector (75 per cent) and within the foodstuff industry the privatised firms are as well more active than on average (66

per cent). This cooperation takes place mainly in the scheme of international seminars, fairs and technical cooperation projects particularly with Finnish and German partners.

Table 12 Financing and Organisation of Training for Personnel in the Sample Firms
(Note: Each statement in each column is separate! the percentage shares show how many of the firms have answered positively)

		Additional financing from / training by:		
Financing of training by:	**The firm itself**	**Estonian organisation**	**International organisation**	**Foreign owner**
Privatised firms				
Foodstuff industry	100 %	33 %	33 %*	67 %
New foreign firms				
Electronics	75 %	--	25 %	50 %
Foodstuff	100 %	--	--	25 %
Services	100 %	--	13 %	13 %
Training organised by:	**The firm itself**	**Estonian organisation**	**International organisation**	**Foreign owner**
Privatised firms				
Foodstuff industry	100 %	33 %**	100 %	67 %
New foreign firms				
Electronics	75 %	25 %	25 %	75 %
Foodstuff	75 %	25 %	25 %	50 %
Services	100 %	25 %	50 %	25 %

** EU PHARE and Tempus programs. **Estonian Chamber of Commerce*

5.5 New Trade Linkages and Potential External Sources of Knowhow

Only one firm in the electronics sector (firm No. 5) reports imports (in intermediate products) from the parent firm (95 per cent of turnover), while exports to parent firms are a rule in all of the electronics firms (one of which exports all of its production to its parent firm, i.e. firm No. 6). This reflects the role of the affiliates which are merely producing intermediate products for their parent firms or for other affiliates of their parent firms abroad (see table 13). Imports from the West are minimal in new foreign owned firms, ranging from 10 to 20 percent of turnover with the exception of one electronics firm (40 per cent) and one service firm (72 per cent, consists of PC hard and software).[11] In privatised firms, the share of imports relative to turnover is only some 2 per cent and consisting of mainly ingredients. The high export share of privatised firms is surprising due to the nature of products, but the majority of it consists of exports by firm No. 3, which produces beverages.

The strong orientation of trade towards the West reveals the rapid development of new international links and the radical vanishment of previous customers (see also table 14). New forward and backward linkages are developing also in the domestic economy, as many of the electronics firms use domestic services in their backward activities, the foodstuff firms typically are dependent on certain backward and forward services and spillover effects emerge from technology

[11] Imports were poorly reported, therefore these data should be considered as indicative approximations.

intensive services firms as they use a large amount of contractual experts. Table 12 further showed that there is demand for domestic services in the organisation of training and education. This would indicate that local knowledge is developing rapidly towards the needs of a market oriented service sector.

Table 13 Exports to the West (%-share of total exports), Parent Firm and Russia[12]

Exports to the West	**1992**	**1993**	**1994**	**1995**
Electronics	--	--	--	--
Foodstuff	--	100 %	100 %	100 %
Services	100 %	100 %	100 %	8 %*
Exports to parent firm	**1992**	**1993**	**1994**	**1995**
Electronics	--	100 %	99 %	86 %
Foodstuff	--	--	--	--
Services	--	--	--	--
Exports to Russia	**1992**	**1993**	**1994**	**1995**
Electronics	--	--	1 %	14 %
Foodstuff	--	--	--	--
Services	100 %	--	--	92 %#
Privatised firms* **	**1992**	**1993**	**1994**	**1995**
Exports to the West	--	--	--	79 %
Exports to Russia	--	100 %	100 %	21 %**

Volume of exports quadruppled in 1995. Volume of exports trippled in 1995.*No exports to parent firms.Firm No. 6 is excluded from these calculations, as detailed data was not provided. This firm exports its entire output to the parent firm. # These exports mainly consist of one Finnish owned firm's turnkey projects within the construction business in Russia.*

Table 14 Share of Exports (%) from Total Turnover in 1995

New foreign firms	Share of exports from total turnover
Electronics	19 %
Foodstuff	6,3 %
Services	46 %
Privatised firms	
Foodstuff	15 %

As table 14 reveals, these sample firms are heavily export-oriented, reflecting the smallness and openness of Estonian markets (with the exception of electronics firms that are mainly serving their parent firms and are clearly cost and efficiency oriented investments). Considering the very recently started transition process in Estonia, these firms have internationalised very rapidly, and could be considered as fairly competitive (recall that over half o fthem are already profitable, see table 8). Potential learning spillovers should be significant in the longer run, when internationalisation effects (including new links in international technical and educational cooperation, replacement of old production capacities and emergence of new production capacities in new foreign owned firms, and all other previously cited transfers of knowledge)

[12]Information on 1991 not reported at all.

should be stronger, providing thus upgrading for current technological capacities and a firm basis for the creation of new ones.

5.6 Innovative Activities in Foreign Owned Firms

The acquired privatised firms all had R&D departments, but they were small as measured by the number of R&D personnel (no other experts were reported either) and held no central role in the production as reflected by the non-existence of patents. Even though they all are foodstuff firms, which are not the most R&D intensive firms in the Western market economies either, these are poor indicators by international standards. Presumably, this sector was not even considered as one requiring R&D activities in the former socialist system, as none of these sample firms had any connections to external R&D institutions or R&D departments of other state firms.

Currently, the privatised firms undertake a significant amount of innovative activities compared to other foreign owned firms of the sample as measured by R&D personnel, number of patents and the ratio of average R&D expenditure to turnover (R&D intensity). R&D intensity is surprisingly high in the privatised foodstuff firms, which can be explained by heavy start up investments in order to restructure R&D capacities. R&D-intensity is not usually typical to the foodstuff industry. The R&D intensity level should normalise during the near future. Nevertheless, this indicates a long-term commitment and interest in the Baltic markets by foreign investors. Electronics firms should have higher R&D intensity, but as these affiliates are mostly serving their parent firms the most R&D intensive activities are centralised in the home countries of parent firms. This centralisation of knowledge-intensive activities further explains the absence of patents.

Table 15 Present R&D Activities, R&D Intensity, R&D, other Development and Training Costs (Average, millions of EEK)

	R&D depart-ment	R&D Personnel. average	Other experts. average	Number of patents	R&D intensit y	R&D expendi ture	Other develop-ment costs**	Training costs
Privatised foreign firms	100 %	4	--	5-7 certificates	16 %	100.3	17	0.85
New firms								
Electronics	100 %	0.5	3	--*	2 %	0.4	0.23	0.01
Foodstuff	50 %	0.5	2.5	--	0.02 %	0.06	0.02	--
Services	11 %	0.5	10*	--	0.09 %	0.14	0.39	0.19

*R&D intensity = R&D expenditures as % -share in turnover; Training intensity= training costs as % share of turnover. Due to status of foreign affiliates, possible patents are in the home country of parent firms. *One firm could not make the difference between R&D and other experts, therefore they are all included here (26 employees). The average is 6 without that firm.** Investment in physical capital, product improvement, etc.*

Note! These figures are only indicative, as the response rate related to questions concerning the four last columns varied between 30-50 per cent in the group of new firms.

6. CONCLUSIONS

New linkages brought by foreign owners (both in trade and R&D cooperation) and the provision of new production capacities (including training, new production technology, etc.) in foreign owned firms in Estonia form an important source of knowledge for the upgrading of technological capacities and for future innovative activities in Estonia. In the longer run, spillover effects particularly in the electronics sector should enhance this process. Restructuring has been significant in foreign owned privatised firms, both in terms of replaced production facilities and in terms of radical reorientation of exports. Surprisingly, all of the privatised firms in this sample are already profitable. Furthermore, profitability seems to correlate with the high degree of foreign ownership (majority ownership) in these sample firms. The current export performance of all of these firms indicates rapid expansion towards the West and a strong competitive position. The latter is also reflected in the profitability of these firms. The vast trading network should already now be an important source of learning.

As the preceeding analyses showed, some the technology-intensive firms seem to undertake a significant amount of R&D activities likewise - surprisingly - foodstuff (privatised) firms. Personnel in these firms seem to be able to adjust perfectly to the new demands set by a market-based economic system. The current R&D activities in new foreign owned firms, as a whole, are not very large, meaning that foreign investors are still developing their operations, which have started relatively recently in most cases, and some investors follow a typical R&D strategy. Namely, R&D activities are centralised in the parent firms (particularly in the electronics sector), except in the case of technology intensive services firms. Furthermore, the Estonian human capital can be considered as crucial, as the labour force at all educational levels is almost 100 per cent Estonian and training costs are after all rather low (as proportionated to turnover). This must reflect the existence of viable inherited knowledge. Hence, the (physical) production capacities seem to have been the main target of restructuring for foreign investors.

To sum up, foreign investors have played a major role in providing new production facilities and technology as well as in providing access to new Western markets and to new cooperation links in R&D activities. Technical, marketing and management training seems to have been modest in terms of invested training capital relative to turnover[13], while foreign investors and organisations have played a major role in providing that know-how. The personnel originates mainly from former state-owned firms in all of the firms, which neutralises the employment creation effect of these investments (which should have taken place, considering the high share of greenfield investments). Personnel reductions have taken place in foreign owned privatised firms, but not in any large extent. All in all, new backward and forward linkages are very intense both in Estonia and internationally in every terms, which should create a firm basis for future innovative activities through spillovers. The development of imitative abilities of other (totally indigenous) firms in the economy is central in this process.

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[13]The data is only tentative, as information on this was poorly reported.

The forecasted decrease during the following 5-year-period in overall FDI in Estonia is not problematic, if foreign investors move into higher technology production activities in Estonia. The latter future tendency is probable, as Estonia is rapidly shifting from the role of a low production cost country to higher levels of production costs due to the rapid macroeconomic adjustment process to a market based system. Therefore, the role of the state in supporting and upgrading continously the accumulation of human capital is central. A major medium term task will be to attract FDIs into not only the currently most competitive sectors in Estonia, but also to industrial sectors that have not previously attracted foreign investors i.e. more technology-intensive sectors.

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'An Empirical Analysis of the Absorptive Capacities of Estonian Firms in Selected Branches'

Questionnaire

Group No. 1: State-owned firms and privatized firms
Group No. 2: New firms, Estonian
Group No. 3: Privatized firms with foreign ownership (incl. 100 % owned)
Group No. 4: New firms with foreign ownership (incl. 100 % owned)

A - Background information on the firm

1. Year of Establishment: _____; year of privatization_____

2. Branch:_____

3. Products:_____

4. Turnover in 1995 (EEK):_____.

5. Sales of the company since 1985 (EEK):

	1985	1987	1989	1991	1995
Sales in EEK					
of which exports					

6. Since which year is your company profitable?_____.

7. Status of the firm: (a) State-Owned _____; (b) Privatized_____; (c) New firm_____.

8. Foreign ownership: share _____% and country of origin:_____.

9. Number of personnel in the firm:

	1989	1991	1993	1995
Total number of personnel, of which:				
Management -Estonian -Foreign				
Blue collar workers -Estonian -Foreign				
R&D personnel -Estonian -Foreign				
Other experts -Estonian -Foreign				

B. (Inherited Capacities), Company's situation before 1991:

10. Did the company have a research and development (R&D) department or other type of R&D activities before 1991?

Yes____ No____; if yes, type of activity_____

Size (number of personnel)_____

11. R&D expenditure in 1985-1991:

	1985	1986	1987	1988	1989	1991
In Estonian Krones/Rbls	____	____	____	____	____	____
Expenditure in training & education	____	____	____	____	____	____

12. Trade activities before 1991 (the West = EU and former EFTA countries):

Exports to the West, amount in EEK _____

Imports from the West, amount in EEK_____.

Exports to Comecon, amount in EEK _____

Imports from Comecon, amount in EEK_____.

13. Did the company undertake any other international cooperational forms?

If yes, which form: _____

14. Did the company have patents before 1991? If yes, name the patent (s), and give the number of patents:_____

_____

Were these patents registered in Estonia?_____or abroad____;

in which countries:_____.

15. Did the company have connections to

a. The military sector_____

b. Domestic R&D institutes_____ ; Which institutes?_____

c. Foreign R&D institutes_____; Which Institutes?_____

d. R&D departments or personnel of other firms_____

C. Company's situation after 1991

16. Restructuring: Does the company produce the same products as before 1991?

Yes____ No____.

If no, what are the changes: Quality improvements in old products ____

Totally new products ____

17. Are you using the same production methods? Yes___, No___

18. Have you made quality improvements in the old production facilities? Yes___, No___.

If production facilities are totally new, what are the origins of the new physical capital?

(Countries)_____.

Are they provided by the foreign owner?_____.

19. Total invested amount in the above development costs:(EEK): (questions 16-18)

1991	1992	1993	1994	1995

20. Share of foreign owner in these costs:

1991	1992	1993	1994	1995

21. Does the company have new management personnel? Yes___, No___. If yes,

Totally new____ or partly____? Since when?_____.

Present R&D activities

22. Does the company currently have R&D activities? Yes____ No____,

If yes, are they of the same kind as before 1991? Yes___, No___.

If no, are they totally new? Yes___, No___ or partly new? Yes___, No___.

Are these provided by the foreign owner? Yes___, No___. If yes, in which way?

_____

Group 3

R&D expenditures in 1991-1995:

	1991	1992	1993	1994	1995
In Estonian Krones	____	____	____	____	____
%-share of turnover	____	____	____	____	____
Expenditure in training & education of the personnel	____	____	____	____	____

23. Is the current R&D personnel the same as before 1991? Yes___, No___.

Are you still using the firm's former research connections(before 1991; see question 15)?

Yes___, No___; if yes, with whom?_____.

Current number and division of R&D personnel:

Number of old R&D personnel_____, number of new R&D personnel_____.

24. Does your company buy R&D services from external sources? Yes____, No____.

If yes, from which of the following:

	Number of external sources	since when, year	Payments, EEK 1991	1993	1995
1. Scientific research institutes and universities in Estonia					
2. Private firms in Estonia					
3. The foreign owner of the firm					
3. Other foreign firms					
4. Foreign research institutes and universities					

25. Trade with Western countries since 1991 (EU and former EFTA countries):

	1991	1992	1993	1994	1995
Exports to the West, amount in EEK	____	____	____	____	____
Imports from the West, amount in EEK	____	____	____	____	____
Exports to the mother firm	____	____	____	____	____
Imports from the mother firm	____	____	____	____	____
Trade with Russia: Exports to Russia	____	____	____	____	____
Imports from Russia	____	____	____	____	____

Group 3

26. Does the company undertake any other international cooperational forms?

    If yes, which form(s): _____

27. Does the company have patents? If yes, name the patent (s) and give the number of patents:_____

    _____

    Are these patents registered in Estonia_____or Abroad_____. In which countries: _____.

28. Does your company invest in training of personnel? If yes:

Financed by:	Organised by:
(a) The firm itself___	(a) The firm itself___
(b) A domestic organisation___	(b) A domestic organisation___
(c) An international organisation___	(c) An international organisation___
(d) The foreign owner____	(d) The foreign owner___

29. Does your company obtain any kind of support from:

    (a) The Estonian government____

    (b) A foreign organisation____

    (c) Others, such as development agencies, or the like____

'An Empirical Analysis of the Absorptive Capacities of Estonian Firms in Selected Branches'

Questionnaire

Group No. 1: State-owned firms and privatized firms
Group No. 2: New firms, Estonian
Group No. 3: Privatized firms with foreign ownership (incl. 100 % owned)
Group No. 4: New firms with foreign ownership (incl. 100 % owned)

A - Background information on the firm

1. Year of Establishment: _____

2. Branch:_____

3. Products:_____

4. Turnover in 1995 (EEK):_____.

5. Sales since establishment to 1995 (EEK):

(add years)				1991	1995
Sales in EEK					
of which exports					

6. Since which year is your company profitable?_____.

7. Status of the firm: (a) State-Owned ____; (b) Privatized____; (c) New firm____.

8. Foreign ownership: share____%; and country of origin_____.

9. Number of personnel:

	1990	1991	1992	1993	1994	1995
Total number of personnel, of which:						
Management -Estonian -Foreign						
Blue collar workers -Estonian - Foreign						
R&D personnel -Estonian -Foreign						
Other experts -Estonian -Foreign						

B. Company's situation since establishment:

10. Educational background of the founder:_____ (see classification above)

Does the Estonian partner belong to a former Estonian firm's R&D staff of a research institute or another firm (before establishment of the firm)?

Yes___, No___. If Yes, where?_____.

11. Does the company have an R&D department? Yes____ No____,

R&D expenditures in EKK, since establishment

1990	1991	1992	1993	1994	1995
____	____	____	____	____	____

% share of turnover:

____	____	____	____	____	____

Expenditures in training & education of the personnel:

1990	1991	1992	1993	1994	1995
____	____	____	____	____	____

12. Where does the Estonian R&D personnel come from?

a. Another Estonian firm___; b. The university___; or

c. An Estonian research institute____.

13. Development costs: Total invested amount in development costs:(EEK):

	1991	1992	1993	1994	1995
Quality improvements Share of foreign owner					

14. What are the origins of the firm's production methods?

(Countries)_____;

Are they provided by the foreign owner?_____.

15. What are the origins of the new physical capital?

(Countries)_____;

Is it provided by the foreign owner?_____.

Group 4

16. Does your company buy R&D services from external sources? Yes____, No____.

If yes, from which of the following:

	Number of external sources	Since when,year	Payments, EEK 1991	1993	1995
1. Scientific research institutes and universities					
2. Private firms					
3. Owner's mother company					
4. Other foreign firms					
5. Foreign research institutes and universities					

17. Trade with Western countries since 1991 (EU and former EFTA countries):

	1991	1992	1993	1994	1995
Exports to the West, amount in EEK	____	____	____	____	____
Imports from the West, amount in EEK	____	____	____	____	____
Exports to the mother firm	____	____	____	____	____
Imports from the mother firm	____	____	____	____	____
Trade with Russia:					
Exports to Russia	____	____	____	____	____
Imporsts from Russia	____	____	____	____	____

18. Does the company undertake any other international cooperational forms?

If yes, which form(s): _____

19. Does the company have patents? If yes, name the patent (s) and give number of patents

_____

Where are these patents registered: In Estonia_____or abroad_____; in which countries:

_____

20. Does your company invest in training of personnel? If yes:

Financed by:

(a) The firm itself___

(b) A domestic organisation___

(c) An international organisation___

(d) The mother firm____

Organised by:

(a) The firm itself___

(b) A domestic organisation___

(c) An international organisation___

(d) The mother firm_____

Group 4

21. Did or does your company obtain any kind of support from:

    (a) The Estonian government____

    (b) A foreign organisation____

    (c) Others, such as development agencies, or the like____

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