The Interplay between Innovation and Production Systems at Various Levels: The case of the Hungarian automotive industry

Havas, Attila

Institute of Economics, CERS, Hungarian Academy of Sciences

August 2007

The Interplay between Innovation and Production Systems at Various Levels: The case of the Hungarian automotive industry

Attila Havas
Institute of Economics, Hungarian Academy of Sciences
Budapest, Hungary
havasatt@econ.core.hu

paper presented at
The 5th International GLOBELICS Conference
"Regional and National Innovation Systems for Development, Competitiveness and Welfare"
Saratov, Russia, September 19-23, 2007

Abstract

The paper first discusses alternative theoretical frameworks to analyse the impacts of FDI on host economies. Second, it provides an overview of major developments in the Hungarian automotive industry since the early 1990s, discussing both firm strategies and the macro level factors influencing the former ones, especially by highlighting the consequences of Hungary's accession to the EU. A tentative taxonomy has also been developed, and applied when discussing the prospects for Hungarian suppliers. The paper concludes that diffusion models and the notion of sectoral system of innovation and production offer a more appropriate conceptual framework to capture the actual socio-economic impacts of FDI in this sector than the generally used spillover models. Notwithstanding the huge importance of globalisation, various elements and dynamics of national innovation systems still do matter. As for a major element of an NIS, namely government policies, it is more fruitful to create an attractive, favourable environment for R&D and innovation than focusing on the promotion of industry-specific R&D and innovation activities. It is also of crucial importance to co-ordinate several policies to enhance competitiveness.

Keywords: automotive production and innovation systems; Hungary; motivations for, and impacts of, FDI

1 INTRODUCTION[1]

Foreign-owned firms have already achieved a significant weight by the mid-1990s in the Hungarian economy for two reasons. First, privatisation techniques favoured genuine owners, who could afford to inject fresh capital – as opposed to the so-called voucher schemes, applied in other Central and Eastern European (CEE) countries – and these new funds were only available abroad. Second, investment promotion policies – e.g. tax holidays, infrastructure and human resource development projects largely financed by public money – also attracted foreign investors. The share of foreign-owned firms has become extremely high compared to OECD member states: their share in total manufacturing revenues was 71.6% in 2002, surpassed only by Ireland (79.5% in 2001) among the OECD countries. Just to indicate how extreme these two countries were in this respect, Belgium, with a much lower share of 'only' 57.2% (2002), ranked 3 on this list. The only other country above the 50% mark was Canada (51.0% in 2002).[2] There was only a single country in the range of 41-50%, namely the Czech Republic (45.5% in 2002); while five countries registered a share of foreign-owned firms above 30% by 1999-2002: France, the Netherlands, Poland, Sweden, and the UK (in alphabetical order). (OECD STI Scoreboard 2005, Table E.6, p. 202)

The amount of foreign capital invested in Hungary also indicates the significant role of foreign-owned companies: FDI amounted to €3.3 billion in 2004, and 2005 saw an even larger inflow of capital, that is, €5.3 bn. In absolute terms, Hungary was second only to Poland concerning cumulated FDI inflow: $61.2 bn vs. $93.3 bn by 2005. (UNCTAD) Thus, FDI stock per capita was $6,122 in Hungary in 2005, ranked between Estonia: $9441.5; and the Czech Republic: $5829. (own calculation based on UNCTAD data). Thus, globalisation has become a key issue both for economists and policy-makers in Hungary.

An important strand of literature has long focussed on the motivations of investors. The most widely accepted concept, the so-called eclectic paradigm, developed by Dunning, is distinguishing market-, resource-, efficiency- and competence-seeking investment projects. More recently, it has become an equally important research question to assess the impacts of FDI on local firms. To what extent and through what channels are foreign-owned companies contributing to the re-structuring of the domestic industries? Do they enhance the competitiveness of indigenous firms by bringing technological and organisational innovations in, or do they have a negative effect, e.g. by forcing some of the domestic firms to exit?

Given the extremely high weight of foreign capital in Hungary, these research questions are of high importance, and automotive industry offers an excellent opportunity to tackle them. This industry has traditionally been a front-runner in globalising its activities, originally in the forms of trade and licensing agreements, as early as the beginning of the twentieth century, and then in the form of cross-border investment projects. The main drivers for the major automotive firms are cutting costs via re-location of production, and gaining access to new markets in emerging economies. They have become quite active in Central Europe, too: practically all major automotive groups, both assemblers and component manufacturers, have already set up their operations in Central Europe, or are building their new plants. (Havas, 2000a, 2004; Pavlinek 2002a, 2002b, 2005) Given these strategic moves, the Hungarian automotive industry has been radically re-shaped: car production started again in Hungary in the early 1990s – after a half-a-century 'recess' –, and suppliers became parts of the global production networks, either via ownership or subcontracting relationships. In

[1] Financial support from OTKA, grant number T 046880, is gratefully acknowledged.

[2] Luxembourg, with its share of 52.9% in 1999, is excluded form this comparison, given its size. It would be simply misleading to compare such a small, and highly specific, economy with significantly larger ones.

brief, new products are manufactured by new entrants or fundamentally transformed incumbent firms, using new production and management techniques, and serving new customers.

The aim of this paper is to shed some light on this sweeping re-structuring process, focusing (i) on the role and impacts of production networks, co-ordinated by major foreign firms; (ii) on prospects and modes of growth; and (iii) on the scope for innovation policy. It is based on interviews with managers, both at foreign-owned and domestic firms, and simple sectoral statistical analyses. The remaining parts of the paper are organised as follows. Section 2 discusses alternative theoretical frameworks to analyse the impacts of foreign-owned companies on domestic ones, namely spillover vs. diffusion models, as well a new concept of the evolutionary economics of innovation, that is, sectoral system of innovation and production. (Malerba, 2002, 2005) Analysing historical trends can help in achieving a better understanding of current developments. Therefore, Sections 3-5 summarise the evolution of the automobile and auto parts industries in Hungary, as well as major developments since the late 1980s. Competition patterns and the role of production networks are then discussed in Section 6. The following section shifts the focus of analysis from the present to the future by looking at the different modes of growth and the prospects for the Hungarian suppliers. Finally, theoretical and policy conclusions are drawn in Section 8.

2 CONCEPTUAL FRAMEWORK

The paper is not aimed at developing new theories: it applies existing theoretical frameworks with the intention to demonstrate their crucial differences. These contrasting frameworks, therefore, are only characterised here very briefly.

The 'pyramid' of the automotive industry has become a universally accepted model to describe the interactions among vehicle assemblers and first-, second- and third-tier (T1, T2, T3) suppliers. (Bongardt, 1992; Freyssenet *et al.* (eds.) 2000; Jones, 1989, 1999; Ruigrok *et al.*, 1991; Sturgeon and Florida, 2000; Vickery, 1996; Womack *et al.*, 1991)[3] Two basic features of the industry can be stressed: (i) firms are bound to co-operate, and thus the appropriate unit of analysis is their networks in many cases, i.e. not individual firms; and (ii) these co-operations are often cross-border ones. These two features are captured by the concept of global production networks. In sum, this model seems an appropriate basis – or broader framework – when analysing the motivations for FDI, both by assemblers and T1 suppliers, as well as the effects of foreign firms on endogenous ones.

Spillover models are probably the most frequently used analytical tools to discuss the impacts of FDI on the host economy. Spillover, strictly defined, means unintended 'leakage' of various types of business practices and knowledge. From a different angle, the 'beneficiary' firm does not pay anything for the 'leaked' methods, information or knowledge – just use them, and thus we speak of non-pecuniary relationships in these cases. A clear policy implication of this conceptual framework is that spillover should be stopped, i.e. governments should put in place a tight enough regulation to protect intellectual property rights (IPR) of firms – in this specific context, IPR of foreign firms.

[3] A somewhat similar conceptual framework, the so-called layer model has been employed to investigate the telecom equipment sector by Fransman, 2002.

Abundant evidence shows, however, the 'sticky', localised nature of knowledge; especially that of tacit knowledge.[4] Innovation studies have also confirmed the importance of tacit knowledge and learning – including learning capabilities – in successful innovation processes. Further, any new pieces of knowledge – on 'its own', or embodied in product or process innovations – can only be exploited if adapted to the needs and circumstances of a given firm, introducing these innovations. (Dosi, 1988a, 1988b; Lundvall and Borrás, 1999) In other words, firms can only benefit from knowledge or 'technological spillovers' when they invest in learning and innovation (developing learning capabilities and innovation skills, etc.). Paraphrasing a widely used 'motto' of mainstream economic, there is no 'free lunch' in this respect, either. Thus, even at the highest level of abstraction – disregarding sector specific features –, the use of spillover as a basic concept for policy conclusions (i.e. trying to stop spillover) is misleading. (Langlois and Robertson, 2006)

It is even more worrisome that in many cases this term is used in a rather vague fashion, covering all types of linkages among firms, not only to denote unintended 'leakages'. Then the problems stemming from a 'loose' use of the term for policy conclusions can be even more severe.

Considering the automotive industry, the use of spillover models is even more questionable for several reasons. First, in this case it is highly relevant to make a distinction between the different directions of buyer-supplier relationships in terms of impacts. Just to illustrate, it is worth recalling the case of Magyar Suzuki. The original, mainly Japanese, suppliers of Suzuki have been strongly encouraged by Suzuki to ship certain parts and sub-systems to the new Hungarian (and other Central European) suppliers of Suzuki, and also to 'nurture' them by making available various organisational and managerial innovations. In these cases *suppliers have major impacts on buyers*, who are actually also suppliers, but in a different relationship. In those other relationships *the buyer*, namely Magyar Suzuki, *has significant effects on its suppliers* through its exacting demand, as well as the various types and forms of technical assistance it is offering to the new CEE suppliers. In brief, the suppliers must improve their performance by introducing new products, processes, as well as non-technological innovations.

Second there seems to be a contradiction between the general findings of the spillover literature and the sectoral characteristics of automotive industry. A survey of the spillover literature analysing the impacts of FDI in the top 10 transition economies suggests limited or negative intra-industry (horizontal) spillover and positive, significant inter-industry (vertical) spillover. (Damijan *et al.*, 1993) A widely held consensus among the analysts of automotive industry is just the opposite: there are major intra-industry impacts stemming from inter-firm relationships. (Bongardt, 1992, Jones, 1989, 1999; Lamming, 1993; Sako, 1997, 1998; Sako and Helper, 1998; Sako *et al.*, 1995; Sturgeon and Florida, 2000; Vickery, 1996; Womack *et al.*, 1991) Actually, given the composition of automotive production systems it is far from a trivial task to establish what intra-industry and inter-industry relationships are: practically all industries are suppliers of vehicle assemblers, and thus firms of several sectors (producing metal, plastic, rubber, glass, chemicals, leather, electric or electronic parts and sub-systems) belong to a given automotive production system.

Third, even the very notion of spillover is highly questionable in the context of automotive production networks, characterised by close co-operation, collective learning, and thus shared knowledge.

---

[4] The notions of information and knowledge are often used as interchangeable ones in mainstream economics, although the latter one is a much broader term: it encompasses the former one, which can be termed as codified knowledge, as well as tacit knowledge.

For the above reasons, alternative, more appropriate, theoretical frameworks are needed to support the analysis of the impacts of foreign investors on indigenous automotive firms. There are two promising, complementary candidates for this task, namely diffusion models and sectoral systems of innovation and production. The remaining parts of this section briefly introduce these concepts.

Diffusion models – as opposed to the strict sense of spillovers – include all sorts of dissemination of technological and organisational innovations, both intended and unintended. From a different angle, pecuniary relationships (e.g. licensing agreements), as well as other forms/ channels of diffusion (e.g. any sort of technological co-operation among firms belonging to a consortium or production networks, etc.) are covered by these models. (Dosi, 1992; Lissoni and Metcalfe, 1994; Metcalfe, 1988, 1990)

The notion of sectoral systems of innovation and production has been developed by Malerba (2002), and defined as follows: "a sectoral system of innovation and production is a set of new and established products for specific uses and the set of agents carrying out market and non-market interactions for the creation, production and sale of those products. Sectoral systems have a knowledge base, technologies, inputs and demand. The agents are individuals and organizations at various levels of aggregation, with specific learning processes, competencies, organizational structure, beliefs, objectives and behaviors. They interact through processes of communication, exchange, co-operation, competition and command, and their interactions are shaped by institutions. A sectoral system undergoes processes of change and transformation through the co-evolution of its various elements." (p. 248)

Although a full treatment of the Hungarian automotive innovation and production system cannot be provided here, the underlying principles of this theoretical framework are followed below when discussing the fundamental re-structuring of this sector, as well as its prospects.

3. Traditions of the Hungarian Car and car Components Industries

3.1. Craft Production before 1945

Cars, first assembled from imported kits, have been produced in Hungary since 1903. 1905 saw the first car designed and built by a Hungarian engineer, János Csonka. Bus manufacturing started in 1909. Preparation for World War I sparked production of cars, lorries, and engines. Ravages of war and The Great Depression hindered the sector in the 1920s. Recovery started in the 1930s, including the assembly of Ford models under a licence agreement. Motorcycle production commenced in the 1930s, too. First imported kits were assembled but local content had increased to ninety per cent by 1935. World War II boosted production again, particularly for military vehicles. (Berend and Ránki, 1955, 1958) All the major car parts – engines, gears, and chassis – had also been produced in Hungary until the mid-1940s. In other words, Hungary's vehicle manufacturers have not been mere assembly units of foreign companies, but have accumulated skills in automotive engineering, building upon a long tradition in mechanical engineering.

Hungarian engineers were rather successful in R&D in the pioneering period of the industry. The most notable ones were János Csonka and Donát Bánki who substantially improved the internal combustion engine in many ways in the 1880s and 1890s. Their most significant – but hardly acknowledged – achievement was the invention of the carburettor in 1893. Bánki also designed a new engine that raised efficiency fifty percent. These R&D results, however, were not commercialised in a large scale production in Hungary. Not even

the carburettor, what was re-invented by Maybach in Germany two years later, and that version became known all over the world.

3.2. Heritage of the CMEA

Automotive production facilities were ruined during the war. Manufacturing of motorcycles, buses, lorries, and other commercial vehicles resumed after the war.[5] Car production, however, was abandoned under a new industrial policy, which shaped Hungary's industrial structure to a CMEA-wide division of labour. The new policy first was influenced informally by Soviet advisors working in Hungary and then by a formal Soviet-Hungarian specialisation agreement signed in 1964. The accord co-ordinated the two countries' industrial development projects, including automotive manufacturing, in the wider context of CMEA. It also stipulated that Hungary would specialise in producing buses for the entire CMEA.[6] Ikarus, Hungary's bus manufacturing firm became one of the largest in Europe, turning out some 14,000 units a year in the 1980s.[7]

Bus manufacturing provided an excellent opportunity to make use of the considerable assets and skills accumulated in car components manufacturing companies, in spite of the lack of car manufacturing since the late 1940s. Hungarian suppliers also shipped car parts to other CMEA countries since the 1960s.[8] Certain automotive components, e.g. engines, axles, undercarriages and tyres for commercial vehicles as well as bulbs, batteries and dash boards for cars, were also exported for hard currencies (to Western Europe, the US and India).

As for R&D, hardly any original project was conducted in this period in a sharp contrast with the pre-war era. The pace of technological improvement was set by CMEA demand. Needless to stress how different these requirements were compared to those of advanced countries, given the severe shortage of cars and the lack of rigorous safety and environmental regulations. The only counterbalancing factor was that CMEA car manufacturers, expect Skoda, based their product development strategy on Western licences since the 1960s. Hence, their suppliers' products were also based on Western licences. The most advanced product and process technologies, however, were not made available through these licence agreements. In other words, it was a 'safe' way to maintain or even widen the technological gap. In fact, due to the lack of incentives to innovate – that is, no import competition at all, extremely long queues for effectively rationed cars, lack of up-to-date safety and environmental rules – CMEA car producers were happy in the 1980s with their 30-40-year old technologies. Their Hungarian suppliers, therefore, had hardly any opportunity and incentives to innovate, either. Those suppliers, however, that exported their products for hard currencies had no other choice than to continuously improve their products through up-to-date Western licences (e.g. from Bosch, MAN, KNORR, ZF, Girling, Lucas) and adaptive in-house R&D projects.

---

[5] Private companies - like in all other sectors, and in all other countries in the Soviet block - were nationalised by the late 1940s. Corollaries of nationalisation and central planning - most notably lack of competition - are not of sector specific, and thoroughly analysed in the literature, hence not discussed here.

[6] For a detailed analysis of the impacts of the agreement and the 'Central Automotive Development Programme' see Bauer *et al.*, 1980, Bauer and Soós, 1980, Soós, 1980 and Tárnok and Vince, 1980.

[7] Production was still 12,350 and 11,980 units in 1988 and 1989, respectively. Collapse of CMEA has caused a dramatic drop: output fell to 7,994 in 1990, and almost every year has seen a further decline since then. Output was a mere 1,576 units in 1994 and 1,162 buses in 1998, dropped to around 100 in the early 2000s.

[8] The single most important buyer has been the (former) Soviet VAZ (Lada) factory. Other significant customers have included the Polish FSO and FSM (Polski Fiat) companies as well as Dacia in Romania. Although (the former) Yugoslavia never joined the CMEA, Hungarian parts were also shipped to her car producer, Zastava (now in Serbia) until the UN embargo in the late 1990s. Given the lack of sectoral statistics for that period, data on aggregate automotive sales to the CMEA are not available.

4. RE-EMERGING CAR PRODUCTION IN HUNGARY

4.1. A policy dilemma

Hungarian government officials had long intended to re-establish car industry for two basic reasons. First, the severe shortage of cars was rather annoying in this reformed planned economy – often referred to as 'goulash communism' in Western media. This shortage resulted in an ageing, obsolete car population. (Havas, 1997) Second, the government also viewed car manufacturing as a means of industrial modernisation, with its exacting technical and organisational requirements. Industrialists also backed the idea as a major step toward integration into the world economy – and as another golden opportunity to obtain big slices of investment funds from the government. Eventually, two consortia were set up by Hungarian companies to promote the re-establishment of car industry in the late 1980s.

One question has, however, divided this apparently unified camp of promoters, namely whether to opt for large scale manufacturing of components for major car producers or to assemble cars again, after a rather long interval, lasting for almost 50 years.[9] It was also an open and much debated question whether to try to mount assembly operations within the framework of the CMEA, or in co-operation with the advanced countries. While the government pondered the issue, two foreign car companies – Suzuki and GM Opel – looking for favourable new locations and market opportunities, 'resurrected' the Hungarian car manufacturing in the early 1990s.

4.2. Magyar Suzuki

Magyar Suzuki, a Japanese-Hungarian joint venture located in Esztergom, some 50 km of Budapest, commenced commercial production of compact cars in October 1992. Investment has totalled $260 million by 1997. Then a further $146 million has been invested to produce a new small car, jointly developed with GM, but assembled separately under Suzuki and Opel badges in Esztergom and Gliwice, Poland, respectively. The Suzuki version is called Wagon R+, and its production is commenced in January 2000. The other new model, called Ignis, was introduced in April 2003. It also means that output will reach 100 thousand units a year. Diesel engines were also added to the product lines in November 2003.

Magyar Suzuki has constantly increased its output, employment and productivity, but was in the black for only 5 years since 1993, and even its 2002 profits were still somewhat modest. 2003, however, saw a significant improvement: pre-tax profits reached almost 10% of revenues. (Table 1) That was the sixth biggest improvement in that year, putting Magyar Suzuki at the rank of 19 in the list of companies by the size of pre-tax profit.[10] Soon it became one of the top exporting companies in Hungary (ranked seventh in 1997, eleventh in 2000, twelfth in both 2002 and 2003, and seventh again in 2004).

[9] These confronting opinions are described in more detail, e.g., by Somai, 1993 and Varga, 1990.

[10] The company making the largest amount of pre-tax profit is not necessarily the most profitable one in terms of return on investment (or any other relative measure).

Table 1: Major data of Magyar Suzuki, 1992-2004

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Domestic sales (units)	929	12,659	16,065	12,178	13,594	16,039	23,788	30,800	28,100	29,019	36,200	39,750	33,854
Exports (units)	–	–	3,309	23,873	38,183	47,700	42,001	35,600	49,600	56,171	49,200	50,200	66,438
Revenues (m HUF)	1,907	9,338	15,468	36,831	56,777	77,035	87,152	91,614	126,017	148,341	148,714	183,159	222,313
Domestic sales (m HUF)	1,903	9,272	13,098	13,333	15,652	19,117	31,867	43,026	41,359	49,329	63,661	79,574	77,318
Exports (m HUF)	4	66	2,370	23,498	41,125	57,918	55,285	48,588	84,658	99,012	85,053	103,585	144,995
Pre-tax profits (m HUF)	..	-6,840	-2,046	-351	887	1,651	16	-1,048	-5,853	-809	4,521	9,894	7,683
Employment (average, heads)	279	487	652	1,032	1,417	1,547	1,528	1,374	1,592	1,784	1,634	1,935	2,443

Source: Magyar Suzuki and press reports

The company aims at substantially increasing its market share in Europe, and hence 10 new models are to be introduced until 2007, though only two of them are produced in Esztergom. The first one has replaced the Swift model family. The second one is a new mini SUV, developed jointly with another member of the GM group at that time, namely Fiat. Following the example set by Wagon R+, the almost identical versions will be marketed wearing different badges: some 40 thousand units as Suzuki make, while around 20 thousand ones as Fiat models. To add these new cars to the current product lines, some $100 million has been invested at the Esztergom plant, doubling the capacity to 200,000 units a year. The pressing and welding plants are to be extended, and a new, water-based painting facility is to be added. Employment will be increased by 400 workers.

Supplier relationships

Supplier relationships, the overall performance of Magyar Suzuki and the broader institutional framework have always been closely related issues since the very beginning. Obviously, a major source of performance improvement is economies of scale, and the only way to achieve that is exporting cars to the European Union as the Hungarian market is simply too small to accommodate a large enough production run. The EU, in turn, requires a 60 per cent 'local', i.e. EU content. Otherwise, prohibitive tariffs are charged on cars shipped by non-EU firms. Thus, as Hungary only joined the EU in May 2004, Magyar Suzuki had to reach 60 per cent EU content in order to export it cars to EU markets. Moreover, it bought certain parts from its local suppliers in relatively low volumes – initially it only produced 30,000-40,000 cars a year – but followed a single-sourcing strategy. Therefore, it had very strong incentives to 'nurture' a local supply base in the beginning. With Hungary's accession to the EU, however, it has fundamentally changed, and accordingly Magyar Suzuki's supplier strategy has been revised.

In the first period, up until the 60 per cent EU content had been reached, Magyar Suzuki had made special efforts to find viable suppliers and improve their performance. Together with its Japanese suppliers, it had conducted a thorough technological and financial audit, covering literally every single aspect of doing business from purchasing inputs through production methods and machinery, to accounting, sales and management, broadly defined. Then joint efforts had also been made to improve the selected supplier's technical level and economic performance, when needed.

Pressing, welding, painting and assembly account for around 20-22 per cent of a Suzuki Swift's value and carried out by Magyar Suzuki itself.[11] Local content, including the above in-house activities, was only 25 per cent in October 1992, but it almost doubled (48 per cent) by the end of 1993 given an extensive and rapid localisation programme. Since then localisation has continued at a much slower pace, reaching 53 per cent by 1997.[12] Magyar Suzuki intends to keep importing the more advanced components, such as engine, transmission and undercarriage, from Japan. As these sub-systems account for around 20 per cent of value-added, the theoretical maximum of local content is 80 per.

Originally it seemed unlikely that Hungarian suppliers could export their products to the Japanese plants of Suzuki Motor Corp., given the significant lag in productivity and

[11] Magyar Suzuki is also involved in producing some metal parts, and thus its share in total value-added has been slightly higher, i.e. 23-24 per cent, since 1993.

[12] Parts and components produced by local suppliers include clutches, battery, seats, seat belts, horn, windscreen wiper, instrument panel, dashboard, wiring harnesses, shock absorbers, bowden, glass, paint, upholstery, rubber and plastic parts as well small, simple pressed metal parts. In other words, these are mid-tech products, at best, and do not constitute high value-added goods.

substantial transportation costs, let alone the then shrinking demand for new cars in Japan. Yet, the joint endeavours of Magyar Suzuki and its Hungarian suppliers resulted in a breakthrough in a few years: exports of rubber and plastic parts to Japan started in late 1994, while springs have been shipped since October 1995. Eight Hungarian suppliers were involved in these activities in 1995, and 3 others joined this 'club' in 1996.

In this period, Magyar Suzuki developed a detailed statistical system to monitor the process of reaching the required 60 per cent of EU content. (Table 2)

Table 2: Distribution of value added at Magyar Suzuki, 1992-1998 (per cent)

	1992	1993	1994	1995	1996	1997	1998
(1) Magyar Suzuki	19	23	23	23	24	24	24
(2) Hungarian suppliers	6	25	27	28	29	29	29
(3) *Local content (1+2)*	*25*	*48*	*50*	*51*	*53*	*53*	*53*
(4) EU suppliers*	4	11	12	14	17	17	17
(5) *EU content (3+4)*	*29*	*59*	*62*	*65*	*70*	*70*	*70*
(6) Japanese suppliers	71	41	38	35	30	30	30
(7) Total (5+6)	100	100	100	100	100	100	100

Source: Magyar Suzuki

* Including associate members of the EU

In brief, Magyar Suzuki had played a substantial role in diffusing new products, production processes, as well as managerial and organisational innovations among its Hungarian suppliers. This should be regarded as a significant contribution to overcome the legacy of the planned economy period in terms of upgrading the technological level of domestic suppliers and improving their performance by introducing new management techniques and learning new types of behaviour, required by the rules of market economy.

The second phase of Magyar Suzuki's supplier strategy started at the end of the 1990s, when the EU content has been stabilised well above the 60 per cent level required for customs-free exports to EU markets. Since then, no special efforts have been made to 'nurture' the domestic suppliers. Those firms, which have been unable to improve their performance, i.e. stuck at the level of merely assembling parts imported from Japan, in spite of the sustained technical – and sometimes financial – assistance of Magyar Suzuki and its Japanese suppliers, provided for many years since the early 1990s, are not awarded any new businesses because they proved unable to develop. Some 10 Hungarian suppliers have had this fate. Those ones that have improved their capabilities – often by investing in new machinery and sometimes in new buildings, too, and thus enhanced their competitiveness – retained their position as suppliers.

In this phase, no statistics are available on the distribution of value added at Magyar Suzuki. Only the number of suppliers can be compared in the two distinct stages of the company's supplier strategy. Magyar Suzuki had 34 suppliers based in Hungary in 1995, 41 in 1996 and 45 in 1998. A further 35 suppliers shipped various parts to Magyar Suzuki in 1996 from EU countries, and 3 ones – all partly or wholly foreign owned – from Central and Eastern European countries. In 2003, 320 suppliers provided either products or services for Magyar Suzuki, of which 66 were operating in Hungary. As no ownership data are kept concerning the suppliers, it is only an estimate that some 40-50 of these 66 firms are owned by domestic investors. As for other Central European countries, around 30 Polish, 20 Czech, 5 Slovak and 4-5 Slovene suppliers have businesses with Magyar Suzuki.

It is simply not possible to keep such intense relationships with 320 suppliers as Magyar Suzuki had to do when it was aiming at achieving the 60 per cent EU content as

quickly as possible. In the current phase, the most they offer is to facilitate liaising with Japanese suppliers for those indigenous or other Central European suppliers that want to develop their competences by co-operating with the long-established suppliers of Suzuki Motor Corp. Another form of a 'reserved' assistance is organising study tours to visit the plants of Japanese suppliers. Every other year 10 Hungarian suppliers can benefit from this exchange programme, co-financed by Magyar Suzuki itself, ITD Hungary[13] and the participating Hungarian firms.

The suppliers for one of the new models had already been selected by 2003 as production commenced in 2004. As for the jointly developed mini SUV, introduced in 2005, the selection process was also underway already in 2003. Whenever a new model is added to the product lines, all suppliers have to bid, even those with whom Magyar Suzuki has had long-established relationships. Experience suggests, however, that some 80 per cent of suppliers can keep businesses after a model change.

The new Swift model is produced at several plants besides Esztergom, and thus suppliers should be able to produce in relatively large runs, as well as shipping their parts to different locations. Similar demand had to be met by those suppliers who have been involved in the Wagon R+ project.[14] Some 80 per cent of the parts of the two versions (Opel and Suzuki) of this car are shared, and thus GM Opel and Magyar Suzuki selected together the suppliers. In that case, the purchasing departments of Magyar Suzuki and Opel Hungary (see the next sub-section) were closely co-operating. As GM has a 20 per cent stake in Suzuki Motor Corp, the parent company of Magyar Suzuki, in principle this sort of co-operation can be an every day practice between the two Hungarian affiliates of the (extended) GM group. This would be rather advantageous for their suppliers: having become e.g. a Magyar Suzuki supplier would mean to get access to the Opel market, and thus much larger, supposedly more profitable production runs. However, the Wagon R+ (Agila) project has been a one-off co-operation between these two purchasing departments of the GM group operating in Hungary.

Following the general industrial practice, T1 suppliers of Suzuki Motor Corp are participating in developing the components and sub-systems of new models. None of the Hungarian suppliers have reached that level, and it is unlikely to happen in the foreseeable future. Simply it would be too big a jump to close the gap between themselves and the established T1 suppliers, such as Bosch, Denso, Delco, Temich and the like, in terms of financial muscles, technological competences and organising capabilities so as to co-ordinate T2 and T3 suppliers' activities, providing support to improve their quality assurance and logistics systems, etc.

The Hungarian suppliers are not mere screw-driving plants, either, as already mentioned. Besides production capabilities, they have had to accumulate important technological competences, too: they have to be able to make the final drawings of components, relying on a so-called surface design provided by Magyar Suzuki, as well to design dedicated tools and the overall production process. Usually the simple tools are produced by the suppliers themselves, while the more complicated ones are made by specialised firms. It is an exception, rather then a rule, when Magyar Suzuki provides the tools, e.g. in case of last minute design changes.

---

[13] ITD is an investment and trade development agency of the Hungarian government, under the auspices of the Ministry of Economy and Transport.

[14] As already mentioned, that model had been developed jointly with another part of the GM group, namely Opel, and produced both in Poland (Gliwice) as Opel Agila and Hungary.

A potential channel of spillover for a supplier could be to poach Magyar Suzuki employees, e.g. engineers either from the production or purchasing department. It has not happened since the early 1990s, although around a dozen engineers have left the Esztergom plant. None of them, however, has joined any Magyar Suzuki supplier: instead, they work in different industries or for automotive firms with no links with Magyar Suzuki. In any event, Magyar Suzuki would take it as a rather 'unfriendly' move, and most likely would stop doing business with such a supplier as that firm could gain sensitive ('insider') information on Magyar Suzuki practices and procedures.

To sum up, Magyar Suzuki has provided its Hungarian and other Central European suppliers with various sorts of technological and managerial knowledge (know-how) on purpose, as it did need to 'nurture' a local supply base to reach the required 60 per cent EU content as quickly as possible. To achieve this goal, it was inevitable to develop close co-operation with the selected suppliers, previously accustomed to the standards and norms of the planned economy, in order to 'drive' them into a different system, namely market economy. Not all 'students' have completed this on-the job training successfully, but most of them have adjusted to the new requirements, and now are able to meet the exacting demand in terms of technological level, timely delivery, and efficient, profitable conduct of business. In that sense Magyar Suzuki has significantly contributed to the diffusion of new products, production processes as well as managerial and organisational innovations, i.e. to develop suppliers' capabilities. Once the 60 per cent EU content had been achieved, Magyar Suzuki has not had strong incentives any more to continue this supplier strategy. Since then, it has made far less significant efforts to develop its local supply base. The current assistance, however, is still not negligible. In short, the diffusion of technological and organisational innovations among Hungarian and Central European firms has been promoted actively and on purpose by Magyar Suzuki, while spillover effects, strictly defined, seem to be insignificant.

4.3. Opel Hungary

Opel Hungary Vehicle Manufacturing Ltd. opened the other Hungarian car assembly plant and an engine factory in a customs-free zone at Szentgotthárd, close to the Austrian border, in 1992, too. Initially GM Opel had invested over DM400 million. Opel Astras were produced in Hungary until December 1998. Parts purchased in Hungary initially accounted for merely 4 per cent of an Astra's value, then 9.6 per cent in 1995-1998.

As for the engine factory, its original capacity had been doubled to 460,000 units a year (i.e. around one-fourth of the total European production of Opel), and cylinder heads had also been added to the product lines due to further investment projects completed by 1996, worth of DM47 million, and DM210 million, respectively. Actual output primarily depends on demand for Opel models in Western Europe as the vast majority of production had been exported to Opel assembly plants even in until 1998 (when cars were assembled in Szentgotthárd), and 100% is exported since then. Due to these secure markets, Opel Hungary was in the black already in the second year of its operation. (Table 3) It made the third largest profits in Hungary in 1997, and was the fourth largest exporter. These results were repeated in the following years, too: the fourth largest profits before taxation in 2000, and still the sixth largest exporting company, in spite of a slight decrease. Its ranking in 2002 was fifteen and seven, while in 2003 sixteen and six, respectively.

Table 3: Major data of Opel Hungary Powertrain, 1992-2004

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Car production (units)	9,401	13,344	12,282	12,488	11,255	12,700	9,700	–	–	–	–	–	–
Car exports (units)	2,736	3,220	2,254	3,956	2,480	2,736	1,208	–	–	–	–	–	–
Engines (units)	20,511	75,741	160,033	266,051	310,034	368,000	417,000	511,813	480,030	399,945	417,905	..	456,199
Gearboxes, Allison (units)	–	–	–	–	–	–	–	–	317	6215	9,939	..	10,354
Gearboxes, CVT (units)	–	–	–	–	–	–	–	–	–	–	26,140	..	..
Revenues (m €)	89	178	302	542	557	660	717	751	671	564	664	..	..
Revenues (m HUF)											148,108	167,404	140,283
Exports (m HUF)	1,691	8,402	29,151	90,178	99,761	121,832	168,248	189,088	177,298	147,306	148,108	167,404	140,283
Employment, Opel Hungary	528	495	666	778	933	1,203	1,104	1,024	956	831	822	844	814
Outsourced employment	164	181	195	227	281	332	351	340	445	444	440	..	..
Value added (m HUF)	-705	2,971	9,470	19,277	30,289	44,607							
Value added (m €)							233	312	313	339	316	..	..
Pre-tax profits (m HUF)	-1,343	736	6,095	14,584	20,691	32,246	33,305	42,296	28,461	-59,563	10,835	11,055	6,120

Source: Opel Hungary Powertrain and press reports

The end of car assembly has not meant that Opel would withdraw from Hungary; on the contrary, further investment projects had been completed to add gearboxes to the product lines. Thus, gearboxes have also been produced in Szentgotthárd since September 2000. First Allison gearboxes for commercial vehicles, and then Opel had spent DM230 million to build a new gearbox factory with a capacity of 250,000 units a year for cars. Production of these so-called CVT gearboxes commenced in January 2002. In the meantime, the capacity of the engine plant has been increased to 650,000 units a year, and that of the cylinder heads to 530,000 units a year. With these projects, GM Opel's investment in Hungary has totalled 600 million euros (DM1.2 billion) by 2003.

Supplier relationships

As already mentioned, the assembly of Opel Astras was relocated to Poland at the end of 1998 as Opel concentrated all its car production meant for Central and Eastern European markets in its new Polish plant. In the period of 1992-1998, the vast majority of parts and components were imported from Germany; essentially it was a CKD operation. Local content remained below 10 per cent.

Opel Hungary, as opposed to Magyar Suzuki, has never been 'forced' to reach a certain level of local content as the cars assembled in Szentgotthárd were sold in the domestic market, and thus EU rules controlling access to the EU markets did not matter. In spite of that, they were trying to find local suppliers to reduce production costs. Most of its local suppliers were Hungarian subsidiaries of its long-established Western European partners. This is the second distinctive characteristics of Opel Hungary, compared to Magyar Suzuki: it prefers working with its well-known suppliers, and thus has encouraged them to set up their operations in Hungary, either investing in green-field plants, or taking over domestic firms, and transferring their technologies as well as managerial techniques to upgrade their skills and competences.

The third distinguishing feature is that Opel Hungary seeks suppliers not only for its Hungarian operations but for other GM plants all over Europe, too. That means, on the one hand, that investments by its long-established suppliers in Hungary have not proved meaningless. On the other hand, production runs, i.e. several hundred thousand units a year, are not a problem either, and thus Hungarian suppliers could rely on economies of scale.[15]

Opel Hungary only had 10 local suppliers in 1996, and 35 ones in 2003, together with 5 ones in Romania and one in Slovenia.

Table 4: Central and Eastern European suppliers of Opel Hungary, 1996-2003

	1996	1997	1998	1999	2000	2001	2002	2003
CEE suppliers	10	13	17	26	29	33	35	41

Source: Opel Hungary

The rising number of local suppliers has been reflected in the value of purchased components for other GM plants. It amounted to DM118 million in 1994, i.e. worth 7.5 times more than Hungarian parts, materials and services bought for Opel Astras assembled in Szentgotthárd. Components exports to GM factories have substantially and continuously

[15] This 'internal' market further increased during the (short) period of strategic partnership between GM and Fiat. Accordingly, the purchasing department in Szentgotthárd was integrated into GM-Fiat Worldwide Purchasing during the partnership.

increased ever since then, reaching DM250 million (€125 million) by 1997, and €360 million by 2003. Purchasing contracts made by 2004 for 2006 worth over €500 million.

Most of the components purchased are aluminium and other metal parts for car assembly operations in other GM plants. In other words, the majority of engine and gearbox components are still imported, although the engine and gearbox factories could provide good business opportunities for Hungarian suppliers, as far as production run is concerned. Western foundries and engineering firms, however, have set up either their subsidiaries in Hungary – either by taking over existing firms or investing in green-field plants – given the promising market opportunities provided by the expanded Opel engine and gearbox plants and the Audi engine plant opened in late 1994. (see the next sub-section) For example, Hydro (previously known as VAW) has opened its green-field aluminium foundry in Győr, close to the Austrian border, just to serve the Austrian and Hungarian engine plants of Opel.

GM (Opel) also involves its T1 suppliers in developing components and sub-systems for new models. The basic concept is devised by GM, and once the supplier is selected, the details are elaborated jointly. As far as the production process is concerned, its development is the responsibility of the supplier entirely. Suppliers working with the purchasing department in Szentgotthárd are participating in the design of headlamps (SAPU), components of gearboxes (Linamar), car stereos, air-conditioners and airbag control equipment (Delphi); they are all foreign-owned.

The smaller suppliers are supported by Opel Hungary's engineers in the framework of its supplier development programme: technological, managerial, organisational, business planning and quality assurance knowledge is transferred in this way.

Licences are not sold by Opel, and thus this channel is not used to diffuse the R&D results. Tacit knowledge, gained at Opel, however, is transferred to other companies in various ways. The usual form is that employees leave, quite often for higher positions at suppliers. At the first glance, it is a loss from the point of view of Opel Hungary; yet, the resources used to train these employees are not regarded as a waste. As finding new suppliers has become an important task, it is obviously easier to work with suppliers where former Opel employees are in high-ranking positions. In these cases it is much more simple to 'develop' these suppliers: besides the formal training workshops, run by Opel Hungary, the day-to-day activities of the former Opel employees can also contribute significantly in various ways to the transfer the various Opel techniques and methods so as to upgrade the competences of the new suppliers. E.g. the former Opel employees can answer all sorts of questions, knowing the nitty-gritty from their own experience, i.e. in many cases there is no need to seek an 'official' meeting with Opel Hungary engineers. They can also offer short, problem-oriented internal training sessions to put the required Opel methods in place.

Another method of knowledge spillover in market economies is setting up spin-off companies, quite often with the explicit, financial support of the 'parent' company so as to streamline its activities, but in the meantime establishing a sound, reliable basis for outsourcing, and thus cutting costs without taking too high a risk. It is not a wide-spread practice in Hungary yet, but there is a rather interesting example at Opel Hungary.

Tool management, that is, designing new tools, producing or purchasing them, as well as maintenance of tools, is an important task at the Szentgotthárd plant, due its activities (machining parts for engines and gearboxes). In the beginning, an internal unit was dealing with these tasks, but it was decided to outsource these activities to a newly established small firm, set up by some Opel Hungary employees, together with two German tool making firms and an Austrian one. Since then it has grown to a successful firm with some 40 employees,

working for other Opel plants, too. Moreover, they are also running training courses on tool management. It is a rather unusual development: when applying for visa to teach at one of those courses in Germany, the civil servant dealing with that application at the consulate wanted to correct the term of "teaching" into "learning"[16] as most Hungarian learn, rather than teach abroad.

4.4. Audi Hungaria Motor Kft (AHM)

A third car producer joined in 1998. Originally Audi AG has invested in Hungary in a new engine manufacturing plant, its first 100 per cent-owned manufacturing base outside Germany. Audi Hungaria Motor Kft (AHM), located in Győr, western Hungary, was opened in October 1994. It was the first engine plant in the world to manufacture five-valve, four-cylinder, engines in commercial production. This new engine generation is built into Audi, Volkswagen Passat, SEAT, and Skoda models. Production of six- and eight-cylinder petrol engines has also been re-located to Győr. Moreover, two new sport models, TT Coupe and Roadster have been assembled since April 1998, and July 1999, respectively, at AHM. A third model, A3 was added in 2001. Output has been increased in several steps, and further engine components have also been added to the product lines, Audi has, therefore continuously invested in its Győr plant, amounting to over €2300 million by 2004. (Table 5)

Table 5: Cumulative investments by Audi Hungaria Motor Kft, 1994-2004 (€ million)

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
130	163	339	343	513	819	1,074	1,258	1,511	1,840	2,335

Source: Audi Hungaria Motor

Audi Hungaria Motor assembled over 100,000 engines in 1995, in its first full year of operation, and nearly 1.5 million in 2004. (Table 6) AHM was ranked second among the exporting companies already in 1997 (producing almost 600,000 engines that year), and became number one in 1998, retaining that position since then. It made the sixth largest profits before taxation among firms registered in Hungary in 1997, and was ranked second both in 2000 and 2001, while third in 2003.

Audi opened a new engine development centre in Győr in June 2001, initially investing €18 million. The main task of the centre is to develop production technologies to cut costs, and to improve the performance of existing engines. It has been an inevitable step since Győr has become the engine production base for the company. It might also be rational to perform some design and/or engineering tasks in Győr related to the sport models, as those are only assembled in Hungary. A further €8 million was invested in 2004 t extend the centre, doubling the staff to 100.

A new tool shop was opened in September 2005, as a result of a €40 million investment project. This new unit currently employs 170 workers, to be extended to 320. It is also pressing body parts for specialty models, produced in small runs, e.g. for Audi RS4.

[16] These terms are rather close in German: 'lehren', and 'lernen', respectively. Thus, the assumption was that the Hungarian applicants had made a mistake.

Table 6: Performance of Audi Hungaria Motor Kft (AHM), 1995-2004

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Engines (units)	104,159	196,352	584,665	986,773	1,001,912	1,060,828	1,220,217	1,280,067	1,334,985	1,480,630
Cars (units)	–	–	–	13,593	52,579	56,776	55,296	53,605	32,337	23,589
Revenues (m HUF)	27,853	54,068	188,925	482,688	720,854	900,597	853,799	838,011	975,928	n.a.
Revenues (m €)	149	266	851	1,889	2,828	3,399	3,466	3,552	3,772	3,924
Exports (m HUF)	27,853	54,025	188,735	481,797	720,286	899,695	853,000	836,504	974,430	n.a.
Employment (end of year)	309	1,011	2,204	3,425	4,312	4,831	4,848	4,828	5,014	5,074
Pre-tax profits (m HUF)	2,811	4,386	15,900	44,343	65,992	84,379	68,259	66,257*	82,371	n.a.

Source: Audi Hungaria Motor and press reports

* Profits after taxation

Supplier relationships

Audi AG has not committed itself to increase the level of domestic sourcing. Local suppliers account for 5 per cent of the value of engines assembled in Győr. All the major components of engines are machined in Győr, using imported casts. AHM managing directors intend to purchase casts and forged parts from Hungarian suppliers. So far a few local – usually at least partly foreign-owned – companies have won orders, shipping machined parts for the engine plant and seats, aluminium and plastic parts for the car assembly plant. Casts are supplied by another foreign-owned firm (originally German, and then taken over by Norwegian investors) based in Győr.[17]

AHM buys inputs through the Volkswagen Group purchasing department (to cut prices of raw materials and components bought in large volumes). This also means that suppliers, capable to meet Audi requirements, could increase their chance to win further orders from other VW firms. Audi buys various products and services worth €70-80 million a year from Hungarian companies for AHM plus various parts worth DM40-50 million for other VW subsidiaries. The latter amount is projected to increase to €100 million.

5. RE-STRUCTURING COMPONENTS MANUFACTURING

5.1. Industry definition: a methodological note

Automotive component manufacturing was not considered a separate industry in international statistics until the 1980s. In the first decades of car manufacturing, independent companies supplied parts as a side business, along with machines, instruments, and parts for other transport equipment, such as bicycles and carriages. Later, car manufacturers either acquired their suppliers or established in-house production of components. Thus information and statistics on this sector used to be subsumed under the automobile or motor vehicle industry. In the 1980s, however, automotive parts emerged as an important industry in its own right because of changes in technology, organisation and trade. The role of component suppliers increased not only in production but also in design; their technical and economic performance has became a key factor in the competition among car manufacturers. Thus the sector now is a new 'entry' in statistics due to its economic significance. A simple reason is that on average 10000-12000 parts are built into a car, accounting for some 50-70% of the manufacturing cost of an automobile.

As a very wide range of products are used to assemble a motor vehicle – practically all industrial sectors supply the automotive industry –, readily available statistics are usually too narrow in terms of coverage. In other words, quite a few automotive suppliers are classified as leather, rubber, plastics, paint, glass, cable or metal producing and processing companies, foundries, electrical and electronics companies, etc. The EU statistical classification also follows this line, i.e. *motor vehicle parts and accessories* (NACE 34.30) excludes engine and tyre manufacturers, most of the electrical and electronic components, as well glass, plastic or certain castings and other metal parts.

[17] It also serves two Opel engine plants nearby: one operating in Szentgotthárd, the other in Austria.

The current Hungarian statistical classification system,[18] practically in harmony with the EU methodology, identifies four automotive sub-sectors:

- manufacture of electrical equipment for engines and vehicles (3161);
- manufacture of motor vehicles (3410);
- manufacture of bodies (coachwork) for motor vehicles (3420), and
- manufacture of parts and accessories for motor vehicles and their engines (3430).

5.2. Performance of the Hungarian automotive components suppliers

Two of these sectors are relevant for this study: manufacture of electrical equipment for engines and vehicles (3161) (henceforth: electrical automotive components), and manufacture of parts and accessories for motor vehicles and their engines (3430) (henceforth: manufacture of automotive components). Although these names might suggest that these two sectors cover at least the majority of automotive suppliers, this is not the case: just as in the EU statistics on the automotive components sector, a wide range of products are excluded (e.g. engines, tyres, glass, plastic, castings and other metal parts as well as bulbs). For this reason available statistics only included 150-160 firms in the early 1990s, while experts estimated that altogether some 300-350 companies were producing motor vehicle parts and components in Hungary.[19] Partly due to a better statistical coverage, and in part due to a genuine increase in the number of companies, the 2001 data already covered some 250 firms in two sectors, namely 3161 and 3430.

These two sectors have significantly increased their sales: the 2003 output of electrical automotive components was around 13 times as much as in 1992, and the other sector – from a much higher absolute level – grew almost 7 times bigger than in 1992, using constant [1992] price data.[20] (For current price data, see Tables 7-8.) The export intensity of these sectors is also worth noting, particularly in the case of the electrical automotive components (3161), where the ratio of exports to sales further increased from an already high level: from 58 per cent in 1992 to around 90% in 2004. Thus, it can be established beyond doubt that these companies face a fierce competition: given the globalised nature of the automotive industry and the liberal import regime there is a strong rivalry in their domestic market, and they also face harsh competition in their export markets, where the bulk of their output is shipped. Moreover, their financial performance has significantly improved, too, i.e. they are

[18] It was introduced in 1992. Previously components manufacturing, in line with the previous international methodology, was treated as part of the automotive industry. Hence no data on components manufacturing are available prior 1992, and thus the current performance of the sector cannot be compared to the one in the pre-1990 period. In other words, it is not possible to analyse the results of the restructuring process statistically.

[19] The primary producers are Rába (diesel engines and axles for commercial vehicles), Bakony Művek (electrical parts), MMG (instrument panels), PEMŰ, TVK, Kaloplasztik, Kunplast (all plastic parts), Perion (batteries), IMAG (seats, wiring harnesses), Videoton (printed circuits, electrical parts and wiring harnesses), Knorr-Bremse (brakes), ADA, Pre-cast and Le Belier (all foundries), GE Tungsram (lighting) and Taurus (rubber parts). Besides these long-established Hungarian companies – some of them already privatised by foreign investors as their new names suggest – well-known foreign companies have also set up their subsidiaries, e.g. Akzo (paints), Bosch, Ford (electrical parts), Cascade and Happich (plastic parts), Denso (fuel pumps), ITT Automotive (electrical parts and wiring harnesses), Michels Kabel (wiring harnesses), Packard Electric (electrical parts and wiring harnesses), UTA (wiring harnesses), VAW (castings) and ZF (gearboxes). The major customers are the local car assemblers, Western European carmakers and their first-tier suppliers, as well as North American commercial vehicle companies.

[20] Constant 1992 prices have been calculated by taking into account producer price indices for these two sectors, or for some years the nearest available ones, e.g. indices for the sector 316, instead of the ones for 3161.

not ‘buying’ export markets at the expense of their profits.[21] Thus, their impressive growth in 1992-2005 is even more remarkable. Figures indicate that the underlying factor of their success is improved labour productivity: measured as value added per employees, in real terms it has increased by 2.5 times in the electrical automotive components sector (3161), and doubled in the other one (3430).[22] Another ‘proxy’ for labour productivity can be sales per employees; then one can observe a 3.6-fold increase in the case of electrical automotive equipment, and a 3.5-fold improvement in the case of automotive components (using constant price figures). Case study evidence suggests that this noteworthy improvement is thanks to the introduction of new processes and management techniques (see Sections 4.2-4.4), and in a number of cases due to the modernisation of equipment, too, reflected in the increase of assets (by around 7 times, in both sectors, using historical asset pricing).

[21] Yet, the profitability of the components sector (3430) – measured as net profits/sales – was rather low until 1997, and fluctuating in the range of 8.6-10.6 per cent since 1998. The other sector (3161) is rather volatile in this respect: it was in the red until 1995, then fared quite well in 1996-2000 (with a net profit/sales ratio between 6.9 and 10.7 per cent), and performing significantly below that level in 2000-2003.

[22] GDP implicit price indices have been used to ‘deflate’ current price value added figures. Of course, only an indication of real term value added figures can be calculated in this way; a proper method would be to use GDP deflators at a sectoral level, but those indices are not available. That is why another indicator is also used here: sales per employees, using sectoral producer price indices to calculate real term sales figures.

Table 7: Manufacture of electrical automotive components (3161), 1992-2005

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2005/1992*
Number of companies	32	39	41	42	49	57	61	62	60	69	72	78	96	89	278.1%
Sales (m HUF**)	8,208	16,408	27,655	38,578	63,539	95,486	133,741	191,706	236,945	250,648	212,794	280,396	270,608	305,430	3721.1%
of which: exports (m HUF)	4,758	4,983	16,923	28,150	54,588	85,367	107,173	155,498	216,253	226,586	190,115	252,983	242,510	..	..
Exports/sales (%)	58.0	30.4	61.2	73.0	85.9	89.4	80.1	81.1	91.3	90.4	89.3	90.2	89.6	..	..
Employment (average, heads)	5,658	6,464	7,070	7,619	10,667	13,189	14,888	16,622	23,630	17,605	19,409	20,033	20,419	22,511	397.9%
Pre-tax profits (m HUF)	-1,070	-558	-1,405	-1,527	4,815	9,243	10,050	13,845	26,395	16,713	9,870	18,307	..	..	..
Net profits (m HUF)	-1,140	-651	-1,487	-1,625	4,512	9,100	9,661	13,147	25,386	15,506	8,450	13,037	..	..	..
Assets (m HUF)	8,218	11,628	12,113	14,730	21,638	28,916	35,790	44,243	52,640	65,207	46,185	60,066	..	..	..
Value added (m HUF)	2,098	4,466	7,634	8,785	19,980	32,565	38,802	49,968	59,726	62,848	60,311	80,163	75,593	80,091	3817.5%
Sales/employee (m HUF)	1.5	2.5	3.9	5.1	6.0	7.2	9.0	11.5	10.0	14.2	11.0	14.0	13.3	13.6	935.3%
Value added/employee (000 HUF)	370.8	690.9	1,079.8	1,153.0	1,873.1	2,469.1	2,606.3	3,006.1	2,527.5	3,569.9	3,107.4	4,001.5	3,702.1	3,557.9	959.5%
Net profits/sales (%)	-13.9	-4.0	-5.4	-4.2	7.1	9.5	7.2	6.9	10.7	6.2	4.0	4.6	..	..	..
Value added/sales (%)	25.6	27.2	27.6	22.8	31.4	34.1	29.0	26.1	25.2	25.1	28.3	28.6	27.9%	26.2%	102.6%

Source: Ecostat and author's calculation

* In case the 1992 data are negative, 1996 is used as a base year

** Current prices, throughout the table

Table 8: Manufacture of parts and accessories for motor vehicles and their engines (3430), 1992-2005

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2005/1992*
Number of companies	88	116	118	132	137	155	165	173	178	180	176	179	224	218	247.7%
Sales (m HUF**)	24,335	32,272	40,949	62,217	85,814	146,793	218,670	273,930	358,961	412,528	398,180	522,915	605,927	733,764	3015.3%
of which: exports (m HUF)	14,053	17,689	23,038	40,377	56,655	105,615	172,223	223,116	309,087	331,985	346,287	445,015	532,530		3166.7%
Exports/sales (%)	57.7	54.8	56.3	64.9	66.0	71.9	78.8	81.5	86.1	80.5	87.0	85.1%	87.9%		147.4%
Employment (average, heads)	14,238	14,914	15,091	15,490	16,574	19,485	21,753	22,079	22,436	24,720	22,189	26,673	27,614	29,319	205.9%
Pre-tax profits (m HUF)	-77	582	1,014	3,292	3,107	8,743	23,989	31,231	41,907	39,470	41,059	58,772	..	..	..
Net profits (m HUF)	-154	318	889	3,030	2,751	8,303	23,098	27,795	37,402	35,471	36,914	49,879	..	..	..
Assets (m HUF)	24,040	24,891	26,133	28,310	48,116	70,095	93,983	105,267	117,025	149,364	141,699	169,020	..	..	..
Value added (m HUF)	9,243	11,523	14,631	20,123	24,520	40,486	62,089	79,961	102,648	117,089	114,445	147,709	164,104	182,781	1977.5%
Sales/employee (m HUF)	1.7	2.2	2.7	4.0	5.2	7.5	10.1	12.4	16.0	16.7	17.9	19.6	21.9	25.0	1464.3%
Value added/employee (000 HUF)	649.2	772.6	969.5	1,299.1	1,479.4	2,077.8	2,854.3	3,621.6	4,575.1	4,736.6	5,157.7	5,537.8	5,942.8	6,234.2	960.3%
Net profits/sales (%)	-0.6	1.0	2.2	4.9	3.2	5.7	10.6	10.1	10.4	8.6	9.3	9.5%	..	..	..
Value added/sales (%)	38.0	35.7	35.7	32.3	28.6	27.6	28.4	29.2	28.6	28.4	28.7	28.2%	27.1%	24.9%	65.6%

Source: Ecostat and author's calculation

* In case the 1992 data are negative, 1993 is used as a base year

** Current prices, throughout the table

5.3. Ownership Patterns

As far as ownership is concerned, a wide variety of forms can be observed. For qualitative analytical purposes it is worth listing the actual ownership forms:

A) Dominant Foreign Ownership

A.1 Green-field investments with 100 per cent foreign ownership. For the purpose of further analysis, it is useful to identify two sub-sets in this group:

A.1.1 Subsidiaries of car manufacturers: AUDI Hungaria Motor Kft., Visteon Hungary Kft (Ford), Opel Hungary

A.1.2 Subsidiaries of component manufacturers: e.g. Bosch, Continental Teves (ITT Automotive Hungary before 1998), Lear (formerly United Technologies Automotive Hungary), Denso, Hydro Aluminium Győr Kft (previously VAW), Michels Kabel, Keiper-Recaro

A.2 'Brown-field' investments: former state-owned companies privatised by foreign investors, e.g. Knorr-Bremse, (Delco) Remy, ZF

B) Dominant Hungarian Ownership

B.1 State-owned companies

B.2 Privatised former state-owned companies:[23] e.g. Bakony Művek Rt., MMG Automatika Rt., Perion Akkumulátorgyár Rt.

B.3 Private companies, i.e. firms established by Hungarian entrepreneurs, e.g. ABF Bowdentechnika Kft

B.4 Joint ventures with dominant Hungarian private ownership, e.g. RATIPUR Car Equipment Co.

Individual companies can be relatively easily classified using these categories, although some companies might have started with green-field sites and taken over existing plants as a brown-field investment at a later stage as they extended their activities in Hungary – or the other way around, e.g. Bosch. As for a more rigorous quantitative analysis at a sectoral level, however, a number of methodological problems arise. First, it is needless to stress that ownership changes have been quite frequent in these sectors, especially until the late 1990s, and hence the overall picture, i.e. the ratio of different ownership forms, has been constantly changing. Therefore, from the point of view of economic analysis, it is a 'moving target'.

Second, given the lack of readily available statistics, it is not possible to precisely establish the ratio of private and state ownership. While seven distinct types of owners are recognised in the Hungarian statistics, namely the state, municipalities, domestic individuals, domestic corporations, ESOP, foreigners and co-operatives, published statistics only provide figures on state-owned and foreign-owned equity. Moreover, one category of ownership – namely 'domestic corporations', that is, share holding and limited liability companies – does not distinguish private and state ownership.[24] Bearing in mind these methodological limitations, available statistics do suggest a dominant share of private (in particular foreign) ownership in both sectors. Data are presented separately for two different periods, namely 1992-1997, and 1998-2003, for methodological reasons (see Tables 9-12).

---

[23] Privatisation has been usually conducted as a combination of ESOP (employee stock ownership programme) and MBO (management buy-out) projects. In some cases it has only been partial, i.e. a certain share of state ownership has been retained, especially in the first stage of privatisation.

[24] Therefore an apparently legitimate formula, assuming that the municipality-owned assets are almost negligible, and thus the ratio of private ownership equals 100% minus state ownership minus 2-6% for municipality stakes, would lead to deceptive results.

Table 9: Ownership changes in the manufacture of electrical automotive components (3161), 1992-1997

	1992	1993	1994	1995	1996	1997
Equity (m HUF)	2,065.8	832.6	842.7	918.4	9,624.0	2,569.6
of which: foreign ownership	121.1	166.5	276.2	505.4	9,282.7	2,200.0
state ownership	1,537.2	154.0	154.0	15.0	15.1	13.2
Share of foreign ownership (%)	5.9	20.0	32.8	55.0	96.5	85.6

Note: Only double-book-keeping companies are included
Source: Ministry of Industry and Trade and author's calculations

Table 10: Ownership changes in the manufacture of electrical automotive components (3161), 1998-2003

	1998	1999	2000	2001	2002	2003
Equity (m HUF)	14,968	16,525	23,442	28,421	24,613	37,666
of which: state (incl. municipalities)	0	0	0	0	0	3
foreign	12,222	13,067	19,540	24,360	20,536	33,382
Share of foreign ownership (%)	81.7	79.1	83.4	85.7	83.4	88.6

Source: Ecostat and author's calculation

Table 11: Ownership changes in the manufacture of parts and components for motor vehicles (3430), 1992-1997

	1992	1993	1994	1995	1996	1997
Equity (m HUF)	19,657.8	21,831.8	22,400.9	23,598.9	27,478.5	40,173.6
Of which: foreign ownership	2,517.8	3,348.1	4,029.3	6,080.8	8,669.8	22,246.8
state ownership	9,130.3	9,051.4	7,190.5	5,434.6	4,389.6	338.0
Share of foreign ownership (%)	12.8	15.3	18.0	25.8	31.6	55.4

Note: Only double-book-keeping companies are included
Source: Ministry of Industry and Trade and author's calculations

Table 12: Ownership changes in the manufacture of parts and components for motor vehicles (3430), 1998-2003

	1998	1999	2000	2001	2002	2003
Equity (m HUF)	60,631	69,396	69,536	75,634	57,374	63,522
Of which: state (incl. municipalities)	445	445	445	445	804	804
foreign	45,048	51,336	53,099	58,622	41,272	46,948
Share of foreign ownership (%)	74.3	74.0	76.4	77.5	71.9	73,9

Source: Ecostat and author's calculation

6 Patterns of Competition and Production Networks

Although car assemblers, T1, T2 and T3 suppliers are all necessary to constitute a production network, and in the end of the day they all share the network's destiny, they have different responsibilities in the division of labour in a given network, and they have to face different

type of risks. Therefore, it is necessary to analyse them somewhat separately – but also keeping in mind the strong and close ties among them.

6.1 Evolving strategies for car-makers to improve competitiveness

Car-makers have to face a strong competition and mature markets in their traditional area of operation. Moreover, they are not – and in the foreseeable future most likely they will not be – in the position to expect a 'breakthrough' from this trap relying mainly on 'revolutionary' technological innovations. Thus they have to devise and implement other strategies:

- cutting costs in order to keep existing markets via offering lower prices,
- introducing new features, offering new functions (e.g. safety, comfort, global positioning systems, recycling) as well as improving reliability and fuel economy,
- creating new market segments in long-established, mature, markets by introducing e.g. sports models, four-wheel-drive cars, light trucks, minivans,
- finding new markets with new customers and ideally less intense competition,
- introducing organisational innovations to improve flexibility, shorten lead and delivery times,[25]
- customising mass-produced models, that is, offering the opportunity to buyers to 'design' their own car, using, of course, a set of standardised components.[26]

In short, price is still the bottom line of competitiveness in the car industry, yet many more characteristics have become a must for car-makers. Two of the above strategic elements are the most relevant from a Central and Eastern European point of view: cost-cutting and entering new markets.

Cost-cutting is a decisive element of basically all car-makers' strategy. That is why they set up their new plants in South America, South-East Asia, as well as Central and Eastern Europe (CEE), where production costs are usually lower than in their established bases, and for the same reason they encourage their suppliers to follow them, and/or to find other ways to offer cheaper parts and components. Another way of cost-cutting is to introduce improved production equipment and vehicle components (that is, incremental technological innovations, as opposed to radical innovations) as well as more efficient production processes (organisational and managerial innovations).[27] In the lean production paradigm – as opposed to the Fordist one – suppliers are important sources of innovations, and new products, processes and managerial techniques are spread quickly throughout the whole network (assembler, T1, T2 and T3 suppliers).

---

[25] Lead times – once constituting a major competitive edge for Japanese carmakers – have become rather short, thanks to the introduction of lean production, where T1 suppliers are involved in the design of new models, and the so-called rugby approach is used – instead of the former 'relay' method – among the various departments involved in designing a new model. (Graves, 1991, 1994) This new phenomenon underlines the importance of organisational innovations, too.

[26] No doubt, it requires a great deal of flexibility in terms of manufacturing and logistics, and, in turn, might lead to longer delivery time and higher costs. Therefore organisational innovations, coming either from carmakers or T1 suppliers, are of crucial importance. Quite often, though, technological innovations are necessary preconditions of organisational innovations, e.g. improved flexibility obviously requires organisational innovations, which, in turn, usually necessitate an appropriate, customised new IT tool kit and/or improved production equipment.

[27] A successful concept of cost-cutting is the so-called platform strategy whereby the basic components of 3-5 models are shared, and thus economies of scales in producing those elements and product variety – that is, apparently different models serving different markets (or segments) – can be achieved simultaneously. This concept requires the introduction of a set of interrelated technological and organisational innovations.

Emerging markets are also considered to be important because by definition they promise new buyers. Moreover, in the late 1980s CEE countries competition among car-makers was practically unknown; on the contrary, buyers had to 'compete' with each others for cars. Hence, most cars were rather obsolete in these countries, making people even more 'hungry' for 'Western' cars in the late 1980s. In short, it seemed to be a Paradise for car-makers. However, this region has become crowded in a very short period of time as several major West European, US and Asian companies have invested in production facilities. To make it worse, optimistic sales forecast have not materialised either, as most people cannot afford new cars, especially in the potentially largest markets, i.e. in CIS countries.

The three car-makers operating in Hungary apply different elements of the above strategic mix. *Magyar Suzuki* assembles small cars. In this segment, profit margins are rather low because the main competition axis is price. Suzuki also puts emphasis on fuel economy, and hence organises special rallies where the most economical drivers are awarded. From time to time small, special batches are produced to appeal to a certain customer group. New models have already been introduced to replace the outdated original model, and further ones are to be added to the product lines in the coming years. As they belong to the same segment, competitiveness is also based on price, as well as fuel economy; yet, design features are likely to play a more important role than in the 1990s.

Opel has decided to abandon car assembly in Hungary. Its new strategy is focusing on low cost manufacturing of high-tech, high-value-added components – engine components, engines and gearboxes – as well as low cost, high quality R&D conducted in Hungary to help improve its overall competitiveness. In short, it is a global strategy with carefully planned division of labour among various Opel plants across countries.

AUDI Hungaria Motor, besides producing engines in large volumes for the entire VW group, assembles its two new sports models in Győr, aimed at serving a special market segment of the affluent young professionals, primarily in the Western European and US markets. In this segment, design – technical and aesthetic features – is the key element of the competition. Yet, price should be kept as low as possible, and flexibility is even more important than in the case of 'normal' cars because of seasonal cycles in demand. Hence, Hungary seems to be an ideal production base with skilled but cheap workers and flexible labour regulations compared to Germany.

6.2 Competitive strategies of suppliers

T1 suppliers are increasingly similar to car assemblers in many respects, and thus they have to face a similar – competitive, global – environment. Reliable quality, continuous cost-cutting – with all its methods and prerequisites discussed above –, timely delivery, as well as the ability to innovate and manage the rest of the supply chain are all indispensable for survival. Therefore, it is hardly possible to single out any distinctive, new competition axis. T2 and T3 suppliers, however, have less responsibilities, the main factor to improve their competitive position is price. Nonetheless, all of them should be able to maintain reliable quality and timely shipment of parts, as well as introduce the technological and organisational innovations developed by assemblers or T1 suppliers.

These general observations apply to *the Hungarian case*, too. T1 suppliers – e.g. Continental Teves, Knorr-Bremse, and ZF – serve the global markets from their Hungarian production bases; only an almost negligible fraction of their output is shipped to the local car assembly plants. In the beginning, their primary concern was cost-cutting in the production phase. Gradually, however, they have recognised that Hungarian engineers and researchers at

various R&D units can provide useful services for their internationalised R&D projects, too, at a rather low cost. Therefore, they have already set up their own, in-house R&D units or decided to do so. Continental Teves is a somewhat exceptional case. Initially its small Hungarian R&D unit mainly worked for the German subsidiary, not for the local one. Since 2001, however, it has been extended, and become responsible to develop sensor technologies at a European scale, and thus also works for the Hungarian subsidiaries. The other way is to 'delegate' Hungarian engineers into the parent company's global research teams. UTA, for example, has not opened an in-house R&D unit, its engineers, however, are involved in a number of R&D projects run by various subsidiaries of the parent company. Sometimes they work abroad for a certain period, at other times they work from Hungary, but as members of virtual networks.

As for the intensity of competition in the local market, it should be taken into account that some 10-12 thousand parts and components are used to build a vehicle. To put it simply, an engine manufacturer, say, might account for a very large share of the whole components sector's output, yet, it does not mean that it would dominate, say, a seat manufacturer, who, in turn, has a much smaller share of the components sector's output.

As for a more qualitative overview, there is a strong competition in the automotive components manufacturing. Although some companies might have a relatively large domestic market share, e.g. in the case of axles, batteries, bearings or lighting, they also have to face a fierce competition in their export markets, and given the relatively small size of the Hungarian market as well as the importance of scale economies, they cannot avoid exporting the bulk of their output. The only exception is engine manufacturing: the combined capacity of Audi and Opel is around 2 million units a year, and thus it is a large enough market for their suppliers. That is why foreign foundries and machining companies are setting up their Hungarian operations (e.g. ADA, Pre-cast, Le Belier, Hydro [originally VAW] and Jung). In this case, there is strong competition for the 'domestic market'. The engines produced in Hungary, in turn, are shipped to the various car assembly plants of the entire VW group and GM Opel in Europe.

6.3 Production networks: sources of innovation

Relying on a survey conducted in the mid-1990s, as well as on a series of interviews and case studies conducted in the late 1990s, and then in 2002-2004, *two major lessons* can be drawn. First, the Hungarian case confirms the general picture emerging from the literature, namely that car assemblers and their T1 suppliers are the most important sources of innovation for the entire production network they coordinate. Second, some buyers, or their first-tier foreign suppliers, provide licences and know-how free of charge for T2 and T3 suppliers. The most important example was Magyar Suzuki in the 1990s (also offering various forms of financial assistance for tooling-up). This is the major element of an explanation to reconcile the apparent contradiction between the low level of expenditures on technology related activities, and the introduction of relatively large number of new products and processes.[28] In other cases, however, it is a prerequisite to buy certain licences or know-how, otherwise there is no business.

As already mentioned, Hungarian automotive suppliers have to adjust to a radically altered international and domestic environment (import liberalisation, loss of former markets, new players in Hungary, etc.). Thus, those who want to survive have also introduced new

[28] Another major factor is that these innovations represent so-called low- or mid-tech technologies, rather than high-tech ones, and hence financially they are less demanding.

management techniques. The most important types of these innovations are total quality management and reliable cost accounting. Foreign partners usually provide technical assistance and training courses to facilitate the introduction of these techniques.

Managerial innovations can be analysed at the level of production networks, too, as opposed to the company level. In the lean production system, first-tier suppliers assume a considerable part of responsibility for product development as well as for organising and managing the supply chain (logistics) as they build and supply entire systems or sub-systems, rather than individual components. In other words, they are responsible for second-tier – and indirectly – for third-tier suppliers' performance, too. Thus, they also provide training, technical assistance to their suppliers to facilitate the introduction of an appropriate quality management, cost accounting, production and delivery systems, etc. More recently Western car-makers follow this way, i.e. they cut the number of their first-tier (direct) suppliers and give them more responsibility.

This 'tiering' has hardly occurred in Hungary until the early 1990s. One should not be surprised, however, as most Hungarian companies have supplied simple, individual parts, rather than complex sub-systems to their customers. Moreover, they have not been involved in product development, either, as the models produced by Audi Hungaria, Magyar Suzuki and Opel Hungary had been designed before their assembly started in Hungary. One should take into account that it was a relatively new concept even for the Western European managers until the mid-1990s. A detailed analysis of the British automotive industry in that period also claimed, that British managers had a long way to go, too, on the road leading towards 'tiering':

> "By collaboration, the first tier of suppliers may help to develop the value chain of vehicle manufacturer or the progress and competitiveness of a national or regional industry. There has been little such activity so far: indeed the major UK suppliers could more accurately be called an unconnected group, rather than a first tier." (DTI and SMMT, 1994, p. 11)

Their Hungarian counter-parts, however, first had to learn even the 'simple' techniques of market economy, too, not only these new principles of lean supply. Moreover, in the meantime they also had to struggle for survival. More recently, however, some preliminary signs of the emerging new supply system can be observed in certain cases. Subsidiaries of major Western component manufacturers are taking on board more Hungarian suppliers, and thus a more pronounced 'tiering' can be observed. For example, ZF has developed a supplier park around its plant in Eger. In short, T1 suppliers assume responsibility in organising the supply chain in Hungary, too, following the global patterns.

7. PROSPECTS FOR HUNGARIAN AUTOMOTIVE SUPPLIERS

7.1 Modes of growth

Discussing the growth opportunities and various modes of growth open to the Central and Eastern European (CEE) automobile firms, it is worth distinguishing different kind of countries (small vs. large; advanced vs. laggard in terms of transition; level of economic development;)[29] and firms (assemblers vs. suppliers). The success of different growth strategies, in turn, depends on firms' performance vis-à-vis their competitors as well as the

[29] Different traditions in automotive industry obviously have different impacts on growth opportunities and modes of growth, e.g. the Czech car industry has been based on own product development while the Polish, Russian, Romanian and Serbian ones on licences. Hungary represents another case by having strong traditions in commercial vehicle and automotive components manufacturing but only 'remote memories' in car assembly.

macroeconomic situation (overall demand, standard of living, taxes and other levies on cars and components, etc.) and trade policies of the respective countries. Firms operating in countries with large domestic market – e.g. Russia – can, in principle, devise strategies to serve their home markets, while firms based in small or medium-sized countries – e.g. the Czech Republic, Hungary, Slovakia, Slovenia (all small) and Poland (medium-sized) – must seek export opportunities should they want to grow. Globalisation of the automotive industry means both opportunities and threats for these firms.

Car and commercial vehicle *assemblers* privatised by large foreign automotive companies, and thus integrated into their global technological, production and marketing networks, might expect the brightest growth opportunities, e.g. VW-Skoda, Fiat Auto Poland. This is usually organic growth, i.e. output is increased by producing new or significantly improved vehicles. Acquisition of other – automotive or non-automotive – firms is not likely. Some commercial vehicle assemblers have been privatised by domestic investors, e.g. in the Czech Republic. It is to be seen if these investors can be successful in bringing capital, new technologies in, and find markets; all required for organic growth. In some cases acquisitions by other, large, powerful companies have occurred, and it might be a potential way out of the lack of capital. Hardly any growth – on the contrary: contraction – can be foreseen for assemblers not privatised yet.

As for *suppliers*, five different modes can be identified.[30] The following taxonomy not only lists these possibilities but also discusses the relationship between a specific mode of growth and R&D.

a) Organic or indigenous growth based on the existing product lines: increased output of the same products given extended capacity and/or improved productivity. It might only be possible in those countries where basically the 'good old' cars and other vehicles are still produced and can be sold. Hardly any R&D or training and re-training – skill formation – is required. At best, some process development and training, re-training is conducted.

b) Organic or indigenous growth based on a diversified, yet, still *automotive product mix*: increased output thanks to further automotive products added to the existing product lines. Most suppliers, previously shipping their products to various CMEA countries, and having lost these markets, have had to take this path, e.g. producing parts for Western European and Asian cars and/or commercial vehicles.[31] Capital and skill formation is required – yet, accumulated skills and experience might provide a sound basis. New products – and then almost inevitably – new processes and management techniques should be introduced. Sources of these innovations vary widely (vehicle assemblers, T1 and other suppliers, in-house and extra-mural R&D units). The supplier in question has to be involved in the innovation process to a varying extent, depending on the source of innovation.

c) Organic or indigenous growth based on a diversified product mix: increased output thanks to adding non-automotive products to the existing product lines. This option is

---

[30] One also has to bear in mind that a wide range of distinctively different industries are to be found among automotive parts and components manufacturers, e.g. chemicals (paints, plastics), rubber, glass, textile, leather, metal, engineering, electronics, etc. Therefore a thorough analysis should take into account technological/sectoral characteristics. Further decisive factors of growth include firm-specific factors (size, ownership, technological and managerial capabilities, etc.), role of foreign investors in the domestic automotive industry, assembler-supplier relationships, macroeconomic situation.

[31] This mode of growth clearly shows that the traditional definition of growth might not be appropriate in transition economies. For detailed, firm-level case studies it is worth considering a special definition of (or approach to) growth: given the radical re-structuring in the region (collapse of the CMEA, import liberalisation, privatisation, etc.) sometimes survival can, and, indeed, should be regarded as growth, even with a contracted output, say, compared to the mid-1980s, if the current output consists of *new products* sold to *new clients*.

most probable in the case of suppliers with already mixed product lines, i.e. producing plastic, rubber, metal, etc. parts for different industries. Requirements are similar the ones under point *b*.

d) Acquisition of another automotive firm, domestic or foreign. Capital needs to be found for this action, it is, therefore, an existing, yet, a rare case. Further, production, R&D and management skills and practices need to be harmonised for success, and these are undoubtedly difficult tasks even in a stable economy, let alone in the CEE economies.

e) Acquisition of a non-automotive firm, domestic or foreign. This option is most probable in the case of suppliers with already mixed product lines, i.e. producing plastic, rubber, metal, etc. parts for different industries. Requirements and challenges are similar the ones under point *d*.

7.2 Outlook for Hungarian automotive suppliers

Privatisation of car assembly in the neighbouring countries provides both challenges and opportunities for Hungarian automotive suppliers. Western European investors, on the one hand, tend to rely on their long-established suppliers. Moreover, Fiat is one of the most vertically-integrated car-maker. Therefore some Hungarian suppliers lost their former businesses when Fiat took over FSM. However, even Fiat has embarked upon a new sourcing strategy, i.e. it has started divesting its in-house component manufacturing plants in Poland in order to cut costs and to focus on its core business. Thus there are new market opportunities even in this case for competitive suppliers, especially for Central European subsidiaries of well-known Western European firms, given that these suppliers can combine reputation, low production costs and favourable location.

Asian firms, on the other hand, do not have a long-established supply base in Europe. Thus, they have to search for local suppliers if they want to meet the local content rule of the EU. Magyar Suzuki has rapidly increased the local content of its cars produced in Hungary, and several Hungarian suppliers are shipping their products to Japan.

Table 13 analyses the major characteristics of different types of companies in the framework of a tentative taxonomy, developed in section 5.3. It also considers the most likely prospects for each group of companies.[32] Two sub-groups, namely *private companies* and *joint ventures with dominant Hungarian private ownership* are not included as firms in these sub-groups differ considerably from each other, i.e. their products, processes, market opportunities can vary on a very wide scale. Two distinctive features, however, can be pointed out. First, usually they are much smaller than A.1–B.2 companies. Second, the so-called aftermarket is usually much more significant for them than for the larger ones.

[32] Of course not every single case can be captured by this taxonomy, e.g. a few major state-owned companies are still in the preparation phase for privatisation, and thus they are somewhat ‘on the road’ to become A.2 or B.2 companies. In other words, their characteristics are rather different compared to a ‘representative’ B.1 firm.

Table 13: Outlook for Hungarian suppliers

Ownership/ Type of plant	Technology	Size	Activities	Markets	Outlook	Impacts on Domestic R&D
Green-field plants of car manufacturers producing components (A.1.1)	*Products*: mid- or high-tech, high value-added *Processes:* state-of-the-art, capital and skill-intensive, but not labour-intensive	1000-5000 employees	specialised in automotive components	a *single customer*, but geographically spread markets (assembly plants of their parent company), outputs are exported	rather stable markets (strong commitment from parent companies), yet, they depend on overall automotive trends and strategic moves of parent companies (e.g. sourcing, location, R&D)	major R&D projects conducted by parent companies, minor product development projects in Hungary when supplying other car assemblers in CEE. Audi has set up an engine development centre; GM Opel is to involve Hungarian R&D units in product development.
Subsidiaries of component manufacturers (green- and brown-field plants: A1.2, A.2)	*Products:* typically mid-tech, some high-tech, mid- or high value-added *Processes:* state-of-the-art, skill-intensive, less capital and more labour-intensive than for A.1.1 firms	from a few hundred employees to over 1000 ones, further growth is rather likely in most cases	specialised in automotive components	*a number of customers*, the vast majority of output is exported	fairly stable business opportunities due to the long-established contacts between parent companies and customers. Although future demand is more difficult to forecast, risks can be spread more widely. Smaller investment compared to A.1.1 cases, hence exit might be less costly.	major R&D projects conducted by parent companies, but in-house and extra-mural R&D and engineering units have been set up, and Hungarian engineers are increasingly involved in international R&D projects, conducted in various Western European countries.
State-owned companies (B.1)	*Products:* low-tech, some mid-tech, low value-added *Processes:* simple material processing, obsolete, general-purpose machinery, labour-intensive	up to 1,500-2,000 employees, shrinking throughout the 1990s	diversified; automotive parts are of secondary importance in the case of large, multi-plant companies	*a number of customers*, usually 1-2 Western T1- or T2 suppliers as well as Magyar Suzuki. A considerable part of automotive output is exported.	rather uncertain, their customers might find cheaper suppliers	hardly any in-house R&D projects or demand for extra-mural ones can be expected from them
Privatised former state-owned companies (B.2)	*Products:* mid- or low-tech, mid-value-added *Processes:* similar to B.1 firms, usually less obsolete	medium or large	medium-sized ones usually specialised in automotive components, large ones diversified, car parts are often of secondary importance	similar to B.1 firms	slightly more promising than for B.1 firms (hence privatised). Yet, privatisation has been financed through loans, and hence debt service might threaten their future since hardly any profits can be retained for badly needed investments.	some in-house R&D projects or demand for extra-mural ones can be expected from them

8 CONCLUSIONS

The first theoretical conclusion of the paper is that diffusion models and the notion of sectoral system of innovation and production offer a more appropriate conceptual framework to capture the actual socio-economic impacts of FDI in transition economies than the generally used spillover models. Thus, the former two concepts provide a more relevant guidance for both theoretical and policy analyses. The main reasons include that spillover models cannot 'tackle' (i) the fundamental restructuring of practically all sectors (and firms) due to privatisation, FDI, technological and organisational innovations, as well as entering new markets (losing the former ones); (ii) the nature and dynamics of learning and innovation processes, including the importance of co-operation and networking, required by the fact that various types of knowledge are needed for a successful innovation process, often possessed by different actors. Further, the specific sectoral features of automotive industry are not captured, either, in a standard spillover model.

Second, it is also argued that innovation systems – both sectoral and national ones – in a small, open economy are strongly influenced by the strategies of foreign firms operating in these host countries. Accordingly, the conceptual framework analysing innovation systems, originally developed in the context of large(r), advanced economies, has to be amended to grasp the important aspects of internationalisation in this different milieu. Further, internationalisation has to be understood in terms of the interplay between national, (multi-country) regional and global innovation and production systems. Hungary, characterised by an almost excessive weight of foreign firms in manufacturing industries either in terms of production or exports, can be regarded as a 'living laboratory' in this respect. An important research question remains, though, namely to disentangle the characteristics of small, open economies, in general, and those of small transition countries, in particular.

Automotive investment activities across borders have significantly intensified in recent years in an attempt to cut costs via re-location of production, and to get closer to the ultimate customers in emerging markets. Central Europe, the immediate neighbourhood of Hungary is no exception either: the region has moved again onto the global stage. Almost all major automotive groups have already set up their operations in Central Europe. These intensified investment activities have had crucial bearings on the Hungarian automotive industry: after a half-a-century interval – imposed by the CMEA-wide division of labour – car production has re-emerged in Hungary in the early 1990s. Suppliers have also invested heavily in Hungary. Moreover, their motivation has not been simply to follow car assemblers; on the contrary, this is only a minor part of the explanation. Their principal reason for setting up subsidiaries – either green- or brown-field plants – in Hungary has also been cost-cutting. The only major local clients for them are not car assemblers but the engine manufacturing plants of Audi and GM Opel; hence the vast majority of their output is exported.

These strategic moves have radically re-structured the indigenous suppliers, too. Several suppliers have been taken over by foreign firms, while others have been integrated into global automotive production networks as subcontractors. In both cases new products, processes and management techniques have been introduced quite rapidly. Components manufacturing is much more important in Hungary than car assembly, even from a somewhat narrow-minded macroeconomic point of view: turnover, employment and exports figures are significantly larger in the former sector than in the latter. Taking a more general perspective, that is, industrial development and competitiveness, suppliers, and particularly the networking activities of T1 suppliers, are still more substantial: it is mainly due to them that new technologies and organisational innovations are diffusing fast and widely in Hungary. From a policy point of view, however, it is necessary to take into account the differences between

various types of suppliers. Therefore, a taxonomy has been developed, and applied when discussing the prospects for Hungarian companies.

Notwithstanding the huge importance of foreign firms' strategies and other aspects of globalisation, various elements and dynamics of national innovation systems still do matter. Just to highlight one of them, that is, government policies, a major lesson can be drawn by comparing general and industry-specific schemes. It is more fruitful to create an attractive, favourable environment for R&D and innovation – e.g. by maintaining a sound, well-performing higher education and research system, providing the necessary physical and institutional infrastructure, facilitating industry-academy co-operation and other forms of networking – than focusing on the promotion of industry-specific R&D and innovation activities. It is also of crucial importance to co-ordinate investment, trade, competition, regional development, employment, education and innovation policy aims and tools to enhance competitiveness.

In sum, the successful re-structuring of the Hungarian automotive industry is not only due to some 'push' factors, i.e. the fierce competition among automotive companies and hence the pursuit of cost-cutting via re-location of their production, but it also thanks to 'pull' factors, i.e. the attractions of the Hungarian economic environment, broadly defined. Given the ever changing, and global, nature of the automotive industry, no country can be complacent; on the contrary, continuously renewed, concerted efforts and well-devised policy measures are needed to achieve further results.

REFERENCES

Bauer, T., A. Patkós, K.A. Soós, É. Tárnok, and P. Vince [1980]: Járműprogram és gazdaságirányítás (Vehicle Programme and Central Economic Control), mimeo, Budapest: Institute of Economics, Hungarian Academy of Sciences

Bauer, Tamás, and Károly Attila Soós [1980]: Kényszerpályák hálójában – Vállalatközi kapcsolatok és műszaki fejlesztés a járműiparban (Forced Paths: Inter-enterprise relationships and technical development in the automotive industry), in Tardos, M. (ed.) [1980], pp. 149-84

Berend, T. Iván and György Ránki [1955]: *Magyarország gyáripara 1900-1914* (Hungary's Industry in 1910-1914), Budapest: Szikra

Berend, T. Iván and György Ránki [1958]: *Magyarország gyáripara a második világháború előtt és a háború időszakában, 1933-1944* (Hungary's Industry before and during World War II, 1933-1944), Budapest: Akadémiai Kiadó

Bongardt, Anette [1992]: The EC Automotive Industry: Supply relations in context, in H.W. de Jong (ed.): *The Structure of European Industry*, 3rd edition, Dordrecht: Kluwer Academic Publishers

Boyer, R., E. Charron, U. Jürgens, S. Tolliday, (eds) [1998]: *Between Imitation and Innovation: The Transfer of Hybridization of Productive Models in the International Automobile Industry*, Oxford: Oxford University Press

Boyer, Robert, Michel Freyssenet [2002]: *The productive models: the conditions of profitability*, Basingstoke: Palgrave Macmillan

Damijan, Joze P., Mark Knell, Boris Majcen and Matija Rojec [2003]: Technology Transfer through FDI in Top-10 Transition Countries: How Important are Direct Effects, Horizontal and Vertical Spillovers?, University of Michigan Business School, *William Davidson Working Paper* No. 549

Dodgson, Mark and Roy Rothwell (eds) [1994]: *The Handbook of Industrial Innovation*, Cheltenham: Edward Elgar

Dosi, Giovanni [1988a]: The nature of the innovative process, in Dosi *et al.* (eds.) [1988]

Dosi, Giovanni [1988b]: Sources, procedures and microeconomic effects of innovation, *Journal of Economic Literature*, Vol. 26, September, pp. 1120-1171

Dosi, Giovanni [1992]: The research on innovation diffusion: An assessment, in: Nakicenovic, N. and Grübler, A. (eds.): *Diffusion of Technologies and Social Behaviour*, Berlin: Springer-Verlag

Dosi, Giovanni, Christopher Freeman, Richard R. Nelson, Gerald Silverberg, and Luc Soete (eds) [1988]: *Technical Change and Economic Theory*, London: Pinter

DTI and SMMT [1994]: A Review of the Relationships Between Vehicle Manufacturers and Suppliers, report on the DTI/SMMT Automotive Components Initiative

Edquist, Charles (ed.) [1997]: *Systems of Innovations: Technologies, institutions and organizations*, London: Pinter

Fixson, Sebastian, Mari Sako [2001]: Modularity in Product Architecture: Will the auto industry follow the computer industry?, paper presented at the IMPV Fall Meeting, 10-11 September, Cambridge, MA, USA

Fransman, Martin [2002]: Mapping the evolving telecoms industry: the uses and shortcomings of the layer model, *Telecommunications Policy,* Vol. 26, pp. 473-483

Freyssenet, Michel, A. Mair, K. Shimuzu, G. Volpato (eds) [2000]: *One Best Way? Trajectories and Industrial Models of the World's Automobile Producers*, Oxford: Oxford University Press

Frigant, Vincent and Yannick Lung [2002]: Geographical proximity and supplying relationships in modular production, *International Journal Of Urban and Regional Research*, Vol. 26, No. 4, pp. 742-

Graves, Andrew [1991]: Globalisation of the automobile industry: the challenge for Europe, in Freeman, C., Sharp, M. and W. Walker (eds): *Technology and the Future of Europe*, London: Pinter Publishers, pp. 261-80

Graves, Andrew [1994]: Innovation in a Globalizing Industry: The case of automobiles, in Dodgson, M. and R. Rothwell (eds): *The Handbook of Industrial Innovation*, Edward Elgar: Aldershot, pp. 213-31

Havas, Attila [1995]: Hungarian Car Parts Industry at a Cross-Roads: Fordism versus lean production, *Emergo*, Vol. II, No. 3, pp. 33-55

Havas, Attila [1996]: Foreign Direct Investment, Product, Process and Organisational Innovations: The re-structuring of the Hungarian car parts industry, paper presented at the EAEPE '96 Conference

Havas, Attila [1997]: Foreign Direct Investment and Intra-Industry Trade: The case of automotive industry in Central Europe, in: Dyker, D. (ed.): *The Technology of Transition*, Central European University Press, 1997, pp. 211-240

Havas, Attila [2000a]: Local, regional and global production networks: re-integration of the Hungarian automotive industry, in: von Hirschhausen, Ch., J. Bitzer (eds): *The Globalization of Industry and Innovation in Eastern Europe - From Post-socialist Restructuring to International Competitiveness*, Cheltenham: Edward Elgar, pp. 95-127

Havas, Attila [2000b]: Changing Patterns of Inter- and Intra-Regional Division of Labour: Central Europe's long and winding road, in: J. Humphrey, Y. Lecler, M. Sergio Salerno (eds): *Global Strategies and Local Realities: The Auto Industry in Emerging Markets*, Basingstoke: Macmillan, pp. 234-262

Havas, Attila [2003]: A multinacionális járműipari vállalatok és a magyar alkatrész-gyártók közötti technológiai és beszállítói kapcsolatok (Multinational Automotive Companies and their Hungarian Suppliers: Technological links), mimeo, Budapest: IE HAS

Helper, Susan [1991]: Strategy and Irreversibility in Supplier Relations: The case of the U.S. automobile industry, *Business History Review*, Vol. 65, Winter, pp. 781-824

Helper, Susan [1993]: An exit-voice analysis of supplier relations: the case of US automobile industry, in: Grabher, G. (ed.): *The Embedded Firm*, pp. 141-160, London: Routledge

Humphrey, J., Y. Lecler, M. Salerno (eds) [2000]: *Global Strategies and Local Realities: The Auto Industry in Emerging Markets*, Basingstoke: Macmillan

Jones, Daniel T. [1989]: Corporate strategy and technology in the world automobile industry, in Dodgson, M. (ed.): *Technology Strategy and the Firm: Management and public policy*, London: Longman, pp. 11-24

Jones, Daniel T. [1999]: The car industry, in: Dyker, D (ed.): *The European Economy*, pp. 307-325, Harlow: Addison Wesley Longman

Lamming, Richard [1993]: *Beyond Partnership: Strategies for innovation and lean supply*, New York: Prentice Hall

Langlois, Richard N. and Paul L. Robertson [1996]: Stop Crying over Spilt Knowledge: A Critical Look at the Theory of Spillovers and Technical Change, University of Connecticut, *Department of Economics Working Paper Series*, 1996-06

Lissoni, Francesco, Metcalfe, Stan [1994]: "Diffusion of Innovation Ancient and Modern: A Review of the Main Themes", in: Dodgson and Rotwell (eds)

Lundvall, Bengt-Åke and Susana Borrás [1999]: *The Globalising Learning Economy: Implications for Innovation Policy*, Luxembourg: Office for Official Publications of the European Communities

Lung, Y., J.J. Chanaron, T. Fujimoto, D. Raff (eds) [1999]: *Coping with Variety: Product* Variety *and Production organization in the World Automobile Industry*, Aldershot: Ashgate

Malerba, Franco [2002]: Sectoral systems of innovation and production, *Research Policy*, Vol. 31, pp. 247-264

Metcalfe, Stan [1988]: The Diffusion of Innovation: An Interpretative Survey, in: Dosi *et al.* (eds)

Metcalfe, Stan [1990]: On diffusion, investment and the process of technological change, in: Deiaco, Enrico, Erick Hornell and Graham Vickery (eds), *Technology and Investment: Crucial Issues for the 1990s*. London: Pinter Publishers

OECD [1992]: The Automotive Parts Industry, in: *Globalisation of Industrial Activities: Four case studies*, Paris

Pavlinek, Petr [2002a]: Restructuring the Central and Eastern European automobile industry: Legacies, trends, and effects of foreign direct investment, *Post-Soviet Geography and Economics*, **43** (1), pp. 41-77

Pavlinek, Petr [2002b]: Transformation of the Central and East European passenger car industry: selective peripheral integration through foreign direct investment, *Environment and Planning A*, **34** (9), pp. 1685-1709

Pavlinek, Petr [2005]: Transformation of the Central and East European Passenger Car Industry: Selective Peripheral Integration through Foreign Direct Investment, in: Turnock, D (ed.): *Foreign Direct Investment and Regional Development in East Central Europe and the Former Soviet Union*, pp. 71-102, Aldershot: Ashgate

Ruigrok, W., R. van Tulder, G. Baven [1991]: Cars and Complexes: Globalisation versus global localisation strategies in the world car industry, MONITOR-FAST Programme, Commission of the European Communities

Sako, M., R. Lamming, S. R. Helper [1995]: Supplier Relations in the UK Car Industry: Comparisons with Europe, Japan and the US, report prepared for the DTI, January

Sako, Mari [1997]: Emergent Dualism in the UK Automotive Industry: Should we be concerned?, mimeo, London: LSE

Sako, Mari [1998]: Does Trust Improve Business Performance?, in: Lane, Christel, Reinhard Bachmann (eds): *Trust Within and Between Organizations: Conceptual Issues and Empirical Applications*, Oxford: Oxford University Press

Sako, Mari, Susan Helper [1998]: Determinants of trust in supplier relations: Evidence from the automotive industry in Japan and the United States, *Journal of Economic Behavior and Organization*, Vol. 34, pp. 387 417

Shapiro, Helen [1991]: Determinants of Firm Entry into the Brazilian Automobile Manufacturing Industry, 1956-1968, *Business History Review*, Vol. 65, Winter, pp. 877-947

Somai Miklós [1996]: Két autóipari óriás Magyarországon: az Opel és az Audi, *Ipargazdasági Szemle, Struktúrák, Szervezetek, Stratégiák*, Vol. 26, No. 3-4, pp. 94-105

Somai Miklós [2000]: Autóipar Magyarországon: a személyautó- és autóalkatrész-gyártás nemzetközi „beágyazottsága" és integráló hatása hazai háttériparra, *MTA VKI Műhelytanulmányok* No.28

Soós, Károly Attila [1980]: Műszaki színvonal és gazdaságosság: Beruházási döntés egy központi fejlesztési program keretében (Technical Level and Profitability: Investment decision in the framework of a central development programme), in Tardos, M. (ed.) (1980], pp. 285-94

Sturgeon, Timothy J., Richard Florida [2000]: Globalization and Jobs in the Automotive Industry, final report to the Alfred P. Sloan Foundation, MIT IPC Globalization Working Paper 01-003

Swain, Adam [1998]: Governing the workplace: The workplace and regional development implications of automotive foreign direct investment in Hungary, *Regional Studies*, Vol. 32, No. 7, pp 653-671

Takeishi, Akira [2001]: Bridging inter- and intra-firm boundaries: Management of supplier involvement in automobile product development, *Strategic Management Journal*, Vol. 22, pp. 403-433

Tardos, Márton (ed.) [1980]: *Vállalati magatartás – vállalati környezet* (Enterprises' Behaviour – Enterprises' Environment), Budapest: Közgazdasági és Jogi Könyvkiadó

Tárnok, É., Vince, P. [1980]: Szervezett bizonytalanság (Organised Uncertainty), in Tardos, M. (ed.) [1980], pp. 219-54

Varga György [1990]: Mibe szállunk be? – Magyar gépkocsi-ipar (Strategic Options for the Hungarian Automotive Industry), *Figyelô*, **34** (21)

Vickery, Gregory [1996]: Globalisation in the automobile industry, in: OECD: *Globalisation of Industry*, pp. 153-205, Paris: OECD

Womack, James P., Jones, Daniel T. and Daniel Roos [1991]: *The Machine that Change the World* (paperback edition), New York: Harper Perennial