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FDI and Innovation in the Course of Transition

Jaroslav Gamzikov

The paper documents the changes in innovation generation patterns and approaches the effects of foreign ownership on the technological intensity of production in Central and Eastern Europe. We find that country-specific factors play a determinative role in the amount of FDI received and in the technological intensity of production by foreign affiliates. We speculate that sectors with more foreign investment are not necessarily associated with the higher innovation propensity in Hungary and Russia. We conclude that while indigenous science and R&D complexes have been deteriorating, inflows of FDI may contribute positively towards the re-building of national innovation systems if co-ordinated by government policy.

Key words: transition economies, foreign direct investment, technology transfer, national innovation system.

JEL classification: P27, O31, F21.

Introduction

The correlation between the inflow of foreign direct investment (FDI) and economic growth is under attack from two sides. Some researchers use data analysis to play down the importance of foreign capital for economic development in the long run (Rodrik 1999), or, more generally, to raise doubt about the contributing role of access to capital markets for the wealth of nations (Olson 1996). There is also a logical trap. MNEs complement their ownership advantages with the location advantages of potential hosts, so as a result locations with 'the future' have better prospects, but if such a future comes it is mistakenly possible to claim FDI responsible (Saggi 2000).

The emphasis is put on the foreign presence's technological content which is seen as a key determinative of foreign investment's usefulness.

> An exogenous increase in investment, whether from home or abroad, would increase the amount of capital (and output) per person, but this would only be temporary as diminishing returns would impose a limit to this growth. The implication for the global economy is that foreign investment can only offset this limit if it includes the transfer of new technological knowledge in the form of new goods, new markets or new processes (Knell and Radošević: 2000: 29).

Other scholars use other arguments to accentuate the importance of technology inflows by FDI.

By employing the endogenous the growth theory model to test the importance of the human capital quality in the host, they consider the indirect outcomes of new technology introduced by foreigners. According to analysis by Borensztein, De Gregorio and Lee (1998), despite statistical insignificance there are positive effects of technology transfer (TT) by FDI on economic growth.

Hence, there is a possibility that although foreign investments mean less *bringing capital*, they mean more *bringing knowledge*. If foreign investment is knowledge-intensive it positively affects the growth of economy acting directly (through the transfer of new goods, practices and techniques) or indirectly (through channels of human development).

This paper discusses whether foreign investment plays a fostering role in the knowledge-relative sphere of the economies of post-socialist Central and Eastern Europe. Transitional economies (TEs) emerged from autarky to face integrating markets and global players and they have to work out effective policies to create new technological capabilities. Since that in the course of transition any investment is desirable, the technological intensity and spillover propensity of FDI is a criterion, which policy-makers underestimate. If governments officially acknowledge its importance, it requires flexibility and a perspective vision to construct a flawless policy on TT by FDI. Problems are plentiful. The transfer of innovation advantages of multinationals requires readiness of environment and institutions. Having unavoidable restrictions on foreign investment raises the questions of whether foreigners introduce technology in full compatibility with the comparative advantages of the host. The network organisation skills, managerial competence or innovation expertise of an MNE may conflict with what is prescribed by official strategists.

Section 1 of the paper views national science and R&D system through its counteraction with enterprises in Hungary and Russia. Section 2 deals with the modes of MNE penetration to different types of transitional markets and estimates its innovation-related effects. Section 3 analyses the intercourse of foreign investors with post-socialist national innovation systems. The conclusion delivers some summary remarks and implications.

Section 1. Knowledge from Indigenous Sources and Their Limitations

Organisational inefficiency of national technology distribution channels has seriously affected microeconomic stance during transition. The abandonment of external R&D support has led to the under-use and deterioration of firm-specific advantages and a fall in productivity. Consecutively, national firms had either to simplify the production process or seek for the sources of technology. Such sources have been accessible via:

1) the creation (or revival) of their own research facilities;

2) the establishment of non-equity long-term alliances with outside R&D organisations;

3) the purchase of foreign technology on the open market;

4) the establishment of technology alliances with foreign companies.

The unstable financial positions of firms distract them from strategic planning, but impose higher credibility standards towards both the internal and external sources of innovation inputs. This inspires reluctance in choosing options 1) and 2), which demand managerial responsibility, co-ordination skills and long-term investing but have an indefinite outcome. Some enterprises have remained being oriented to outmoded research networking or indigenous innovation capabilities if it is preordained by their ownership specific advantages. For example, poor export performance in the initial stage of transition has boosted the employment of scientific over-capacities in the fields of aerospace and defence in the Ukraine and Russia[1]. The rest of the technology-demanding firms in TEs, however, are burdened with the limitations of national technological systems.

Still, these systems are highly country-specific (Table 1). The differences between the shares of R&D carried by the industrial sector in Hungary and Russia indecate the differences between the two countries in terms of macroeconomic development and microeconomic environment. What were the short-term problems in one country (inflationary pressure, inadequate legislature on privatisation and bankruptcy, organisational distress, social instability)[2] have been constant features of the other country's transitional process. Also, the increase in the amount of business R&D units in Hungary may be explained by large FDI inflows rather than by the utilisation of national enterprises' innovation potential in a comparatively favourable environment. Havas

Table 1. Research and Development in Hungary and Russia, Institutions, 1992-1998.

	1992		*1994*		*1996*		*1998*	
	HU	*RUS*	*HU*	*RUS*	*HU*	*RUS*	*HU*	*RUS*
Science Institutions		2077		2166		2360		2549
	68†		63		73		na	
R&D Institutions		1360		842		678		489
Universities	1071	446	1106	400	1120	405	na	393
Industry	98	340	183	276	220	342	na	240
Others	50	332	49	284	48	337	na	348
Total	1287	4555	1401	3968	1461	4122	na	4019

Note: † The data on Hungary in the first two rows are the cumulative data for all institutions, which the Hungarian Central Statistic Office names "Research Institutes".

Source: Goskomstat, p. 469; Havas (2000), p. 4.

1) Competing internationally in such industries means being able to innovate independently. Barriers against informal knowledge spillovers and idea exchange in areas that are crucial for public security are more solid, because the cost of knowledge is very high and intellectual property protection methods are specific.

(2000) implies that much of the success of Hungarian firms in the introduction of the new products and processes came from a reduction in spending on their own R&D and re-orientation to sub-contracting agreements with parent companies or foreign partners, which sometimes provide licenses and know-how free of charge. New channels of technology supply and technology give-aways provide extra pressure on basic science public Research Institutes.

Table 1 shows a higher propensity of Hungarian Higher Education to conduct R&D, which is explained by the historical difference between the role universities played in the two countries. The first university was established in Russia in 1724 as part of the Academy of Sciences, which was founded in the same year. Meanwhile the official history of the Hungarian Academy began four and a half centuries after the first national university's establishment in 1367. Post-socialist Hungarian universities, which once developed independently as national centres of knowledge generation, are returning to their roots by embracing the activities of Research Institutes.

Notable is the fact that Science Institutions engaged in basic research expanded in Russia during transition while the amount of R&D Institutions engaged in applied research and technology development dropped significantly (Table 1). Hadjitodorov (1999) observed the same trend in Bulgaria while Romijn (1998) reports that Hungarian applied research institutes have severer difficulties and quantitatively contracted more than academic research units. There are two factors underlying such bias in favour of fundamental science in TEs.

The first factor is non-focused government subsidies. Industrial collapse damaged the old networks of technology distribution but they will not function even upon re-construction. There are basic incompatibilities in firms' utilisation capabilities and inadequate production capabilities of basic knowledge generating units that have no incentives to co-operate with industry. While firms had to act fast and change drastically, scientific institutions relied on public funding and changed reluctantly in most TEs. The "preservation" of the traditional innovating patterns has been considered an attainment. This resulted in a softness of budget constraints that delayed structural reforms in the organisation of the innovation process. At the same time the changed economy cannot digest what is offered by the traditional Academia scientists, whose output is economically irrelevant. Data from Table 1 reveal that a number of Russian R&D Institutions probably escaped into the category of Science Institutions seeking sanctuary under the subsidies' umbrella.

The second factor is that applied science and technology development came under bigger

2) Monetary incentives played a greater role in Hungary than in neighbouring socialist countries and differentiated incomes could not be a distress factor for social consensus in the early years of transition. At the time when the core reforms started the population had already got used to changes in interest and exchange rates, prices and salaries. The opening of markets was not a shock for a nation which had a unique experience of economic co-operation and integration, being a member of the CMEA (since 1949), GATT (since 1973) and IMF (since 1982). FDI had been regulated on the basis of special legislation introduced there in 1972 and many national firms had direct access to external markets before the political changes of the late 1980s.

pressure than ever in Central and Eastern Europe. Soviet ministries had delegated most R&D activities to sector-wide research institutions and more specialised 'design bureaux', which served enterprises on a contractual basis. Linkages between these bureaux and firms were loose due to the common problem of economic incentives. Because profits and efficiency were less important than reports on working the project out, the drawbacks of forced networking were particularly evident in testing, application, and problem solving. Nevertheless, since the amount of funding on R&D was set from above, co-operation between researchers and firms occurred on a large scale. This co-operation dissolved when transition began. In modern market economies, development expenditures in firms account for 4/5 of all expenditures on R&D (Pavitt 1997). But in 1996 the business sector was responsible for only 37.4% of gross domestic expenditures on R&D in Hungary (hitting the record-low 28.6% in 1993) and for the record-low 15.3% in Russia.

The decline in industrial spending on innovation was preordained by the economic turmoil. In the early years of transition management shut down in-house R&D facilities in Central and Eastern Europe for the sake of cost cutting. Also, low demand for technology caused by the decline in production output pushed many independent R&D institutions out of the market. Basic science institutions exempted from market influence with the help of public support and subsidies had no incentives to incorporate abandoned R&D functions. They have re-produced old models both in the theme's choice and in its working it out. To elaborate, in TEs funds go to structures generating knowledge intended for the economic system which has already gone. Importantly, in discussions on technology's contribution to the growth of economy, the topic of the budget's share, which goes to science and R&D, becomes, in some sense, irrelevant. Enterprises get less necessary technology than might be expected from the amount of money for its generation distributed by government.

Finally, bottlenecks in the channels of tacit knowledge's delivery exacerbate the tendency towards the fragmentation of science and R&D activities, which lowers the effectiveness and narrows the range of research. The fragmentation also causes a decrease in both co-operation and rivalry between researchers and, as another step to jeopardy, it breaks the *routines* along which previous experiences in testing and implementing the initiative lead technological exercises. In the end, the contraction of R&D units replaced old inefficiency constraints with new institutional ones on the path of knowledge from scientific laboratory to the shop floor — if a firm finally turns black it will not find usual R&D subcontractors around.

Section 2. MNEs and Innovating in TEs

Stability is an important issue for technological co-operation in TEs. MNE trades its technological advantages for deficit resources if the superiority of technology is not sufficient to achieve a

Table 2. Technological Attractiveness of the MNEs' Modes of Entry for a Host.

	Level of Technology Novelty	*Spillover Propensity*
Joint Venture	low/middle	middle/high
Acquisition or Greenfield	uncertain	uncertain
Technological Alliance	middle/high	uncertain

monopoly position. However, the trading in technology raises going-concern value. The long durability of knowledge-intensive items makes the obligation of agreement conditions crucial in arm-length transactions. If an innovator fears that technology will be used by a third party, overused or re-sold, he insures against negative outcomes by raising the price. This has negative impacts both on technological progress and public welfare. On the one hand an innovator has less stimulus to innovate if he cannot protect the results of his innovation, on the other hand access to the results of innovation is limited by their high prices.

If TT occurs on the basis of long-term relationships the cost of innovating goes down. When there is mutual trust and routines are established partners concentrate more on the adaptation of technology, increasing the efficiency of its usage. The flow of information from a subsidiary or partner helps core R&D facilities innovate better and more diversely. In turn, R&D outlets form a network, or a combination of networks in the case of strategic alliance, where common access to information and resources enhances the capabilities of each outlet.

Because the possibility of getting new, long-living, or sophisticated technologies through arm-length transactions is limited by the strength of national business, TEs' governments turn to the options of TT by FDI means: acquisition, joint venture or technological alliance. The choice between them diversifies both the strategy of a potential investor and the government's policies affecting his decisions on the method of entry. The more attractive local assets are, the greater is the ability of a government to bargain and credibly demand higher export-propensity, technological intensity of local production, local content, etc.

Joint ventures were initially vehicles of MNEs' penetration to Central and Eastern European markets due to the nature of the drift from plan to market. JVs are an unstable mode of technological co-operation because the partners' assets are complementarily different in transferability. Multinationals had mainly used JVs to learn about the market and establish business contacts while avoiding capacity extension. Their propensity to invest and penetrate technologically rises with the buying out of the local partner's share. Host governments have to acount for this factor, though for them it is comparatively easier to control JVs and keep them linked with local firms.

Now in most of the countries of Central and Eastern Europe, barriers against the acquisitions of locals exist only in areas where investment affects public interests. However, legislature ease has not been enough to encourage investors. The important switch from JV to greenfield

investments and acquisitions cannot change the core location characteristics. It would have a positive deepening effect on the activities of foreign investors, which have already found national comparative advantages attractive, but would hardly attract investors of a new type.

The group of TEs whose JVs were comparatively strong instruments of attracting foreign investment has continued to gain a large share of the capital inflows directed to Central and Eastern Europe. Accordingly, the rest of the TEs benefit less than policy makers expected when they liberalised MNEs' access. It is interesting to group TEs according to the principal factors which seem to have a causative relationship with FDI inflows.

1) Small domestic market countries, which have a fast reforming pace and medium and high comparative advantages: Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovak Republic, and Slovenia. World Bank data (WB 2000) let us calculate that the mean PPP GDP in current international dollars is $9,790 per capita and the mean net inflow of FDI in current US dollars is $168 per capita in this group annually for the period of 1997-1998.

2) Small or fairly small (Kazakhstan) domestic market countries, which recorded a slow pace of reforming and have medium and low comparative advantages: Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Georgia, Kazakhstan, Kyrgyz Republic, Macedonia, Moldova, Tajikistan[3]. PPP GDP per capita and FDI per capita are $3,587 and $48 for this group in 1997-1998. Notably, Belarus contributes much in terms of GDP while Azerbaijan and Kazakhstan contribute enormously in term of FDI received. Without Belarus the group's PPP GDP per capita is $3,172 and the exclusion of Azerbaijan and Kazakhstan brings the net inflow of FDI per capita down to $23.

3) Big or fairly big (Romania, Uzbekistan) domestic market countries: a) Poland; b) Romania, Russia, Ukraine, Uzbekistan. PPP GDP per capita is $7,532 for Poland and $5,445 for b) subgroup in 1997-1998. FDI per capita figures are $146 and $29 consequently.

Belarus is a special case because it has $6,073 of PPP GDP per capita and $17 of FDI per capita in 1997-1998. Explanation lies, firstly, in economic integration with Russia, which let old-fashioned economies of scale be employed for export-orientation development towards the neighbouring market. Secondly, the reluctance of the national elite to follow the common socio-economic reforming patterns inspired negative perceptions of potential foreign investors. Another special case, which even asked to be in the separate subgroup, is Poland. Among TEs this is the only country where a large population is combined with a substantially developed economy. Accounting for the achieved social and ethnic stability and rich traditions of reforming, it comes with no surprise that Poland alone received $6.4 billion of FDI in 1998 while all countries of the first group received $8 billion.

On the whole, however, country-specific data on TEs remind us of the general trends in foreign

3) Turkmenistan and Yugoslavia are excluded from analysis for lack of data but estimation prescribes them to fall into the second group of countries.

direct investment distribution—countries with natural resources, advancing countries and bigger markets receive more FDI. For example, Azerbaijan and Kazakhstan, which are comparatively populous and resource-endowed, are responsible for 67.2% of all net FDI received by the countries of the second group in 1997-1998. The group is far from homogeneity, though low levels of productivity, lower aggregate income of population, geographical distance, weaker institutions and socio-political or ethnical instability found among these nations are associated with less foreign investment received. Natural resource endowments raise the levels of FDI per capita in the short term in countries where MNEs place low-and mid-level technology engaging in extraction and primary proceeding (Azerbaijan, Kazakhstan and Turkmenistan). Better start-up conditions and proximity to the current and would-be EU members is also a positive factor (Bulgaria). Nevertheless, overall the second group of TEs has fewer chances to compete with other potential locations for technology-intensive FDI in Central and Eastern Europe. Leaving this group aside we concentrate further on Hungary and Russia. Analysis of the representatives of the first and the third groups seems to be more productive for clarifying the differentials in the kinds of FDI an TE gets.

Presumably countries of the first group are to be the locations where MNEs will actively use FDI for export-oriented production and subcontracting. Consequently outside-oriented production in these countries demands comparatively sophisticated technology and high skills. In turn, subsidiaries in the third group of countries are less concerned with technology inputs and the skill level because cost-efficiency is reached through production for the local market. One can bear positive expectations for R&D activities to be stimulated via FDI in both groups of countries. If the 'Rich TEs' of the first group win technologically advanced FDI, which produce in order to supply developed markets, then the expansion of comparatively sophisticated production will call for the establishment of R&D outlets. In turn, if FDI in 'Big market TEs' is oriented to supply a non-advanced local market, then the technology gap between home and host makes it sensible to create R&D facilities for adapting advanced technology and/or developing less advanced technology to meet local demand.

In reality these expectations are groundless. The advance of 'Rich TEs' firms to developed markets has been expanding via intra-industry trade compensating for the vertical disintegration of the economy during transition. Subcontracting is a very significant part of their FDI-related export activities, especially in the automotive sector (Hoekman and Djankov 1996). The creation of laboratories for a narrow range of research will not be so cost-efficient compared to technology import and R&D outsourcing if the degree of vertical specialisation is high. A survey of 24 Hungarian firms by Romijn (1998) reveals a low emphasis on the expansion of research by foreign subsidiaries despite their access to funds. Knell (2000) confirms earlier findings that in Hungary there is no relationship between firms with foreign investment and innovative activity.

In the case of 'Big market TEs', excluding Poland, the range of technological backwardness of products tradable in these markets is not to be underestimated. Low income and undemanding consumption habits increase the bearability of the technology gap to the extent where the marginal transfer of soft technology to a subsidiary is enough to keep and expand the market share opposite importers and local firms. Local innovating facilities are not necessary when technology is to be marginally above the level, which secures technological advantage over local rivals and sustains barriers against other foreign technology to come. Put simply, a common situation is when an MNE incorporates its TE outlet in distribution, marketing, service and production (in the case of 'Rich TEs') networks but outsources its R&D to foreign laboratories.

There are no known data on the technology composition of foreign investment in Central and Eastern Europe and this creates difficulties in understanding the role of FDI as an TT channel on the industries' and enterprises' levels. Knell (2000) investigates R&D activity and technology transfer in Hungary, using results of a survey carried out by Tamas in 1996 (cited in Knell (2000: 193-194)). It seems that in FDI-intensive sectors of the Hungarian economy (Metal-processing Machinery, Vehicles, and Telecommunication Equipment), only in Metal-processing Machinery was it that firms with foreign participation invested considerably more in Base, Applied and Experimental Research than firms with no foreign investment. It did not, however result in a consequently large gap in the intensity of Product Development in Metal-processing Machinery, while such a gap existed between affiliates and local firms in Vehicles and Telecommunication Equipment. In Vehicles, industry-specific patterns of product development seemed to be a major factor, which was responsible for the fact that twice as many foreign affiliates bore *any* R&D activity compared to domestic firms (58.2% vs. 27.7%). In Telecommunications Equipment, where technology has high development costs and is easily transferable, foreign affiliates were building their technological superiority on License and Know-how Purchase while domestic firms invested more in Indigenous Research.

It is not surprising that enterprises with foreign investment were not willing to invest in Base Research (except for Metal-processing Machinery) because during the initial years of acquisition (or start-up) and start of production technological superiority is attained by bringing the technology packages together with managerial competencies and Western-style quality control standards. What is surprising, however, is that while affiliates were paying more attention to Product Development, Hungarian firms were more likely to introduce new products in 1996. Knell (2000) employs the explanation of strong market share motivation and weak local science and technology system's motivation of foreign investors. Also, worth consideration is the fact that human capital-intensive[4)] revealed comparative advantages in Hungarian manufacturing turned positive

4) Human capital intensity indicator is based on the share of scientists, technicians and office employees in total employment.

in 1997. It is tempting to link the emergence of competitive advantages with the activation of technologically advanced efficiency-seeking export-oriented foreign investors[5], but responsibility may also be on the changes in one or two product groups, which MNEs invested heavily in (Éltetö 2000).

In a 'Rich TE' MNEs had not been more innovative than local firms, at least for the initial period of transition. Were the consequences of FDI presence more propitious for technological development in a 'Big Market TE'? Russia received most of its FDI in 1998 ($US 11,773 billion) when according to the Goskomstat agency the leading recipients were the Oil, Gas and Refinery related sector (16.0%) and Food and Beverages (12.5%). The shares of Oil, Gas and Refinery and Food and Beverages had quickly expanded in the 1990s while the share of Machines Building and Metal Works, which was the third leading recipient with the exclusion of services and trade related sectors, shrank from 15.2% of total FDI in 1995 to 6.5% in 1998.

Despite the broad character of Goskomstat's data and definitions we find it conceivable to combine the figures of FDI inflows with those of the sector distribution of enterprises' innovation-related activities. Machines, Equipment, Instruments, Vehicles enterprises, which are not primary receivers of foreign investment, are definite leaders in technological change. Enterprises linked with sectors in which foreign investors showed declining interest, lead enormously in fields associated with the process of innovation itself: R&D and Technology Development. 53% of firms in Machines, Equipment, Instruments, Vehicles engaged in R&D and 64.3% in Technology Development versus 3.3% and 1.6% of firms in Natural Resources Extraction and Primary Processing and 14.2% and 7.6% of firms in Food, Beverages and Tobacco. The gap is also huge in Software Purchases, Training, Purchase of Equipment and other Capital Funds and is being closed only by the amount of Food, Beverages and Tobacco firms that purchased new technologies (31.1% of all firms vs. 35.9% of firms in Machines, Equipment, Instruments, Vehicles). Hence, Machines, Equipment, Instruments, Vehicles enterprises demonstrate a bigger innovation potential compared to the two industrial groups where most of FDI recipients are found.

The relationship between firms with foreign investment and innovative activities is unclear in both TEs including advanced Hungary, where firms with foreign participation were responsible for 65% of all export-earnings and of all industries Machinery had already concentrated 65% of all FDI stock in 1995. In Hungary FDI went to more technologically demanding sectors but the question persists: what is the real scale of the innovation-related benefits from MNEs' presence ? Blahó and Gál (1997) stress that in Hungary FDI was directed predominantly to industries and factories which had operated above the average levels of technological productivity and economic

5) See, for example, Kaminski (1999) who analyses changes in revealed comparative advantages using mirror statistics of Hungarian trade with the EU.

efficiency. Therefore, we cannot say whether foreign technology's contribution played any decisive role in the better performance of foreign capital in one TE over another[6].

We must, though, make a note of the adverse consequences of technological assets brought together with FDI. In TEs part of the technology of foreign origin goes to sectors where location advantages are weak[7] and economies of scale can be employed to cater solely to the national/regional market. Here, as mentioned, the threat of competition from imports determines the bottom level of technological intensity. If the market is remote and transportation and co-ordination costs are high, this level falls down further to the point where the subsidiary has only a marginal advantage over the local firm. On the other hand, in some TEs, the foreigners' ownership-specific R&D advantages intensify the extraction of exportable natural resources with few forward and backward linkages, which are biased to foreign suppliers.

Even in fast reforming and economically advanced TEs, MNEs rarely launch sophisticated or *new* products (Blahó and Gál 1997). Foreigners avoid high start-up costs, acquiring locals with their infrastructure, production lines and laboratories, and narrowing the range of products. Cost cutting and relying on the best of inherited product lines make it unnecessary to build or re-build linkages, along which technology's spillovers occur. Interestingly, opportunities for spillovers are few even if FDI is more technologically intensive and export-oriented. For the sake of export efficiency, foreign investors integrate linkages to international networks, leaving domestic firms without routes for technological externalities. In this situation indigenous research potential is oppressed in two ways: directly (with the delegation of R&D functions abroad) and indirectly (by siphoning off capital, which cannot work in the host within the framework of current corporate strategy).

Section 3. New National Systems of Innovation and FDI

As mentioned in the beginning, contemporary research scrutinises the indirect i.e. non-related to

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6) The other factor distorting the analysis of FDI technological consequences is the inflow of soft-technology. The sole transfer of soft-technology results in 'shallow' integration, which eases access to internationally competitive innovation assets, but sustains the technological gap with countries generating knowledge (Dyker and Radošević 1999; Radošević 1999). In many TEs national strategists and the public examine the technological intensity of an investment project by the criterion of productivity's increase, which could be caused by managerial effectiveness. Since post-socialist firms have been poorly managed an MNE first mobilises easily transferable soft-technology advantages to win local markets. Soft-technology can even solely back up successful export-oriented production if a local firm had held strong ownership advantages prior to the investment.

7) Location advantages are strong in the Russian Oil, Gas and Refinery sector but weak in Food and Beverages. For the period of the 1994-1998 the share of the Mineral Products group of commodities was never lower than an impressive 42% level of the US$ value of all Russian exports (in current prices). In the same years the Food and Agriculture products share in the country's exports never exceeded 4.2% (Goskomstat: 659). At the same time there were large inflows of food and agricultural imports and their value regularly accounted for about a quarter of the total value of Russian imports.

capital consequences of the arrival of FDI, e.g. improvement in labour or technology. We have seen that in TEs FDI could come to sectors with low technological intensity and few channels for efficiency spillovers. Allocation of resources to these sectors driven by MNEs has a limited effect on the quantitative improvement of these resources and growth prospects.

If a host possesses R&D labour and an R&D institutions' network, whose quality is sufficient for the adaptation and imitation of technology, spillovers from subsidiaries to local firms promise to be smooth. High quality of local R&D assets is associated with a substantially larger spillovers' propensity, because MNEs consider innovation-related institutions and labour as part of the location advantages and use them by collaboration agreements, technology partnering or establishing R&D outlets. But in Central and Eastern Europe it is not optimal for foreign investors to intensify R&D even though there are innovation-related location advantages. The reasons are: 1) local R&D systems are in negative dynamic: innovation routines are under-employed and scientists and technicians are increasingly less qualified; 2) the stoppage of the production of sophisticated goods for rich markets means a drop in demand for indigenously developed complex technology[8].

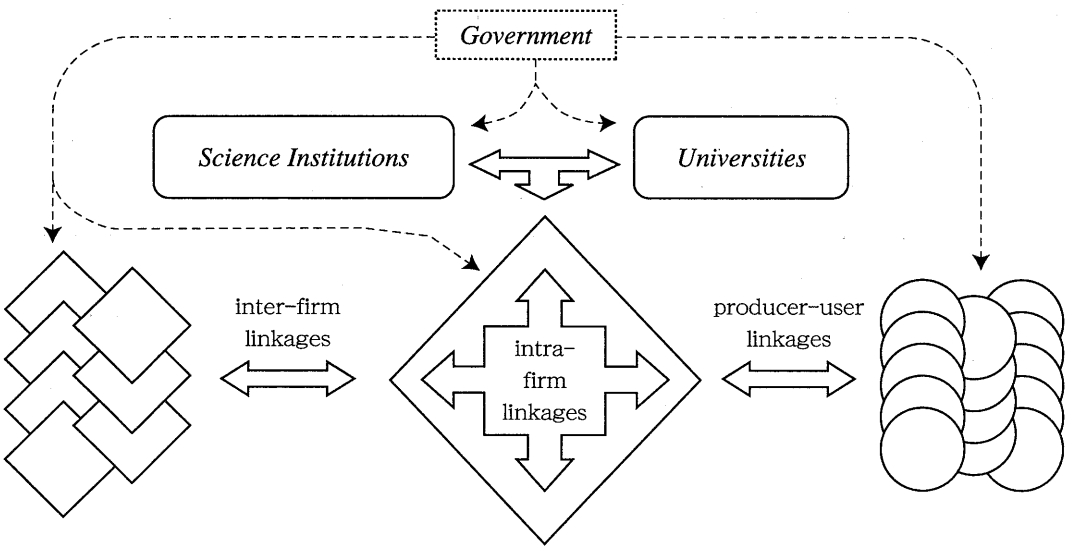
The R&D potential of an TE is an effective location advantage when it is matched and supported by other basic location advantages. If the latter ones do not improve, R&D potential will degrade to a state of correspondence with the resources and environment. Budget constraints and specific government reforming policies make the process either painfully short (East Germany, Czech Republic) or not less painfully prolonged (Bulgaria, Russia).

The environment in which R&D potential changes and TT takes place in TEs can be approached within the framework of national innovation system (NIS) (Lundwall 1988; Nelson, *ed.* 1993; Pavitt and Patel 1995; Edquist, *ed.* 1997; Cimoli 1998; Mowery and Oxley 1995, OECD 1997). Whether an NIS is the national institutions with their incentive structures and competencies, which determine national technological learning (Patel and Pavitt 1994), or a system of interaction between firms, universities and government agencies aiming to produce science and technology within national borders (Niosi *et al.* 1993), we add the following. An NIS stays national inasmuch as there are institutions and agents producing and using economically useful knowledge in a national fashion. An MNE, which overcomes national boundaries becomes part of at least two different national systems of innovation (Lundwall 1992: 18) and it is tempting to investigate the role of a multinational in a host NIS.

Radošević (1997) argues that national or regional responses to industrial transformation are not

8) Economic efficicency is easily reached with pertinent technology and know-how imports. In a private interview, an administrator of the Moscow representative office of a major MNE named ideas offered by local researchers as being *excessively revolutionary* as the main reason for failed R&D co-operation with local science institutions.

Figure 1. National Innovation System.



yet articulated and there are still no NISs in countries of Central and Eastern Europe exept in an embrionic state around business groups and sectors. We think, however, that the ultimate character of transformation does not imply that the trajectories of changes of different areas of the economy (and the old innovation system among them) would correlate. Many signals coming from a transforming economy vanish, being unfocused or misinterpreted. The collapse of networks and the hindering of intra-institutional co-ordination in this situation show not an NIS dissolving but a radical alteration via the rebuilding of hierarchies' and re-delegation of functions and competencies. The dynamic image of an TE's NIS is hard to observe because the low commercialisation and path-dependency of its old forms make its transformation sluggish and shielded by the transformations of business and governance. Undoubtedly, among the hardest to trace are the points of interaction of foreign and local NISs where foreign investors are the leading agents.

1) The internal organisation of firms and innovation process.

The innovation process is firm specific because firms from different countries and different sectors bear different patterns in the evaluation, accumulation and usage of technological opportunities (Pavitt and Patel 1995). The methods of internal R&D management shape the innovation process within firm affecting usage of firm-specific advantages. The firms' differences are seen in their counteraction with the environment as in contractual relationships or arm-length trade. Through these channels there is pressure on partners to adapt to the structure of a firm's organisation and its needs. If the pressures are in imbalance, as in the case of an

MNE and a firm from an TE, the weaker partner has to change[9]. Although such adaptation raises the effectiveness of the partnership it does not necessarily have a positive impact on the host NIS on the whole.

In this context, if governments choose a foreign investor on privatisation tender, a foreign partner for a turnkey project or joint venture, it is also their internal structures that must be evaluated. It is an actual problem for every party in technology tranfer: is the internal organisation of a company shaped by a home NIS combinable with the NIS of the host? Philips, a known leader in R&D internationalisation, could not integrate technology, product design and development and left the CIS market in 1998 after investing $64 million in a cathode-ray tubes factory. If a company's internal organisation is currently compatible with the host innovation system, does it bear potential to change with the system in the future? Long term contacts with science institutions and state agencies had secured shares on the markets of apparatus and chemicals for such MNEs as Bruker and Hoechst AG for three decades. However, delays in managerial decisions and problems with the competency delegation between units caused a loss of market in the 1990s and prolonged the restructuring of local operations.

We stress that the operational independence of a subsidiary is crucial when transition is fast. The cost of slow deciding is high not only at greenfield but when a foreign investor obtains knowledge of the host's environment buying a local business out. Representatives need confidence in making decisions on what should be integrated into the corporation schemes and what should be scrapped during internal re-organisation. Uncertainty and the complex character of changes in TEs make this kind of knowledge highly location- and time-specific. Many have first to bring and risk their money and technology in these countries to calculate the possible payback and a sharp strategy. Failure to realise that leads to the hardening of intra-corporate co-ordination and lost opportunities on transitional markets.

2) Inter-corporate co-operation.

Changes in the patterns of interaction of innovation agents have two-fold outcomes in Central and Eastern Europe. On the one hand locals seek for intra-firm co-operation between them and foreigners. The abandonment of state planning and the discontinuance of finance and knowledge inflows to local firms accentuated the need for their own R&D, product development, marketing, design and re-training. An average local company or research unit with underdeveloped enterpreneurship and marketing skills sees access to the world-scale ownership-specific competencies

9) Changes on a stronger side are more evident and are the result of cummulative pressure from local firms and institutions. If foreigners' conflicts in counteraction with locals are high in number, the host innovation system resists and the subsidiary has to adapt the parent organisational schemes to the local situation. If the headquarters do not welcome potential change there are possibilities of either tensions on the question of intra-firm co-ordination or market exit.

of an MNE as the first-best option. On the other hand foreigners are reluctant to initiate deep co-operation. Instability on the partner's side aggravated with the irreducible uncertainty of the business environment diminishes the chances for a successful long run partnering.

Also, from the host government's point of view technological collaboration is a desirable but insecure tool. Firstly, it might distort the allocation of resources in a way, which would be harmful both for the NIS and public welfare. A foreign firm can co-operate with a host firm in, say, the exploitation of satellite launching technology transferring upstream activities and therefore jobs and technological skills abroad, or exporting supply and cutting off the local users, both from the public and private sectors. Secondly, the discontinuous character of learning must be taken into account (Radošević 1999). A productivity rise based on the transfer of soft technology brings an impressive improvement in performance affecting the policy makers' decisions. However, the status of an effective and competitive subcontractor of an MNE does not secure further qualitative development in technological integration. To overcome the foreign partner's opposition to 'excessive' improvements the host side must mobilise a large physical investment locally and fully develop its own innovation capacities.

3) Interaction of producers and users.

Active and competent final users are crucial for the functioning of the NIS (Lundwall 1988). Final users are the final testers of the product or process developed in the laboratory and their response can change the current orientation of the innovation systems, which in TEs have been biased towards upstream R&D. The idea of a technological good as a *package* rather than a *thing* is still new for post-socialist science and research institutions. By internalising downstream activities such institutions gain in the areas of their indigenous weakness, i.e. the co-operative service or the fixing and adaptation of technology already sold. Feedback loops from foreign consumers are particularly valuable, but considering geographical proximity a foreign investor is a near substitute. It imposes higher standards on suppliers of technology because of corporate expertise in the choice of suppliers and the methods of pressure over them. If a foreign investor uses locally developed products in export oriented production it sets higher standards for the innovation network, which support these products, because it is one of the indirect sources of its competitiveness on the world markets.

Disregarding export propensity, subsidiaries on the whole are capable of the establishment and active use of value-enhancing feedback linkages. Still, while there are few such cases in TEs the importance of the foreign-domestic producer-user relationships has yet to be pronounced.

4) Universities and Academia scientists and industry.

Two key factors are to be mentioned here. Firstly, the fact that basic research units and

universities have been structurally separated in Central and Eastern Europe impeded knowledge exchange and labour mobility between these institutions. This made universities incapable of full-figured research activities and caused the dysfunction of basic science in background research or the provision of trained specialists. Tertiary education has for a long time been exempted from the process of dynamic learning on national or even regional levels. Despite the comparatively high teaching qualification of professors, in many cases they distribute inapplicable, 'too-basic' knowledge and loosely perform as researchers and project leaders. Actually, in Central and Eastern Europe there are few projects associated with universities and even fewer amount of them incorporate contractual or consulting ties with industry.

Secondly, as noted, the comparatively protected basic science sector is oriented towards the restoration of the past patterns. This results in the production of 'pure knowledge' while 'applied research, development and other business-related activities are seen as necessary evils, the result of crisis and falling levels of research funding' (Balázs 1997: 177). According to this logic, private funding, especially from a foreign investor, is treated only as an excuse for the 'improper' use of equipment and skills and 'wasting' of scientific potential. Such an approach undermines perspectives for the sharing of technological expertise and the exchange of ideas between traditional Academia and MNEs.

However, apprehension of contacts is not groundless, because the potential co-operation effects are mixed. By far the most promising form of an Academia-MNE relationship was partnering with venture or semi-venture scientific firms. These firms use facilities and ideas of basic research institutions but fertilise them with managerial flexibility, high learning propensity and diversity of skills. Their role has stayed marginal since their contracting with MNEs is limited to a few spheres where TEs hold complex ownership-specific scientific competencies (lasers, aerospace)[10]. Except for these ventures, foreign firms' existing technological collaboration with the local scientific systems in TEs is shallow. It is difficult to characterise it complimentarily. MNEs tend either to utilise transferable tacit knowledge in international R&D networks (the export of locally trained researchers) or directly exploit non-transferrable facilities and equipment, minimising collaboration with locals (like networks for the testing of agrochemical or nuclear accelerators and piles).

In Central and Eastern Europe foreign firms have the potential to assist in the re-establishment of innovation-related links between public institutions, enterprises and other organisations. The technological expertise of an MNE transforms the distributive channels but it also affects

10) Marinova (2001) names the areas of technological strength of Eastern European countries analysing their patenting activities in the US. Common strengths are: petroleum, coal, chemicals and other related products, country-specific strengths are: mining (the former USSR, Poland, Bulgaria), textiles, clothing, footwear and leather (former Czechoslovakia), printing, publishing and recording media (the former GDR), health (former Yugoslavia), energy (Romania), design (Slovenia).

innovation generation. FDI may interact with the key bends of old innovation networks, simultaneously re-routing linkages between them. Initially, the production efficiency of technological outputs increases through co-ordination and cost cutting. Finally, a foreign firm boosts knowledge sharing when it recombines the elements of the old NIS or exposes them to outer influence judging by their compatibility and economic value.

The influence of MNEs on the reformation of an NIS might, however, be third-best for an TE. It happens if foreign investors optimise accumulated NIS-specific assets but do not address the re-production of the elements of the host's scientific potential. If a nation does not breed institutions and networks and does not co-ordinate its economic agents, the uncontrolled activities of foreign firms bring brain drain or holes in the capital. In the current context, the role of transitional governments is accentuated. Their practical agenda must include the development and implementation of a truly systematic strategy towards the NIS, whose integrative part is interaction with foreign investors.

Conclusion

FDI presence is a beneficiary factor for the host's development in cases of technological co-operation because multinationals are more competent in innovation-related activities and they share their competencies. This layer of ownership specific advantages compensates for limits on access and poor knowledge of the local market and justifies investing for an MNE. In the case of catching-up countries, which are at a distance from the technology frontier, delivery of such advantages is especially noticeable and rewarding for both parties.

Though the current paper cannot embrace the whole picture of technological counter-action between locals and foreigners in Central and Eastern Europe, it still points out that the role of FDI in the innovation process in TEs is complicated. The integration of approaches in the course of the study allows for several conclusions.

1) R&D systems fail to work in TEs for the following reasons. a) The basic science sector has been marginally reformed. It reproduces old patterns and does not respond to the small but diversified demand from the economy. b) R&D activities became fragmented and innovation routines got broken. c) In-house research has yet to be re-built on the micro-level.

2) We suggest that economically advanced countries with smaller markets attract FDI with high export propensities while in bigger markets the export propensity of foreign affiliates is low. In the latter case production's technological intensity will secure a marginal advantage over importers and host firms in a competition, which is set by the low technological intensity of local demand.

3) Industrial sectors that are comparatively strong in innovating do not necessarily receive

more FDI. Foreign direct investment goes to sectors of low or low-medium technological intensity with limited scale and scope for R&D. There is also little potential for spillovers in these industrial branches.

4) FDI has both positive and negative impacts on the NIS in TEs. Nevertheless, if the government controls and co-ordinates the inter-linkages between the agents of different NISs, multinationals improve the host NIS, increasing flexibility in R&D and networking and employing evaluation and organisational competencies.

It is worth noting that from the very beginning foreign investors coming to Central and Eastern Europe were not oriented towards the spheres where meaningful technology diffusion might have occured. At worst, their activities hampered the positive restructuring of the indigenous R&D complex. At best they have been able to spread optimisation impulses on parts of the innovation networks on the national level. These processes were hard to capture for all impacts were abated with the path-dependency of the old innovation schemes. But we conclude that the most crucial factor, which could affect the technological performance of foreign investors, has been the strong and profound public policy of post-socialist governments. Such a policy has not to cover solely FDI and technology transfer issues but must be more embracing, revitalising linkages and skills. It should simultaneously address the environment, institutions, and resource distribution but stay case-specific, effective and transparent.

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