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Global Value Chains and Upgrading – Experiences of Hungarian Firms in the Machinery Industry[1]

Global production networks and global value chains have become widespread today. In these cases firms locate the various stages of their value adding activities across different countries[2]. The activities of global value chains form a new phase of globalisation characterised by fragmented production, transfer of technology, and decreasing transport costs (Kaplinsky 2013). Developing countries are involved in these production networks, perceiving this as an important (if not the only) way to develop. The Central European countries have taken an active part in the chains of multinational firms since the nineties. The benefit derived from this participation varies across sectors and firms. In this article we analyse the experiences of Hungarian companies in the machinery industry. The structure of the article is the following. After a description of the basic research question and methodology, a literature review is provided. In the following section we introduce the companies surveyed and review their product-, process- and functional upgrading experiences. Finally, we discuss our findings and suggest some managerial and policy implications.

Journal of Economic Literature (JEL) codes: F23, M21

Keywords: global value chains, upgrading, machinery industry, MNC subsidiaries, Hungary, case study

The inclusion of Hungarian firms in international production networks and global value chains (GVCs) is a fact[3]. The question is how these companies can exploit their possibilities and how they can improve their position. We try to assess the process of upgrading and the role of the supplier firm and the mother company in this process. Therefore we asked questions relevant to product, process and functional upgrading during personal interviews at supplier companies. Among other things we asked about the steps taken to improve the

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[2] *http://www.oecd.org/sti/ind/global-value-chains.htm.*

[3] *The foreign value added content of exports can be a measure of vertical specialisation and GVC inclusion. As shown by, for example, Stehrer et al. (2012), between 1995 and 2011 this foreign value added increased drastically in Hungary, reaching one of the highest levels (45%) internationally.*

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 which feature upgrading by Hungarian firms participating in GVCs. This methodological approach has both advantages and drawbacks. There are some factors which emerge during the upgrading process (like the transfer of tacit knowledge) which are difficult to measure on a sectoral or macroeconomic level, but which can be revealed in personal interviews. A case study 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 important features which have previously been neglected. Case studies can be used as tests for the applicability of theories. On the other hand, – as a drawback – case studies are not representative and provide limited scope for generalization and can be criticized for being subjective.

Literature review

Over recent decades international trade and production has become controlled by global value chains. It can be said that GVCs construct the market themselves; their network is a complex political and economic system *(Smith et al. 2014).* There is a vast and widening literature on the activities and methods of measuring global value chains. We focus now on the topic of upgrading within GVCs, the literature about which is also abundant.

The structure of global value chains can be various and complex. Although we tend to imagine so, in most cases activities within a global value chain do not follow each other linearly. There are feedbacks and iteration, and activities such as R&D, coordination, and support services are present in several segments of GVCs. In certain sectors GVCs are somewhat more linear, while in others they tend to be horizontal. As *Baldwin–Venables (2013)* describes, multiple parts of a product can come together from different locations for assembly (this is a "spider" configuration) or production, or there can be a sequential process adding some value at each stage (a "snake" formation). These two types can even be combined or joined. Parallel with their increasing fragmentation GVCs have become longer and the number of transactions between firms has grown. Value chains are the networks of these transactions.

The importance of *services* in value chains has increased significantly over the past decades. Both the manufacturing process itself and the period after production utilise several kinds of services *(Dachs et al. 2012; Stehrer et al. 2012).* The share of services in the output of manufacturing industries has increased in European countries, and this phenomenon is linked to technological innovation. An increasing number of innovative firms gain more of their turnover from services. In some cases production firms have even turned to R&D or service activities instead of manufacturing (like IBM's Hungarian affiliate).

Participants in 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 most often not controlled by one single leader; their direction itself can be fragmented. One affiliate of a multinational can have several roles within its

function *(Sass–Szalavetz 2014)*, and it can have higher (global) and lower level tasks within one segment.

Here, we analyse here upgrading from the perspective of 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 has usually been applied since then (besides economic upgrading we may also speak of "social upgrading"[4]). According to these authors the upgrading of a firm may be:

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. inter-sectoral upgrading: using the knowledge acquired in particular chain functions to move into different sectors (often also called 'inter-chain' upgrading which takes 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 this, production processes can also be improved by matching safety, technical or environmental standards – as a condition of market entry – which 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 through 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 that its affiliates fulfil more and more complex tasks. Functional upgrading can be realised in three main ways. The first is via a *widening* of functions: today there is practically no firm that only produces; several other functions have been joined to the production itself, such as logistics, purchase, controlling, information technology, maintenance, development of tools, and even communication and human resource management, etc. The extent of such diversification of functions depends on the company's size and age. The second method

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

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, in which an affiliate can become itself regionally or globally competent and responsible. An example of 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 the kind of skills that strengthen the position of the firm within the GVC.

It is important to stress that local subsidiaries' upgrading process is embedded in a broader dynamics: the whole value chain exhibits continuous evolution. As external conditions change, mother companies, and GVC governors react and modify value chains, develop certain parts, reorganise, and diversify. Innovation activity is continuous. From the participant firm's perspective upgrading is a must, and 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 introduced some 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 producers connected to a global distributor and this specifies the necessary products.

The economic power of the lead firm in a buyer-driven GVC stems from the control of marketing and retail activities, while in a producer-driven GVC it is proprietary knowledge and technology which dictates *(Keane 2012).* Over the years, as 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, and 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 central governing mechanism is price *(Gereffi et al. 2005).* The organisation of the chain presents low barriers to upgrading; the process 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. 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, involving tacit knowledge exchange and knowledge spill-overs. The lead firm specifies what it needs, and controls the highest valued activity in the chain *(Cattaneo et al. 2013).* Producers in relational chains are more likely to supply products which are differentiated in terms of complexity, quality, origin or other characteristics. 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. Small firms can find themselves sometimes "locked-in" due to their reliance on

a single lead-firm. Lead-firms can assist suppliers in upgrading, it does not affect their core competency, but it increases the efficiency of their supply chain. Thus in such chains significant product and process upgrading by local suppliers takes place. At the same time, functional upgrading is either discouraged or limited to certain functions *(Schmitz 2006).*

Hierarchical governance is characterized by vertical integration and managerial control within a set of lead firms that develop and manufacture 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).*

Upgrading experiences in Central and Eastern Europe

Within the economic literature on global value chains and upgrading, the experiences of developing countries in Asia, Africa, or Latin-America represent a higher proportion than analyses of the practices of Central and Eastern European economies[5]. There are, however, some articles concerning certain sectors in which upgrading and the GVC participation of the firms in this region are analysed.

Applying an econometric method, *Javorcik–Spatareanu (2009)* analyse spillovers from foreign multinationals to Czech affiliates. They demonstrate a kind of self-selection effect, thus multinational suppliers are different from other firms in terms of various characteristics (productivity, wages, capital-intensity, etc.); thus better performing firms are more likely to become multinational suppliers. Apart from this, they find that such suppliers learn from their relationship with multinational firms.

Perhaps the highest number of publications on global value chains and upgrading in Central Europe refer to the automotive industry (see for example *Pavlínek et al. 2009; Fortwengel 2011).* These usually apply industry-level analyses. *Pavlínek et al. 2009* find that the proportion of low value-added components produced in Central Europe decreased and that of the high-value added components increased during the decade from the mid-nineties onwards.

Poland's product upgrading was especially impressive. Thus, the Central European automotive industry did manage to become increasingly integrated in the value chain of high-tech components within the value chain of high-tech component production. Moreover, as *Fortwengel (2011)* states, nowadays, unlike in earlier phases of internationalization, it is also premium cars which are produced in these countries. However, the overall picture is complex and partly contradictory. The upgrading path of the Central European automotive sector is not yet established, and depends on a several influencing factors. *Krzywdzinski (2008)* also finds some evidence on social upgrading, analysing working conditions in the Central European automotive industry.

Upgrading within a global value chain is strongly correlated with technology spillovers. The study by *Pavlínek–Zizalová (2014)* relates productivity and technology spillovers to process and functional upgrading. Here the analysis takes place at company level. Based on hundreds of questionnaires and interviews over several years this article explores the linkages between Czech automotive suppliers and foreign companies. They conclude that

[5] *There is a considerably larger literature on the GVC participation of these countries applying value added trade data and a macroeconomic approach.*

spillover effects and the outcome of upgrading are somewhat heterogeneous across the industry and depend on the absorptive capacity of firms. This reinforces earlier results that those firms whose absorptive capacity is better can benefit more from integration in GVCs and improve their position *(Scott-Kennel 2004)*. In the case of the Czech firms foreign owners dominate the automotive sector, and most capable domestic suppliers have also been taken over by foreigners. Foreign multinationals require high quality standards and strict delivery timing, and those who were unable to meet these were squeezed out. This was even more the case following the 2008-2009 crisis. Certain investors (mainly South Korean and Japanese) "brought" their own supplier networks. Regarding those Czech suppliers who had been successfully integrated into GVCs, the sophistication and quality of the components they supply have increased in most cases. However, the picture regarding productivity and technology spillovers and upgrading is mixed among domestic Czech firms *(Pavlínek–Zizalová 2014)*.

Automotive GVC participant firms are analysed by *Domanski et al. (2013)* too, but in this case in Poland. They examine the effect of the international crisis and find that the majority of Polish manufacturers that are tier-one or tier-one/tier-two suppliers were not adversely affected by the crisis. Its negative effects are more visible among tier-two and lower-tier suppliers as well as among companies manufacturing for the aftermarket. Labour-intensive manufacturers experienced a greater decline in sales, and suppliers for major carmakers operating in Poland were in a better position than suppliers integrated with the supply chains of assembly plants located in Western Europe. *Domanski et al. (2013)* find that the continuous process of functional upgrading of automotive subsidiaries in Poland has largely slowed since 2007, except for the development of some financial and accounting services. Prospects for further upgrading will primarily depend on the prosperity of the sector and the strategies of transnational corporations.

Global networks in the Slovak clothing industry were analysed by *Smith et al. (2014)*. The authors state that those firms that have upgraded successfully within a GVC were able to weather the crisis more effectively. Regarding social upgrading, export growth was achieved, but cost pressure on Slovak clothing firms resulted in a decline in employment.

Roukova et al. (2008) analysed footwear production networks in Poland and Bulgaria, based on surveys of firms. They found cases in which the participation in international production networks promoted the development of footwear firms in Poland (investing in new factories and technologies, and developing networks of their commercial offices, and advertising). Many companies are dependent on the foreign contractor, mostly factories that have had a very good start but were not able to cope with the growing market competition from cheaper footwear production imported from Asian countries. In Bulgaria the great majority of footwear production is sold in Italy. The Italian contractors in Bulgaria are either large firms or Italian firms which went bankrupt at home and moved to Bulgaria and established their business there in the first half of the 1990s. For these firms the advantage of geographical proximity, cheaper labour, a lack of tax control and weak law enforcement during the transition were important. Some of these firms were among the first to leave Bulgaria in the beginning of 2000s because of increasing state enforcement of labour acts and regulations *(Roukova et al. 2008)*.

Upgrading in electronics in Hungary and Romania is the subject of an article by *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-2000s, these countries were also hit by relocations towards Asian countries. Often the companies' own foreign suppliers were brought into the countries and this had an effect on domestic suppliers. *Sass–Szalavetz (2014),* however, do find successful R&D based upgraders among Hungarian subsidiaries and stress the importance of proactive behaviour, the local business climate and high-skilled employees.

Case study findings of three Hungarian subsidiaries in the machinery industry

In this section 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 of compiling information about their experiences of upgrading.

In line with the previously mentioned taxonomy of *Humphrey–Schmitz (2002),* 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 previously specialised 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. Interviews were based on open-ended questions that focused on the histories, drivers and outcomes of upgrading.

Sample companies

Sample companies were selected with the aim of demonstrating the heterogeneity of successful development trajectories even within one single industry. We have therefore included a small, a medium-sized and a large company in the sample. Two of them are export-oriented with export shares above 95%. One company is integrated in global value chains by 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 also heterogeneous from the point of view of their governance structures. (B) and (C) are both vertically integrated in their MNCs' organisation, and they are subject to explicit coordination, i.e. they have a hierarchical form of governance. Conversely, (A) enjoys a high-level of autonomy in all functions (see below) 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 (B), and a global (C) company, respectively. (A) has a domestic (30% minority share) owner, which partly explains the relatively higher autonomy of the local management. Another factor that influenced the development trajectory and the autonomy of (A) is that

its current foreign owners are two Austrian private equity firms.[6] *Table 1* summarises the main data of the companies in our sample.

Table 1

Data of the companies surveyed (2014)

	A	B	C
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

(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.
Source: interview data and income statement for sales

As the table data make obvious, all companies were founded at least a decade ago. Being an established company was an important selection criterion, since upgrading is based partly on demonstrated subsidiary capabilities. 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 managers interviewed 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 a strategic initiative on the part of (A)'s local management, in the cases of (B) and (C), expansion was the result of the owners' relocation decisions.

[6] As is evident from the management literature, there are great 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 use to coordinate subsidiaries (Barber–Goold 2007; Klein et al. 2012).

Specialised initially in the manufacturing of control units to be integrated in industrial production equipment, (A) decided to upgrade and also include the manufacturing tasks involved in complex, own-designed production equipment in its product mix. Upgrading in this case required not only new product development, and technological and design capabilities, but above all business development capabilities: the capability to persuade customers that a small Hungarian factory is a reliable supplier of production equipment, complete assembly lines, and of newly designed, customised solutions.[7]

Conversely, the expansion and the upgrading of the product mix at (B) and (C) were driven by the mother companies' relocation decisions. Production at (C) 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. At the time of the interview, two thirds of the MNC owner's newly developed products were manufactured in Hungary.

(B) 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. The mechanical metal processing activity was transferred to the privatised facility in 1990. Positive experiences motivated the owner to engage in greenfield expansion, and have a separate production site constructed in the Győr Business Park. The assembly of complex welding robots was located to the new production site, 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. This means the Hungarian subsidiary is about to expand its product mix substantially, including a variety of electron beam chambers and production machines for welding: these products, used in the automotive, aircraft and space industries are expected to become the main drivers of increases in demand.

Expansion (in both B and C) was continuous, and of such great extent that it required not only the enlargement of the initial facility but also the construction of new production facilities. (C) already has four production facilities in Hungary; (B) recently completed the construction of its third facility. As a result of consecutive (re)locations, Hungary has become the largest European production location for both (B) and (C).

Decisions on the expansion of production and on the location of newly developed products were in several cases the outcomes of intra-MNC competition:[8] the results of demonstrated subsidiary capabilities. However, once the decision on the expansion of 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.

[7] *Interestingly, the crisis contributed to the fulfilment of (A)'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 rather than making new investments. Demand increased for (A)'s solutions, such as camera control systems (automatic optical inspection and handling solutions) and dedicated retrofit solutions for existing production systems.*

[8] *In the case of (C), for example, competing locations included partner subsidiaries in Romania, Slovakia, Serbia, and Bulgaria.*

Evolution of the production process

As already argued 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, i.e. with the continuous improvement of production capabilities. Demonstrated subsidiary capabilities proved to be the precondition for further product upgrading, i.e. for the location of newly developed products to the given subsidiary, together with the transfer (or the *de novo* procurement) of the production technology necessary for the manufacturing of the newly developed products.

A conspicuous common feature of our interviews was that the companies surveyed 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 which represented 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 a 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 the 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.

(A) has not invested in the introduction of formal process improvement techniques; nevertheless, its products comply perfectly with the non-negligible formal requirements of Audi, its main customer, even without these practices.[9] (A)'s experts keep monitoring the technological development that takes place in their industry (e.g. in control techniques) by attending top international fairs and transferring information about the newest innovations to their core employees through targeted seminars.

(B), the medium-sized company, employs engineers and a group of quality control managers. Some of the engineers have qualifications in continuous improvement, failure mode & effect analysis (FMEA), and value analysis / value engineering (VA-VE) methods; however, these practices are not systematically applied at (B) – only on an ad hoc basis in the course of process improvement projects. A major process development objective at (B) was the reduction of the time requirement for manufacturing customised, special purpose machinery. The reduction in 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 for the full assembly of an industrial welding robot decreased to between 3 and 4 months (previously, full assembly took 5 to 8 months).

Process development is even more formalised at (C). Formalisation is manifested in the systematic introduction of up-to-date quality control & quality improvement techniques

[9] *Notice that in (A)'s case the lack of formal process management techniques can be explained by the fact that (A) outsources large volume manufacturing tasks to processing (turning, forging) workshops in the region. (A) tends to specialise in the know-how of the design of customised special purpose machinery and in its final assembly, deployment and installation.*

(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, (C) 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 forward not by individual projects (i.e. by implementing the latest production concepts from time to time), but 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 audited as well.

In 2008, (C) 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 (C)'s environmental programme, which transcends the 'simple' implementation of an ISO 14001 Environment Management System (implemented in 2004). In an effort to reduce CO^2 emissions, the Hungarian subsidiary invested heavily in solutions that improve sustainability, reduce emissions and enhance energy efficiency. In 2008, the strategy of 'no increase in CO^2 emissions' was announced by the headquarters. Although the Hungarian subsidiary has increased its production volume by more than 50% since 2008, its CO^2 emissions have 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.

Conversely, the involvement of the Hungarian management in the procurement and deployment of new production machinery was already a function of demonstrated subsidiary capabilities at (C), hence it can be considered as a primary example of functional upgrading. The development of this function was a long and gradual process at (C), 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 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 (C) 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 at the headquarters, before the lines were transferred to Hungary. Later again, following several successful upscaling exercises, the Hungarian engineers were already entrusted with the design, procurement and deployment of the technological equipment, without the involvement of their Danish colleagues. This kind of functional upgrading was facilitated by another functional upgrading achievement: the introduction of the process development function. Local engineers have acquired 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 depth[10]) was not characteristic of company (A). 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, finance, HR, logistics, training, engineering, R&D, business development and sales. Consequently (A) resembles a family managed, autonomous, domestic-owned company rather than a subsidiary integrated through hierarchical governance arrangements into a multinational company's organisation, which can be explained by the fact that (A)'s owners are private equity investors.

(B) 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.[11]

The current division of labour is the outcome of substantial functional upgrading by the Hungarian subsidiary: over the last decade the owner has simultaneously developed both the original site (acquired in a privatisation transaction, specialised in metal processing) and the greenfield location, in terms of transferring new products, transfer/purchase of the necessary production equipment, and transfer of new business functions. As for this latter, over time the Hungarian subsidiary has gradually taken on 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, and 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

[10] 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).

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

reflected by the increased proportion of the highly qualified Hungarian engineers in the workforce. The co-managing director of the Hungarian subsidiary in charge of production and technical development is the Chief Technical Officer of the Head Office: he spends some days at the Hungarian subsidiary every week. 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 their Hungarian colleagues with the technical specifications of the robots to be designed and manufactured.

The three most recent examples of functional upgrading at (B) 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.

(C) 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 to Hungary as well. Service for Hungarian customers was organised from the local distribution centre, where not only the locally manufactured products were stored, but also 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 not only related to HR, since its activity portfolio is more variegated than providing simple training provision for the employees. Another function the training centre performs is 'indirect' business development: (C) organises courses for, among others, architectural engineers who provide deep insight into the ways (C)'s products can be used in buildings, and into environmental friendly solutions that apply (C)'s products, etc. The e-Academy site operated by (C) serves similar objectives.

Functional upgrading took a new turn with the location of a shared services centre (specialised in finance and IT) to Hungary. Although similarly to local sales and after sales activities, it is performed by a separate legal entity,[12] from the point of view of the Hungarian location this decision can still be considered functional upgrading.

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

[12] *(C) has three subsidiaries in Hungary. Our interview was conducted 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 specialising in group-level financial transactions and IT-services.*

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 relevant documentation) of all the required procedures. We do not need to emphasise here that the transfer of the corporate culture[13] and the development of the HR function involved substantial intangible investment, addressing, for example, workforce development and the improvement of employee commitment.

Another function that was even more systematically developed at (C) was supplier development. The localisation of supplies required the development of supplier screening and system audit skills.[14]In 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, the design of customised development programmes (jointly with suppliers), consultation, coaching and the evaluation of the results. The outcome of the programme (which, again, necessitated substantial intangible investment by C) was a spectacular increase in the share of local suppliers: currently (in 2013) the share of locally procured input is 27 %.

(C) is, however, also an example of functional 'downgrading', i.e. of the loss of previous mandates. Due to the headquarters' decision regarding organisational renewal and the 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, which provides services for all companies in the group. Later, IT-related tasks were also transferred to this SSC, which involved a reduction in the number of IT employees and a partial loss of (C)'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 (C)'s mandate in procurement (irrespective of the already recognised successful local management of this business process). Similar global consolidation is expected in distribution and in the organisation of internal transactions.

Discussion and implications

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 by providing markets for the subsidiaries' products. At the same time 'entrepreneurial' subsidiaries *(Birkinshaw 1997, 1998)* compete (internally) for

[13] 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 (C)'s employees are handicapped or workers with other disabilities.

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

additional resources and upgrading opportunities, by successfully absorbing the transferred resources, demonstrating their capabilities and taking initiatives on their own.

Conversely, the upgrading trajectory of (A) required more *entrepreneurial learning* (e.g. *Wang–Chugh 2014).* Responsibility for business development makes this case unique (or, at least, quite rare) among foreign-owned Hungarian companies. Responsibility for business development and the complete portfolio of business functions makes the evaluation of functional upgrading irrelevant in this case. The flipside of the coin is that both product and process upgrading are strongly interrelated with (A)'s business development performance. These differences notwithstanding, integration in global value chains was a similarly strong driving force of (A)'s performance: many of its new business partners have been acquired, directly or indirectly, through its major business partner, Audi's Hungarian subsidiary.

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 assets[15] and in intangible assets the return of which is ambiguous[16] (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 increases (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.

As for the managerial implications of our findings, the three best approaches 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.
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 leads 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

[15] 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 networks) and computerised information (firm-specific information solutions and databases) – Corrado et al. 2005; Görzig–Gornig 2013; OECD 2013.

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

outward FDI, and the promotion of MNC subsidiaries' backward linkages – *Antalóczy et al. 2011).*

Second, (A)'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 (C) demonstrated, large local subsidiaries of blue chip, global companies have a special role in driving growth and industrial upgrading in Hungary. As *Bouquet–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 (B) is also in a special position in terms of weight, being the largest production site in Europe). Consequently, policy should treat these companies with special care by, for example, initiating 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.

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