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**UPGRADING OF HUNGARIAN SUBSIDIARIES
IN MACHINERY AND AUTOMOTIVE
GLOBAL VALUE CHAINS**

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Upgrading of Hungarian subsidiaries in machinery and automotive global value chains

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Abstract⁵

Global networks shape international production and trade. The main question of our paper is how Hungarian companies can improve their positions within these global value chains. The production and export of automotive and machinery industry are dominated by foreign multinational enterprises, therefore these sectors were chosen as examples. Research is based on interviews that explore local manufacturing subsidiaries' product, process and functional upgrading experience. Our findings show that there are differences among the firms in terms of extent of upgrading. This depends on one hand, on the owner's global strategy and on the type of final products. On the other hand local capabilities are of crucial importance among the factors that influence the volume of intangible transfers. Furthermore, our interviews suggested that upgrading is not a unidirectional process: previously gained mandates can also be lost. Economic policy should support the business development and entrepreneurial learning and provide adequate conditions for suppliers and subsidiaries of leading multinational enterprises.

JEL: D22, D24, E23, F16, F23, L6, L62, O52

Keywords: global value chains, machinery industry, automotive industry, Hungary

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Introduction

Global production networks have become widespread for today. Their activities form a new phase of globalisation characterised by fragmented production, transfer of technology, decreasing transport costs (Kaplinsky, 2013). Developing countries are involved in these production networks perceiving this as an important (if not only) way of development. The Central European countries take part actively in the chains of multinational firms since the nineties. The benefit from this participation varies across sectors and firms. In this paper we analyse the experiences of Hungarian companies in the machinery and automotive industry.

Since around 2000, intra-industry trade turnover data reveal a strong expansion between the Visegrad (V4) countries and their main trading partners (Germany, Austria) in the automotive and machinery industry suggesting an increased cross-border activity of global value chains (GVCs).⁶ The role of foreign enterprises in both industries is dominant, often with over two decades of presence in Hungary. While in the automotive industry large corporations entered and play a decisive role, in the machinery industry the picture varies, giving an opportunity to analyse large, medium and small foreign-owned subsidiaries. Upgrading is strongly related to both industries, an ideal terrain for its analysis. The long history of foreign owned subsidiaries in the country enables to analyse the development of the interviewed companies, OEMs in the automotive industry and different sized suppliers in the machinery industry alike.

The structure of the paper is the following. After the description of the basic research question and methodology a literature review is provided. In the next section we introduce the surveyed companies and review the product, process and functional upgrading experiences of them. Finally, we discuss our findings and propose some managerial and policy implications.

⁶ WIOD table data for the years 2000 and 2011 show a significant increase of the export and imports of each individual V4 country especially towards Germany, but for their intra-industry trade relations as well.

Main questions and methodology

The inclusion of Hungarian firms in the global value chains is a fact. The question is how these companies can exploit their possibilities, how they can improve their position. We try to assess the process of upgrading and the role of the given supplier firm and the mother company in this process. Therefore we asked questions relevant to product, process and functional upgrading during personal interviews at companies. Among others we asked about the steps taken to improve the production process, about the emergence of new functions, and their knowledge-intensity and about the evolution of the product mix.

Thus, our methodological approach is to apply case studies of upgrading by Hungarian firms participating in GVCs. Sample companies in the machinery industry were selected with the aim of demonstrating the heterogeneity of successful development trajectories even within one single industry. Large automotive corporations owning foreign affiliates in the automotive industry on other hand offered good samples to detect differences behind the similarities. Being an established company was an important selection criterion, since upgrading is based partly on demonstrated subsidiary capabilities.

There are some factors accumulated during the upgrading process (like transfer of tacit knowledge) which are hardly measurable, but personal interviews can reveal them. An advantage of the case study approach that it does not involve data problems stemming from aggregation but reveals the individual characteristics of the supplier company (industry, activity, employment, foreign expansion and its motivations, ownership structure). This method is rich in detail and can provide important information concerning up till then neglected but important features. Case studies can also be used as tests for the applicability of theories.

Our sample companies represent small, medium and large corporations, in order to identify possible correlations between size and upgrading. Interviews were based on open-ended questions that focused on the histories, drivers and outcomes of upgrading.

Literature review

As known, during the recent decades international trade and production has become controlled by global value chains. There is a huge and widening literature on the activity and measurement of the global value chains. We focus now on the topic of upgrading within GVCs, the literature of which is also abundant.

Participants of a global production network constantly develop their activities. Suppliers for global value chains are often multinational companies themselves. Thus, - contrary to certain beliefs - GVCs are mostly not controlled by one single leader, the direction itself can be fragmented. One affiliate of a multinational can have several roles within its function (Sass-Szalavetz, 2014), it can have higher (global) and lower level tasks within one segment.

We analyse here upgrading from the aspect of the companies that take part in a global value chain. We apply the widely used and accepted definition of upgrading, which is a move from a lower value-added activity towards a higher value-added one (Barrientos et al., 2010, Milberg-Winkler, 2011).

Economic upgrading was organised into *four main types* by Humphrey-Schmitz (2002) and this typology is usually applied since then (besides economic upgrading „social upgrading” also exists⁷). According to these authors upgrading of a firm may be:

⁷ Social upgrading is not discussed in this paper. It means improvements of working conditions and rights and includes measurable standards, such as health, safety, working hours and enabling rights, like non-discrimination, freedom of association (Barrientos et al., 2011). As some authors claim, economic upgrading can lead to social upgrading, but not necessarily (Barrientos et al., 2010, 2011, Bernhardt – Milberg, 2011, Bernhardt, 2013, Goger, et al., 2014). Several factors affect the interaction of economic and social upgrading, like the type of work, status of workers (Barrientos et al., 2010). There are cases when economic upgrading in a GVC can lead even to social downgrading, labour exploitation, production shift to lower-wage areas.

1. product upgrading: moving into more sophisticated product lines (which can be defined in terms of increased unit values)
2. process upgrading: transforming inputs into outputs more efficiently by reorganising the production system or introducing superior technology
3. functional upgrading: acquiring new functions in the chain (or abandoning existing functions) to increase the overall skill content of activities
4. intersectoral upgrading: using the knowledge acquired in particular chain functions to move into different sectors (often also called 'inter-chain' upgrading taking place in one strand of a value chain).

Certainly, these groups can be linked, they overlap or derive from each other. Therefore it is sometimes difficult to distinguish product and process upgrading, especially where the introduction of new processes generates new categories of products. Apart from that, production process can also be improved by matching safety, technical or environmental standards – as a condition of market entry - that may lead to products with better qualities, but these are not necessarily of higher-value to the producer (Ponte-Ewert, 2009). Economies of scale can also increase profits in value chains but not only from process upgrading, but also via aggregating orders to increase the volume of sales. This can actually lead to product 'downgrading' (lower value products sold in larger amounts, see Gibbon – Ponte, 2005).

Regarding the manufacturing sector, the largest number of articles have concentrated on functional upgrading, and emphasize that basic and business activities are linked. Upgrading can be voluntary, but in most cases the mother company expects/obliges that its affiliate fulfil more and more complex tasks. Functional upgrading can be realised in three main ways. The first is via *widening* of functions: today there is practically no firm that only produces, several other functions have been joined to the production itself, like logistics, purchase, controlling, information technology, maintenance, development of tools, even communication and human resource management, etc. The extent of such diversification of functions depends on the company size and age. The second way of functional upgrading is the *deepening* of a given function by its increasing complexity. Certain functions of a GVC participant firm can become more skill- and creativity-

intensive, the technological capabilities of the firm are extended (Sato – Fujita, 2009). A third kind of functional upgrading is the widening of the *scope* of a given function, an affiliate can become itself regionally or globally competent and responsible. An example for this is if some kind of shared service centres are established at the local affiliate firms (Szalavetz, 2012). Functional upgrading usually increases the number of white collar workers at the firm and enables the accumulation of such skills that strengthens the position of the firm within the GVC.

It is important to stress that upgrading of affiliates, GVC participants often takes place together with the changing and development of the whole production chain. As external conditions change, mother companies, GVC governors react and modify value chains, develop certain parts, reorganise, diversify. Innovation activity is continuous. From the participant firm's aspect upgrading is a must, crucial for survival.

More recent contributions have highlighted the links between different forms of GVC *governance* and the possibilities for upgrading, particularly functional upgrading. Governance is a top-down process starting from the lead firms, while upgrading is bottom-up concept to improve initial positions (Lee–Gereffi, 2015). According to the first typology decades ago, governance can be producer-driven or buyer-driven (Gereffi–Korzeniewicz, 1994). In the first case large manufacturers control the production process through their owned affiliates, while in the second case there is a network of international (offshore) producers. The economic power of the lead firm in a buyer-driven GVC stems from the control of marketing and retail activities, in a producer-driven GVC the proprietary knowledge and technology dictates (Keane, 2012). As years passed and GVCs became more and more widespread, the increasing complexity of production networks made it necessary to create a more refined typology of governance structures. Thus five types of governance were defined (Gereffi, et al. 2005): market, modular, relational, captive, hierarchical. Each governance type can exert different effects on the upgrading of a supplier firm.

Market governance involves simple transactions with no formal cooperation between participants and the cost of switching to new partners is low. The buyer has no controlling interest in the production, the parameters are defined solely by each firm at its point in the chain, and the central governing mechanism is price (Gereffi, et al. 2005).

The organisation of the chain presents low barriers to upgrading, it may not be easy without the support of lead-firms (technical, financial support, market information, etc).

In the case of *modular* governance suppliers make products or provide services to a customer's specifications. Here the product is more complex, but sufficiently modular in design. Technical standards and information regarding the product can be specified and communicated to a third-party. Suppliers produce independently, take full responsibility for production and may further outsource production.

Relational governance types involve complex interactions between the lead-firm and supplier. The buyer and supplier develop intertwined relationships involving tacit knowledge exchange and knowledge spill-overs. The lead firm specifies what it needs, and controls the highest valued activity in the chain, thus having the ability to exert more control over the supplier (Cattaneo et al., 2013). Producers in relational chains are more likely to supply differentiated products in complexity, quality, origin or other characteristics. As a result, dense interactions and knowledge sharing occurs, but this knowledge cannot be codified, easily transmitted or learned. Furthermore, relational linkages take time to build, so the costs and difficulties involved in switching to new partners tend to be high.

Captive governance is characterised by a high degree of monitoring and control by the lead-firm, with small firms dependent on those larger buyers for trade. Small firms can find themselves sometimes “locked-in” due to their reliance on a single lead-firm. Lead-firms can assist suppliers in upgrading without any associated conflict of interest. Since the core competence of these lead firms tends to be in areas outside of production, helping their suppliers upgrade their production capabilities does not affect their core competency, but it increases the efficiency of their supply chain. Thus in chains characterized by captive relationships, significant product and process upgrading by local suppliers takes place. At the same time, functional upgrading is either discouraged or limited to some functions (Schmitz, 2006).

Hierarchical governance is characterized by vertical integration and managerial control within a set of lead firms that develops and manufactures products in-house. This usually occurs when product specifications cannot be codified, products are complex, or highly competent suppliers cannot be found (Cattaneo et al., 2013).

Hierarchical structures provide regular employment, guarantee quality and build producer capacity. Intra-firm activities facilitate the transfer of intellectual property and knowledge which may be commercially sensitive.

Within the economic literature on global value chains there are some articles concerning certain sectors where upgrading and GVC participation of the firms in Central-European region are analysed. Here we name those that include Hungary.

Upgrading in electronics regarding Hungary and Romania is the subject of the article of Plank-Staritz (2013). As low-cost export production platforms CEE firms were integrated into the global electronic production networks during the nineties. This was supported by local governmental policies. Later in the mid 2000 years these countries were also hit by relocations towards Asian countries. Often own foreign suppliers were brought to the countries and this had an effect on domestic suppliers. Sass-Szalavetz (2014) do find succesful R&D based upgraders among Hungarian subsidiaries and stress the importance of proactive behaviour, local business climate and high-skilled employees.

Since the investments of foreign automotive companies in the 1990s, Hungary excels in the manufacture of engines, transmissions and other main parts, as well as the assembly of cars, although the latter has a lower portion of total production. The main part of the production is directed to export markets, therefore Hungarian automotive export has been increasing in recent decades. Export takes place mainly within the global value chains (corporate network). Regarding the increase of the value added and production upgrading this corporate network (global production network or global value chain) has a key role (Pavlínek et al. 2009).

Concerning the upgrading process in the automotive industry in the CEE countries, Pavlínek and his co-authors (2009) analysed long-term changes in the structure of automotive component exports in Central European countries. Using three classes of automotive products according to their value added, he revealed that the structure of Hungarian export between 1996 and 2006 moved to high value added products. Based on company research, he added that the characteristics of production influence prospects for industrial upgrading. When the product is designed locally, more added value is created in the host country (2009, p. 54.). At the end of the 2000s the picture in

the Hungarian automotive sector is rather heterogeneous: there were companies with medium or high local content (e.g., Magyar Suzuki), and companies with very low local content (e.g., Audi Hungaria Motor). This draws our attention to the heterogeneity of the upgrading process. Jürgens and Krzywdzinski (2010) highlighted the fact that upgrading in the narrow sense does not necessarily mean upgrading in the broader sense. Based on case studies and surveys, upgrading of the organization of work and the transfer best practices (e.g., working time flexibility) into the CEE countries were realized as part of the standardisation of the production (Krzywdzinski 2008).

Another type of upgrading process can be seen when multinational companies transfer their R&D, marketing and distribution competences to local subsidiaries. Concerning research and development output, Winter (2010) draws attention to the constraints on the growth of domestic part, namely R&D as a core competency, which remains located in the home countries of the MNCs. Smahó (2012) also confirmed this. She investigated the knowledge-based process and knowledge-transfer system of the automotive industry in six Central and Eastern European countries and in Austria and Germany as well. She pointed out that foreign direct investments has led to the initiation of a modernisation process in the automotive industry. However, R&D activities cover only applied research. Basic research stayed at the home the headquarters of the MNCs. Regarding research and development figures of the vehicle industry, there are remarkable differences not only among the two regional groups but among the CEE countries themselves as well.

Case study findings of three Hungarian subsidiaries in the machinery industry

In this part we present and analyse the findings of interviews carried out with the CEOs of multinational companies' Hungarian subsidiaries in the machinery industry. Three subsidiaries have been surveyed with the aim to compile information about their upgrading experience.

In line with the mentioned Humphrey-Schmitz's (2002) taxonomy, upgrading may take place in the field of the products manufactured by the given company (shift to

higher-than-before unit-value products), in the efficiency improvement of the production processes (process upgrading), or in the take-up of additional business functions by companies specialised previously only in production (functional upgrading). Finally, upgrading may be intersectoral, when the accumulated competencies are applied in new sectors that promise larger rents and beneficial externalities. Our interviews aimed to reveal details about the first three manifestations of upgrading: intersectoral upgrading is not relevant in our sample.

We have included a small (TIPA Vezérléstechnikai Kft), a medium-sized (IGM Robotrendszerek Kft) and a large company (Grundfos Magyarország Gyártó Kft.) in the sample. Two of them are export-oriented with export shares above 95%. One company is integrated in global value chains through selling the majority of its products (70 % of total sales) to a local subsidiary of a large global company.

Sample companies are to some extent heterogeneous also concerning their governance structures. IGM and Grundfos are both vertically integrated in their MNCs' organisation, they are subject to explicit coordination: a hierarchical form of governance. Conversely, TIPA enjoys high-level of autonomy in all functions (see later) and its transactions can be characterised by relational governance, especially in the case of its dominant buyer.

Another explanatory factor of intra-sample heterogeneity is the ownership structure. Two companies are integrated in the multinational organisations of a rapidly globalising IGM and a global Grundfos company, respectively. TIPA has a domestic (minority: 30%) owner, which partly explains the relatively higher autonomy of the local management. Another factor that influenced the development trajectory and the autonomy of TIPA is that its current foreign owners are two Austrian private equity firms.⁸ Table 1 summarises the main data of the companies in our sample.

⁸As it is evident from the management literature, there are large differences between private equity firm owners and vertically integrated MNCs in terms of governance arrangements, i.e. between the degree of autonomy granted by private equity firms to portfolio companies, and the patterns headquarters coordinate subsidiaries (Barber–Goold, 2007; Klein et al., 2012).

Table 1: Data of the surveyed machinery companies (2014)

	TIPA	IGM	Grundfos
Owner's nationality	Austrian (70%) Hungarian (30%)	Austrian	Danish
Number of subsidiaries in the MNC	3 (*)	24	80 + companies in 55 countries
Products	production equipment (automotive), customised machines and industrial electronic equipment	welding robot systems	pumps (and components thereof) for diverse applications (industrial, construction, utilities, agriculture etc.)
Foundation	1995 / 2006 (2)	1990 / 2000 ⁽⁴⁾	2000
Number of employees	47	166 ⁽¹⁾	2,200 ⁽¹⁾
Sales 2013 (€ million)	4.6 ⁽³⁾	19.7	428.4
Share of exports (%)	15	99.5	97

Source: interview data and income statement for sales

(1): at the time of the interview

(2): predecessor established in 1995; since 2006 in the current form (ownership, activity portfolio etc.)

(3) 2014

(4) entered through privatisation, major development through greenfield expansion

(*) portfolio companies in a diverse range of industries

All companies were founded at least a decade ago. Upgrading is a gradual and time-consuming process, consequently the analysis of companies' upgrading experience requires a timeframe of at least a decade of operation.

Product upgrading

The interviewed managers were unanimous in reporting a substantial expansion of the product mix during the past decade, both in quantitative and in qualitative terms. While the evolution of the product mix was the outcome of the own strategic initiative of TIPA's local management, in the cases of IGM and Grundfos expansion was the result of the owners' relocation decisions.

Specialised initially in the manufacturing of control units to be integrated in industrial production equipment, TIPA decided to upgrade and include also the manufacturing tasks of complex, own-designed production equipment in its product mix. Upgrading in this case required not only new product development, technological and design capabilities, but first of all business development capabilities: the capability to persuade

customers that the small Hungarian factory is a reliable supplier of production equipment, complete assembly lines, and of newly designed, customised solutions.⁹

Conversely, the expansion and the upgrading of the product mix at IGM and Grundfos were driven by the mother companies' relocation decisions. Production at Grundfos expanded rapidly with the relocation of additional products from the investor's home country and from its other facilities. Product upgrading took a qualitative turn when the MNC owner's newly developed products were also located to the Hungarian facility. By the time of the interview, two thirds of the MNC owner's newly developed products are manufactured in Hungary.

IGM has a "textbook-type" product upgrading history. The initial entry mode of its owner was through privatisation of the Győr facility of a socialist state-owned enterprise. Mechanical metal processing activity was transferred to the privatised facility in 1990. Positive experiences motivated the owner to engage in greenfield expansion in the Győr Business Park for the assembly of complex welding robots, followed by the transfer of the production of control systems. Currently the subsidiary is in the process of substantial product upgrading with the partial relocation of the MNC owner's most up-to-date (electron beam) technology from its German subsidiary. Expansion (in both IGM and Grundfos) was continuous, and of such a large extent that it required not only the enlargement of the initial facility but also the construction of new production facilities (Grundfos has already four production facilities in Hungary; IGM recently completed the construction of its third facility). As a result of consecutive (re)location turns, Hungary has become the largest European production location for both IGM and Grundfos.

Decisions on the expansion of production and on the location of newly developed products were in several cases the outcomes of intra-MNC competition:¹⁰ the results of demonstrated subsidiary capabilities. However, once the decision on the expansion of

⁹Interestingly, crisis contributed to the fulfilment of TIPA's upgrading objectives. During the crisis years automotive companies (the main customers of 'A') would opt for improving the efficiency and the reliability of their production equipment instead of making new investments. Demand increased for TIPA's solutions such as camera control systems (automatic optical inspection and handling solutions) and dedicated retrofit solutions of existing production systems.

¹⁰In the case of Grundfos, for example, competing locations included partner subsidiaries in Romania, Slovakia, Serbia, and Bulgaria.

the Hungarian location was taken and investment was made (i.e. production technology was deployed to the newly established manufacturing facility), it became self-evident that the production of specific newly developed products will be located to Hungary. In short, the deployment of the new production technology created a path dependent trajectory for further product upgrading.

Evolution of the production process

As advanced already in the previous section, product and process upgrading are strongly interrelated. The improvement of process efficiency started with an effective absorption and mastering of the transferred technology. Demonstrated subsidiary capabilities proved to be precondition for further product upgrading.

A conspicuous commonality of our interviews was that the surveyed companies co-evolved with the mother companies. Subsidiaries kept pace with the technological development of the production and testing equipment related to their core activities: irrespective of size, they purchased (several times during the surveyed period) new production equipment that represents frontier technology. They invested in enterprise resource planning solutions, where the manufacturing modules contribute to production scheduling, material requirements planning, engineering data management and the like: in short to process optimisation.

We found strong positive relationship between size and commitment to adopt formal process development techniques, such as lean practices. As highlighted in the operations management literature, the combination of advanced manufacturing technologies and lean practices may result in synergistic effects on operational performance (see review by Khanchanapong et al., 2014). Lean practices have a positive impact on multiple dimensions of operational performance: product quality, lead time, flexibility and costs.

TIPA has not invested in the introduction of formal process improvement techniques, nevertheless its products perfectly comply with the non-negligible formal requirements of Audi, its main customer, even without these practices.¹¹TIPA's experts keep

¹¹ Notice that in TIPA's case the lack of formal process management techniques can be explained with the fact that TIPA outsources large volume manufacturing tasks to processing (turning, forging) workshops in

monitoring the technological development that takes place in their industry (e.g. in control technique) and transfer information about the newest innovations to their core employees through targeted seminars.

IGM, the medium-sized company employs highly skilled engineers for development tasks and a group of quality control managers.. A major process development objective at IGM was the reduction of the time requirement of manufacturing customised, special purpose machinery. The reduction of lead time required a comprehensive review of the processes, and the optimisation of both the core and the support processes (e.g. logistics).Consequently, the time requirement of full assembly of an industrial welding robot decreased to 3 to 4 months (previously full assembly took 5 to 8 months).

Process development is even more formalised at Grundfos. Formalisation is manifested in the systematic introduction of up-to-date quality control & quality improvement techniques (such as kaizen, Six Sigma and lean manufacturing) that at the same time ensure the continuous enhancement of process efficiency. Investment in the work environment (health and safety) also contributed, albeit indirectly to process efficiency improvement. Moreover, Grundfos has adopted advanced approaches to measuring business excellence. Production (quality, sustainability) and productivity improvement, in short: the improvement of *the company's own* (company-specific) *production system* is driven ahead not by individual projects (i.e. by implementing from time to time the latest production concepts): it constitutes one of the objectives of *lasting strategic programmes*.

In 1996, the Danish headquarters launched an overarching performance management programme using Manufacturing PROBE, a best practice benchmarking solution. PROBE implementation starts with a review of the operational and management practices which are benchmarked with the help of a database of more than 7,000 companies in 40 countries. The method helps to identify inefficiencies and proposes solutions for improvement. In the second half of the 2000s new group-level reviews started, and that time, the Hungarian subsidiary was already audited as well.

the region. TIPA specialises rather in the know-how of the design of customised special purpose machinery and in the final assembly, deployment and installation thereof.

In 2008, Grundfos started a systematic business excellence development programme (EFQM Excellence) trying to improve on all aspects identified by the PROBE benchmarking tool. The outcome was non-negligible productivity improvement. This programme has also opened up a variety of functional upgrading opportunities (to be detailed later).

Another channel of process upgrading was related to Grundfos's environmental programme, which transcends the 'simple' implementation of an ISO 14001 Environment Management System (implemented in 2004). In an effort to reduce CO₂emission, the Hungarian subsidiary invested heavily in solutions that improve sustainability, reduce emissions and enhance energy efficiency. In 2008, the strategy of 'no increase in CO₂emission' was announced by the headquarters. Although the Hungarian subsidiary has increased its production volume by more than 50 % since 2008, its CO₂emission declined in absolute terms. This was achieved through investment in factory buildings, e.g. heating and lighting; adoption of green solutions (deployment of solar panels, and heat pumps etc.); substitution of old production equipment for new, energy efficient machinery; systematic analysis of energy consumption and waste and dedicated improvement steps. A positive side-effect of this programme was additional process upgrading: investments made in order to achieve sustainability objectives turned out to have considerable impact on process upgrading as well.

Functional upgrading

The expansion of production has, to some extent, automatically triggered functional upgrading at the surveyed companies. Support activities such as HR, accounting, administrative and clerical work, factory maintenance, quality control, etc. were immediately delegated to the local level.

The involvement of the Hungarian management in the procurement and deployment of new production machinery was already function of demonstrated subsidiary capabilities at Grundfos, hence it can be considered as a primary example of functional upgrading. The development of this function was a long and gradual process at Grundfos, since the first milestones in the expansion of local production were marked by

the relocation and the local deployment of the foreign investors' own production machinery from Denmark. Later on, the further expansion of the local production necessitated already the purchase of new production machinery. Demonstrated subsidiary capabilities contributed to the increased involvement of the local process engineers and procurement officers in the selection and procurement of the new production machinery. However, although the local experts of Grundfos participated in the selection of the new equipment, the assembly lines were first delivered to the headquarters' premises, installed and tested (pilot production runs were manufactured) by the engineers and the technicians of the headquarters, before transferring the lines to Hungary. Later again, following several successful upscaling exercises, the Hungarian engineers were entrusted already with the design, procurement and deployment of the technological equipment, without the involvement of the Danish colleagues. This kind of functional upgrading was facilitated by another functional upgrading achievement: by the introduction of the process development function. Local engineers have gained the responsibility for designing the layout of the assembly lines and for optimising the manufacturing processes of the new products.

This gradual development (functional upgrading in breadth and depth¹²) was not characteristic for TIPA. Upon foundation, the CEO of the local subsidiary was entrusted with the building up of the firm. Ever since, he has been responsible for finding and hiring experts in all the necessary business functions, including procurement, finances, HR, logistics, training, engineering, R&D, business development and sales. Consequently TIPA resembles to a family managed, autonomous, domestic-owned company rather than to a subsidiary integrated through hierarchical governance arrangements in a multinational company's organisation, which can be explained by the fact that the owners of TIPA are private equity investors. The upgrading trajectory of TIPA required rather entrepreneurial learning (e.g. Wang-Chugh, 2014). Integration in global value chains was a similarly strong driving force of TIPA's performance: many of its new business partners have been acquired, directly or indirectly, through its major business partner: through Audi's Hungarian subsidiary

¹² Functional upgrading in breadth refers to the increase in the number of business functions a given company is responsible for. Functional upgrading in depth denotes the increase in the complexity and knowledge-intensity of a given business function (Szalavetz, 2012)

IGM is an in-between case from the point of view of autonomy. There is a clear division of labour between the Hungarian subsidiary and the Austrian owner: the latter is responsible for sales, logistics and also for general engineering and strategic R&D issues. The Hungarian subsidiary assumes responsibility for operational procurement tasks (strategic procurement decisions are retained at the headquarters) and for all the operational support activities that are related to the local core activity (except for logistics and sales). Local responsibility is accompanied by a relatively high degree of autonomy in a number of (auxiliary) functions.¹³

The current division of labour is the outcome of substantial functional upgrading by the Hungarian subsidiary: in terms of transferring new products, transfer/purchase of the necessary production equipment, transfer of new business functions. As for this latter, over time the Hungarian subsidiary has gradually taken up several business functions, including engineering; the design of the internal robot base (welding cables, control lines, etc.); IT: programming of the industrial robots; and various support functions, including procurement, controlling, process and product development.

R&D is carried out jointly with the engineers and the product developers of the Austrian owner. The increased role of the Hungarian subsidiary in MNC-level R&D activities is reflected by the increased share of the highly qualified Hungarian engineers in the workforce. Since the owner retains the responsibility for marketing and sales, the customers negotiate the necessary specifications for the design and the parameters of the required customised machinery with the headquarters' experts. The Austrian engineers decide about the division of the R&D tasks with their Hungarian counterparts: they provide the technical specifications of the robots to be designed and manufactured to their Hungarian colleagues.

The three most recent examples of functional upgrading at IGM was the take-up of joint responsibility for the programming of the robot systems; the hiring of a sales specialist (he is responsible for the Hungarian customers and reports directly to the Head Office), and the further development of the electron beam technology that is in the process of being partly relocated from Germany to Hungary.

¹³ The degree of autonomy was fairly high already in the very beginning – note that the Austrian owner's first investment (privatisation of an existing facility) took place in 1990!

Grundfos has followed an even longer functional upgrading trajectory, assuming responsibility for product development and testing; for the development of the software embedded in the production machinery; for selected procurement tasks and for the localisation of procurement (i.e. for finding domestic or CEE suppliers instead of the traditional advanced economy suppliers). As the Hungarian subsidiary had become the largest European manufacturing facility, the Danish headquarters decided to locate distribution and logistics also to Hungary. The service of Hungarian customers was organised from the local distribution centre where not only the locally manufactured products were stored but the full product mix of the MNC owner. Over time the local distribution centre became responsible for other CEE economies as well.

In 2007 a training centre was inaugurated at the 'headquarters premises' of the Hungarian subsidiary in Tatabánya. This business function is related not only to HR, since its activity portfolio is more variegated than simple training provision for the employees. Another function the training centre performs is 'indirect' business development: Grundfos organises courses for, among others, architectural engineers that provide deep insight about the ways Grundfos's products can be used in buildings, about environmental friendly solutions that apply Grundfos's products, etc. The e-Academy site operated by Grundfos serves similar objectives.

Functional upgrading took a new turn with the location of a shared services centre (specialised in finances and IT) to Hungary. Though similarly to local sales and after sales activities, it is performed by a separate legal entity,¹⁴ regarded from the point of view of the Hungarian location this decision can still be considered as functional upgrading.

As mentioned earlier, EFQM Excellence Programme opened up a variety of opportunities for functional upgrading in depth. Envisaging business excellence in all functions, the programme addressed among others workforce management, supplier management and environmental management as well. As for workforce management,

¹⁴ Grundfos has three subsidiaries in Hungary. Our interview was made with the CEO of the manufacturing subsidiary (four factories, a distribution centre, a training centre and the 'headquarters' responsible for support functions). Another subsidiary is responsible for sales, targeting the Hungarian market, and maintenance and repair services. Finally, the third subsidiary is the shared services centre specialised in group-level financial transactions and IT-services.

the absorption and the local implementation of the mother company's corporate culture required non-negligible development of the related functions, often in a formalised, standardised manner. Workforce management for example is being improved through the implementation of the Occupational Health and Safety Management System (OHSAS 18001 certificate), which requires implementation (and the documentation thereof) of all the required procedures. Needless to emphasise here, that the transfer of the corporate culture¹⁵ and the development of the HR function involved substantial intangible investment, addressing for example workforce development, and the improvement of employees' commitment.

Another function that was even more systematically developed at Grundfos was supplier development. The localisation of supplies required the development of supplier screening and system audit skills.¹⁶In the Hungarian case it also necessitated non-negligible support to suppliers in order to help them meet the requirements. In 2011, the Hungarian subsidiary developed a supplier excellence programme. In addition to auditing suppliers' business processes; conveying quality, cultural, ethical, and environmental requirements, and monitoring performance, this multi-year programme included the transfer of best practice solutions, design of customised development programmes (jointly with suppliers), consultation, coaching and evaluation of the results. The outcome of the programme (that, again, necessitated substantial intangible investment by Grundfos) was a spectacular increase in the share of local suppliers: currently (in 2013) the share of locally procured input is 27 %.

Grundfos is, however, also an example of functional 'downgrading', i.e. of the loss of previous mandates. Due to the headquarters' decision on organisational renewal and concentration of specific business functions in shared services centres (SSC), the first loss of mandate concerned finance and accounting: this function was transferred to the newly established SSC that provides services for all companies in the group. Later IT-

¹⁵ The Hungarian subsidiary is relatively autonomous in designing and implementing its corporate social responsibility (CSR) policy. It finances various local community (social, environmental and educational) projects. As a result of deliberate corporate policy, 5 % of Grundfos's employees are handicapped or workers with other disabilities.

¹⁶ System audit refers to auditing existing and potential suppliers' performance including quality, social and environmental dimensions.

related tasks were also transferred to this SSC, which involved a reduction in the number of IT employees and a partial loss of Grundfos's IT-related mandate.

The most recent decision on organisational restructuring involved the concentration of the procurement tasks in one centralised organisational unit. This entailed the partial loss of Grundfos's mandate in procurement (irrespective of the recognised successful local management of this business process). Similar global consolidation is expected in distribution and in the organisation of internal transactions.

Case studies on automotive companies

Our sample companies are remarkable players in the Hungarian economy (i.e., in terms of volume of investment, value added, employment, export) and due to their continuous investments they are also good examples of upgrading process. This group of automotive companies includes final assemblers and main parts manufacturers too.

One company is directly owned by the parent company (Mercedes-Benz Manufacturing Hungary Kft.), the other is a subsidiary of a Group's company (Audi Hungaria Motor Kft.), and the third belongs to a European affiliate of a global company (Opel Szentgotthárd Autóipari Kft.).

Table 2: Data of the surveyed automotive companies (2014)

	Opel Szentgotthárd	Audi Hungaria	Mercedes-Benz Hungary Kft.
Owner's nationality	U.S.	German	German
Number of subsidiaries in the MNC	10 (Opel AG)	16 (Audi Group)	26 (Daimler AG)
Activity	production and sales of internal combustion engines; production of cylinders; production and repair of transmissions; production of engine components/parts	final assembly of passenger vehicles; production of internal combustion engines; tool making	final assembly of passenger vehicles
Foundation	1990	1993	2008
Number of employees (2014)	813	10,954	3,428
Sales 2014 (€ million)	150	7,420	2,815
Share of exports (%)	96.00	99.98	99.68

Product upgrading

Opel Szentgotthárd and *Audi Hungaria* were brownfield investments in the early 1990s, while *Mercedes-Benz Hungary* is a classic greenfield investment in the late 2000s. The evolution of product mix is substantial in the case of all subsidiaries since the founding.

Regarding *Opel Szentgotthárd*, engine production and final assembly of cars started at the beginning of 1992. Due to positive experiences General Motors decided to increase the capacity of the engine factory and the volume of final assembly later. Thanks to consecutive investments since the beginning, the product portfolio has been expanding. Even so, there were some turning points in the history of the Hungarian affiliate when new production started, some activities ceased, and when the position of the Szentgotthárd plant in the global value chain changed (both upward and downward). Shortly after GM acquired full ownership in 1995¹⁷ it announced new investments and

¹⁷ The company was founded in 1990 by the General Motors Corporation (GM) as a joint venture, the minority stake (25%) was owned by the Hungarian company Rába.

the doubling of the capacity of the engine plant. In the following years manufacturing of some other products (cylinders) started. Production in Szentgotthárd was realised through cooperation with the European subsidiaries of GM. There are some functions that ceased (final assembly of passenger vehicles) because of uncompetitive small scale production. This decision was taken by the owner (GM), relocating activities and instead increasing the offshore production in Poland and China. After that the Hungarian subsidiary focused on producing engines and main components.

In 2000 the production of Allison transmissions began. It was the first overseas factory of the U.S. producers. The year 2003 was an important upgrading milestone because production of all own-use cylinders began. The next turning point was the period where the company was a part of the joint venture with the Italian Fiat. Between 2000 and 2005 the company was owned 50-50% Fiat and GM respectively. The corporate network (Pavlínek et al. 2009) and the position of the Hungarian affiliate played a key role regarding product upgrading. During the joint ownership with the Italian Fiat, the reputation and the position of the Hungarian plant in the company's global value chain declined.¹⁸ Production stagnated; furthermore, in this period significant stock piled up at the factory. Global cooperation between GM and Fiat was not successful and cooperation ended in 2005. The Hungarian factory was returned to GM as part of GM Powertrain Europe, responsible for manufacturing engines and transmissions.

Since the establishment of the *Opel Szentgotthárd* the General Motors Company has invested more than 700 million euro in the development of production technology (i.e., evolution of the production process). The construction of the Flex-plant in 2012 made fast and flexible product changeovers possible. That means that it became able to control capacity immediately in response to market needs. The favourable Hungarian business environment played an important role in this investment. The introduction of flexible working hours in labour regulation increased the competitive advantage of the Szentgotthárd plant. At the same time the old engine factory also produced the former "FAM1" engines, which are exported to China. In 2014, with an investment of 60 million

¹⁸ <http://www.autoipari-klaszter.hu/2009/04/28/szentgotthard-sem-orulne-a-fiat-es-az-opel-autoipari-fuziojanak/>

euro, production capacity of the Flex-plant grew by 60 percent, up to 650 thousand engines per year. Together with the production of the “FAM1” engines the Szentgotthárd plant may become the biggest engine factory in Opel AG.

Both the growth of the production and the dynamic expansion of product assortment are relevant at *Audi Hungaria*. Regarding upgrading process, due to the positive experiences (i.e., high profitability and quality of the Hungarian subsidiary) gained over past decade the parent company Audi AG continuously developed the production plant with a record high investment of 7.4 billion euro. The establishment of *Audi Hungaria* was based on relocating an engine production from Ingolstadt (Germany) to Győr. Today, beside the production of small-series engines for Lamborghini in Italy, *Audi Hungaria* is the only engine producer within the Audi Group.

The upgrading process experienced at Audi Hungaria in general had two phases. At first the owner (Audi AG) started a pilot project of small-series production to judge how the plant would measure up to expected results. On the basis of that success Audi AG has been starting a number of pilot projects over the last decades. The main profile of *Audi Hungaria* is engine production; it started with 1.8-litre four-cylinder five-valve engines. In the following period new technologies and products were introduced in the Győr factory. Use of existing capacities and increasing capacities in Győr was dependent on global market conditions. The production highly depends on global markets because within the GVC the *Audi Hungaria* plant is a worldwide supplier and exchange partner. The toolmaking department was established in 2005. Its main task is to supply all production places of Volkswagen Group. In 2011 the toolmaking part was further developed. It is a major asset and technological development, employing more than 580 people work in toolmaking in Győr in various shift models.¹⁹

The position of the Hungarian factory within passenger car production has been improving since the beginning. The Audi TT is produced exclusively in Győr and in the last 7-8 years the final assembly of several new models²⁰ was launched. Since the beginning there has been upgrading in technology of the production of passenger vehicles as well. The management of Audi AG experienced the success of the assembly of

¹⁹ <https://audi.hu/en/profil/termekek/szerszamgyar/>

²⁰ TT Sport Coupé, TT Roadster, A3 cabriolet, RS 3 Sportback

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two series of Audi TT in Győr: after that a decision was made to install complete car production from press shop to final assembly at the local level. In 2013 the production of the Audi A3 sedan started in the new factory building. This investment is a proof of progress in production, as this is the first vehicle completely produced in Győr.

Mercedes-Benz Hungary was founded in 2008 as a subsidiary of the German Daimler AG. The main activities are final assembly and production of parts. There is also a toolmaking department that can make important corrections to existing tools in cooperation with Daimler AG plants in Sindelfingen and Bremen in Germany. In addition to these two sites, parts are also delivered to Rastatt in Germany and to Valmet Automotive in Finland. Car production started in 2012. The current strategy of Daimler AG is to increase the compact class within the total production portfolio in order to be dominant by 2020-2025.²¹ Therefore the Hungarian plant is a new production place for the future portfolio.

The task of *Mercedes-Benz Hungary* in the global value chain of Daimler is not only final assembly: the production plant cooperates with the affiliate in Rastatt in Germany and the independent manufacturer Valmet Automotive in Finland (Daimler AG 2013). The Mercedes A-Class is made in Germany, Finland and Hungary while the rest of compact range (B and GLA) is made only in Germany and Hungary. This network has a key role in the economical production of compact cars, optimises the capacity of the two factories and allows for flexibility and optimal adjustment of resources. Internal competition is very strong because all models at each location can be built in any order and volume. On the other hand, models produced at several locations and units can be allocated optimally in the production network.

Most of the upgrading activity of *Mercedes-Benz Hungary* is focused on the development and expansion of final assembly capacities. Thanks to favourable Hungarian experiences (politics and local factors of production), production management decided to expand existing capacities. Mercedes CLA Class is produced exclusively in Hungary, but further expansion of demand and the possible option of

²¹ http://www.portfolio.hu/vallalatok/magyar_mercedes-vezer_az_elektromos_hajtase_a_jovo.1.214633.html?utm_source=index_main&utm_medium=portfolio_box&utm_campaign=portfoliobox

producing it in Mexico may change this position.²² Competition among the global production places is rather strong.

Corporate issues are the main driving force of product upgrading. Mergers or inter-industrial cooperation (in the case of *Opel Szentgotthárd*) determine the potential of development. Further, competition and in some cases cooperation among production places influences the evolution of the production mix. In the case of *Audi Hungaria* competition factors like cost pressure also continuously play an important role in specifying local product mix. Intra-firm competition plays an important role in all companies measured. In the case of *Mercedes-Benz Hungary* the short term development prospects of the newly established factory are obvious. Tax holidays, state/EU investment incentives (grants), training contributions and the liberalization of the labour law²³ (using flexible working hours) also play an important role in investment and development decisions. However, *Mercedes-Benz Hungary* was not fully satisfied with the level of vocational training in Hungary. Therefore, the company started a training program for both prospective and current employees.

Evolution of the production process (process upgrading)

Opel Szentgotthárd introduced a SAP system in 1996 to provide support for globalization among factories, offering interoperability. The factory's Environmental Management System obtained the ISO 14001 certificate in 1997, and the QS/ISO 9000 certification for quality management standards in 1998. In 2014 when production started in the new Flex-plant, new types of machines were installed and new methods of organizing work were introduced to increase the effectiveness of production. One of these new features, for example, is to increase the number of tasks carried out by machines.

General Motors has been continuously improving energy and environmental efficiency in the Hungarian affiliate. Reducing CO₂ emissions²⁴ and waste are good

²² http://hvg.hu/gazdasag/20131008_Amerikaban_is_meno_a_kecskemeti_Mercedes

²³ http://m.portfolio.hu/vallalatok/szentgotthardi_csillagok_szazmilliardokat_hozott_az_onfelaldozas.201482.html

²⁴ The carbon footprint is the sum of all emissions of CO₂ (carbon dioxide). The calculation of carbon dioxide emissions is based on the energy consumption equivalent of the CO₂ emission of the fossil energy or, for transport activities, the emission and fuel consumption.

examples for that. Thanks to an investment in 2014, Opel Szentgotthárd achieved energy savings by developing certain parts of the processing machine lines serving central cooling and lubricating systems. Modernization the machines installed in 1996 with new computer controlling system means the factory can save energy and reduce errors during production.

Audi Hungaria uses the SAP system and also the ISO 9000 system, and in 2000 introduced lean production. The factory has had its own environmental management system since 1999, and obtained ISO 50001 in 2011. There is a full monitoring system for the whole factory (i.e., not only covering production). The main driving forces in the evolution of the production process are takeover of standardized production processes, using local ideas to increase affectivity and last but not least local decisions based on the strategy set by the Audi AG. Since 2013 Audi Hungaria has been a full-fledged company, elaboration of local strategy is the responsibility (elaborating and implementation) of the Hungarian affiliate.

Ergonomic innovations in final assembly were introduced continuously in Győr using both the Group's and local ideas. The exchange of new methods among the company's global production places is mutual. This development process is also helped by the exchange program in the Group. Engineers from Győr visit worldwide production places to exchange experiences. Audi Hungaria also hosts engineers from other factories. Process upgrading also focuses on increasing energy efficiency. Projects on reducing waste generated during production and using renewable energies are completed or are in progress.

SAP and ISO 9001 monitoring and quality assurance is applied by *Mercedes-Benz Hungary*. In 2011 before starting production the factory obtained the ISO 140001 environmental certification. During production the factory uses the best available technology (BAT). Thanks to continuous monitoring the factory is committed to reducing emissions. All models fulfil the ISO 14062 regulations (eco-friendly product design). Following the environmental protection goals of Daimler AG, a low CO2 emission program was started in the Kecskemét factory. The main target is to reduce the CO2 emission by 20 percent by 2020. Up to now the optimization of transport activities

was realized by giving up road transport and using train carriages from 2013. As a result the factory reduced its carbon footprint.

Functional upgrading

Production support activities like maintenance-, controlling- and production management functions, product introduction, as well as human resources are usually delivered at the local level. The expansion of local responsibilities and the carrying out of new functions within the value chain are confirmed by the interviews and corresponding company reports.

The subsidiary position of *Opel Szentgotthárd* has been changing.²⁵ As mentioned earlier, the development of the product-mix of *Opel Szentgotthárd* is continuous. Parallel with the expansion of production (variety and volume as well), support functions were developed. In 2001 logistical infrastructure was developed in order to prepare for the factory's increasing future output. Other supporting functions like industrial engineering responsibilities also expanded. Monitoring and developing the production processes is one of the tasks dedicated to local engineers. In addition, quality management and environmental management were expanded, were the application of IT solutions in the last period.

Audi Hungaria has been undergoing functional upgrading. In a period of ten years the company became the central engine supplier of the Audi Group. The most important steps were the creation and expansion of R&D facilities and the tool factory. However the R&D activities in Hungary are mostly applied research as mentioned Smahó (2012), the core competencies are located in the home country/parent company (Winter 2010). Even so these activities are important for the creation of higher added value in Hungary, and also for strengthening international cooperation and moving the position of the Hungarian subsidiary within Audi AG forward. In 2001 the Department of Internal Combustion Engines started. The aim of the department is development (friction

²⁵ In 1997 the trade department of Opel Hungary in Budapest was given regional functions. The newly created organization became independent under the name Opel Southeast Europe Ltd. Its responsibilities include organizing sales-related tasks for Hungary and several Central and Eastern European countries as well.

optimization and engine-acoustics analysis, as well as the development of engine derivatives) and working out manufacturing engineering tasks to support serial-production and also education. Regarding R&D, in addition to series-produced engines, test engines have been built in Győr since 2010. As mentioned earlier in the literature review, the complexity of the production has been increasing within the GVC since the beginning. In 2011 *Audi Hungaria* expanded its development activities with the Complete Vehicle Development department, which is responsibility for testing vehicles close to production. Developments are also utilized in higher education by supporting the practice-oriented educational concept at the Technical Faculty of Széchenyi István University in Győr.

Since 2011 *Audi Hungaria* has been taking part in dual vocational training. Cooperating with Győr's vocational schools, in the framework of dual education, 100 students complete their practical studies at Audi annually (HITA 2012). In 2011, after a history of cooperation and as a step into a new phase, a new department called the Audi Hungaria Internal Combustion Engines Department was launched at István Széchenyi University in Győr, was inaugurated. Its research profile is the design and development of internal combustion engines (i.e., tribology of automotive engines, modelling, simulation, and experimental analysis of friction and lubrication phenomena related to internal combustion engines) along with the development of alternative automotive drive systems and automotive industrial technologies.²⁶

The inter-firm tasks of the *Mercedes-Benz Hungary* have been expanding from the beginning. The toolmaking department cooperates with German plants; parts are delivered to the German plants and to the Finish partner. Because of the importance of the product segment and increasing demand for models, cooperation has been deepening since 2012. In the area of functional upgrading, *Mercedes-Benz Hungary* is very proactive in Hungary. In 2009 *Mercedes-Benz Hungary* made a strategic decision and introduced dual vocational training in the factory. In 2011 Mercedes-Benz Hungary signed an agreement with the Faculty of Mechanical Engineering and Automation (GAMF) of the College of Kecskemét to cooperate in dual education. Additionally, an exchange program was started students from all around global sites to visit the factory

²⁶ <http://tmk.sze.hu/department-of-audi-hungaria-internal-combustion-engines>

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in Kecskemét. There is close cooperation between the German and Hungarian factory sites not only for students but for engineers from the R&D department as well. The company's goal is to increase local added value. When production began there were 16 Hungarian supplier companies: this number doubled by the beginning of 2015.²⁷

Changing subsidiary position and embeddedness

Examples of product assortment expansion have been mentioned above. This leads to the allocation of certain functions to local subsidiaries, changing the position of the affiliate within the global value chain. New functions increase embeddedness, providing the affiliate as well as the local suppliers with more functions. Functional upgrading, i.e., cooperation with local organizations and educational institutions, also increases embeddedness.

Opel Szentgotthárd started final assembly of cars in 1992. Due to the optimisation of production within the global value chain and better market- and production conditions, the owner considered developing final car assembly in Poland and China and to cease assembly in Hungary. In other cases relocation was favourable for the Hungarian affiliate. As a result of the former crisis, GM reorganized its global value chain and with it optimized European production. In Bochum (Germany) employees and IG Metall did not agree to the bailout program, and GM management decided to close the factory by the end of 2014. Contrary to this, as a result of a good relationship between employers and employees due to additional investments, Szentgotthárd will become the primary engine producer of Opel AG in the medium-term. Expansion of engine production from 2012 saw some functions outsourced to suppliers. As such the factory has approximately 400 subcontractors and employed staff working in the field of engine production.

Continuous development has led to even more functions being dedicated to *Audi Hungaria*. The Győr plant became the leading engine producer within the Audi Group, serving other Volkswagen factories as well. The company's global position was improved in 2013 when complete car production started, making *Audi Hungaria* a full-fledged company.

²⁷ <http://vs.hu/gazdasag/osszes/tovabbi-allami-tamogatasrol-targyal-a-kecskemeti-mercedes-gyar-0120>

We attempted to classify the three companies based on the typology of governance introduced by Gereffi and his co-authors (2005). They defined governance models based on three factors: the complexity of information exchange; the codifiability (adoption of technical standards) of knowledge; and the capabilities resident in the supply-base. As the author concluded, the type of governance depends on the technological characteristics of the product, i.e., the complexity of production.

Sturgeon and his co-authors (2008) highlighted the complexity of the investigation of the governance as global integration continues to drive the complexity of the analytical problem upward. Schmitt and Van Biesebroeck in a current research²⁸ are investigating the governance in the automotive supply chain using empirical analysis. They separate profit, value added and research and development linkages. They find that in the case of the profit and the value added activities, the relations show *modular* type while the R&D the relations are *captive*. Using this approach in terms of value added Opel and Audi has modular and Mercedes-Benz hierarchical governance. Concerning R&D, the governance of Opel is captive, of Audi is relational and of Mercedes-Benz is hierarchical. Differences can originate the position of the subsidiaries within the MNCs and also the type/complexity of the final products.

Policy implications

Our study based on cases of machinery and automotive firms has some implications for managers. It seems that the three best ways for local subsidiaries striving to gain access to additional resources and engage in further upgrading are as follows.

1) Excel in absorbing mother companies' transfers and continuously demonstrate local capabilities.

²⁸ "Relationship governance in the automotive supply chain"
http://www.rug.nl/research/ggdc/activities/workshops/eframe/slides/session2_vanbiesebroeck.pdf
based on a work in progress: Schmitt, A. - Van Biesebroeck, J. Relationship governance in the automotive supply industry - an integrative approach. University of Leuven, Faculty of Economics and Business.

2) Be aware that the various upgrading channels (product, process and functional) are interrelated: try to identify the interrelated aspects of past specific upgrading results and ‘push’ to achieve new opportunities in the given fields.

3) Lay particular emphasis on intangible transfers: try to gain additional intangible investments in a variety of conventional (footnote 10) and unconventional fields by taking initiatives and gaining the attention of headquarters (Bouquet–Birkinshaw, 2008). This latter recommendation led us to the policy implications of our findings.

First, the surveyed cases have demonstrated the importance of plugging into global value chains, which needs to be supported by all possible means (including support to both inward and outward FDI, and the promotion of MNC subsidiaries’ backward linkages –Antalóczy et al., 2011).

Second, TIPA’s case demonstrated the importance of business development and entrepreneurial learning. This finding highlights the often neglected difference between upgrading by subsidiaries integrated in the global value chains as parts of their MNC owner’s organisation, and industrial upgrading (see e.g. Kawakami–Sturgeon, 2011). This latter requires the promotion of entrepreneurship or, in broader terms, the development of the national system of entrepreneurship (Ács et al., 2014) that needs to *complement* the FDI-based modernisation trajectory Hungary has been following.

Third, and finally, as the case of Grundfos demonstrated, large local subsidiaries of blue chip, global companies have a special role in driving growth and industrial upgrading in Hungary. As Bouquet and Birkinshaw (2008) demonstrated, weight is a strong explanatory factor of headquarters’ attention and commitment: these flagship subsidiaries have greater-than-the-average upgrading perspectives (see also: Birkinshaw et al., 2007). (Notice that IGM is equally in a special position in terms of weight, being the largest production site in Europe).

Consequently, policy should treat these companies with special care, for example, initiate regular regional and national level consultations with the representatives of these companies, in order to ensure that the framework conditions of their operation become and remain optimal.

Conclusions

This paper discussed the experiences of three machinery suppliers and three automotive OEMs. Industrial upgrading, global learning and transfer of general production principles can be observed at all of the automotive companies. The upgrading process appears mostly through changing the position/role of the subsidiaries within the firms' global value chain. There are differences among the firms in terms of the scale of the upgrading. It not only depends on the owner's global strategy but on the type of final products.

Mercedes-Benz Hungary is a final assembler closely cooperating with two other production places, therefore using global solutions as well as implementing new methods and technologies is beyond question. Technological and organizational upgrading means using and implementing Daimler AG's global solutions during the whole production process (from procurement to sales). *Audi Hungaria* has become a strategic subsidiary not only in the case of the internal combustion engines (gasoline and diesel) and R&D activities but in final assembly and the exclusive complete production of certain classes too. The upgrading process is continuous, using not only the innovations of the MNC's global solutions but the know-how of local employees as well. *Audi Hungaria* is the textbook example of global learning and transfer. *Opel Szentgotthárd* – after an optimisation/rationalisation process – maintained its engine production and expanded its portfolio with the production of transmissions. The negative effects of global trends appeared here the most. The impetus of the upgrading process is precisely reflected in the changes (relocations) within the global company. After the inauguration of the Flex-plant it became able to increase and change its engine production more flexibly to keep in step with changing market conditions. This was a great upgrading leap forward, raising the affiliate in the company's hierarchy.

An overarching finding of our interviews was that plugging into global value chains accelerates the development of local subsidiaries: in a continuous *technological, organisational and management learning* process they *co-evolve with their MNC owners*. Owners provide the necessary means for subsidiary learning and upgrading, in the form of tangible and intangible investments, and through providing markets for the

subsidiaries' products. In terms of product upgrading, the surveyed subsidiaries depend on their mother companies: products developed in the central and/or regional research departments are transferred to the premises of the Hungarian production facilities. Nevertheless, some of the surveyed companies host R&D and testing facilities, hence they contribute to a smaller or larger extent to overall R&D activities.

'Entrepreneurial' subsidiaries (Birkinshaw, 1997, 1998) compete (internally) for additional resources and upgrading opportunities, by successfully absorbing the transferred resources, demonstrating their capabilities and taking initiatives on their own.

Another finding was that there is a strong, positive relationship between size and intangible investments: large and powerful global MNCs are more inclined to invest both in 'conventional' knowledge-based assets²⁹ and in intangible assets the return of which is ambiguous³⁰ (such as corporate culture, CSR, supplier development programmes). This finding is important given that a large and increasing number of studies contend that intangible investments have substantial spillover effects; and contribute to productivity increase (as intangible assets are complementary to tangible assets, such as up-to-date production machinery – Corrado et al., 2014; Goodridge et al., 2012; Khanchanapong et al., 2014).

Furthermore, our interviews suggested that upgrading is not a unidirectional process: external factors, such as changes in the business environment and/or in parent companies' strategic decisions may result in the partial loss of previously gained mandates. For example, globalisation tendencies often force large MNCs to centralise selected functions and improve thereby the efficiency of support activities. Consequently, the loss of certain competencies is in most cases independent from the local companies' performance.

²⁹ Traditional intangible assets include innovative property (R&D and design-specific intellectual property rights, and technological competencies); organisational assets (embodied in firm-specific human capital, organisational practices, reputation, brand equity and business network) and computerised information (firm-specific information solutions and databases) – Corrado et al., 2005; Görzig-Gornig, 2013; OECD, 2013.

³⁰ Or, at least, return on investment in these intangible assets seems more elusive than the return on traditional intangible investments.

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