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NEW GLOBAL DIVISION OF COMPETENCES?

THE INTERNATIONALIZATION OF ENGINEERING IN GERMAN AUTOMOBILE COMPONENTS SUPPLY COMPANIES[1]

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Internationalization of manufacturing industries is usually discussed with regard to labour-intensive production. But there are some tendencies that stand for the internationalization of research, development and design, too. And if it is true that the know-how of the multinational companies is going global, we have to face a new division of competences between cores and peripheries. The paper will present an empirical example of automobile components supply companies. This sector has become important for the "national innovation system" in Germany. The North American automobile industry has shown the successful shift of know-how into newly industrializing countries to use cheaper labour costs also for highly qualified employees. Delphi, which had been a part of General Motors and became independent in the 1990s, arose as a technology centre in Northern Mexico. Delphi employs 200 000 persons worldwide; the headquarters are in Troy (Michigan, USA), Paris, Tokyo und São Paulo. Delphi has built up more than 30 technology centres for research, development, design and testing (Fig. 1). The most important of these centres, employing about 2 000 engineers and technicians, is located in Ciudad Juárez, Northern Mexico. This is a region that is usually known for cheap maquiladora branch plants and not for qualified labour. But Delphi gives work to engineers and technicians, too, as well as in new technology centres in Poland and India (Fuchs 2002).

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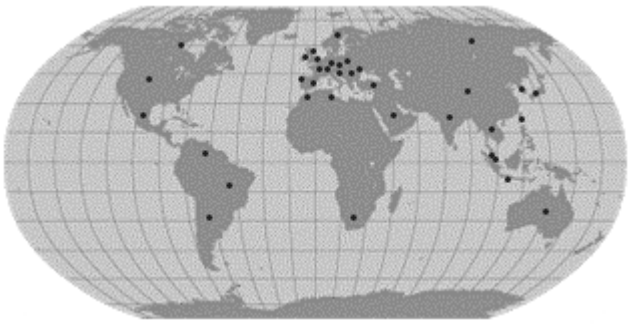
Fig. 1.- *Locations of Engineering and Test Centres of Delphi (Source: Delphi 2002)*



Delphi is an example of the internationalization of a company supplying very different automobile parts. The electronics sector especially is very dynamic and ready to "go global". The internationalization of knowhow-intensive tasks could lead to new international competition which, for example, is different from the international division of tasks for textiles and clothing: regions do not only have to optimize the regional conditions for standardized functions of the company organization, but also for know-how-intensive parts of the global value chains (see Meyer-Stamer 1997). But there are also forces against globalization, such as the high quality standards of the OEMs (Original Equipment Manufacturer), which often lead to a cautious management strategy.

This study follows the micro-analytical view and aims to analyse the shared visions of managers about the global division of R&D, and the ways managers are steering the processes. The study will show governance on the micro level, and it will provide insights into power structures which are much more complex than hierarchical relations, but which resemble ideas as discussed in the network society (Messner 1997). To analyse the shared visions of the managers of a company is central to this study. This can only be discovered by qualitative and explorative studies, and not by standardized methods. Focusing on the shared visions, we can tie the approach to the cultural turn of economic geography. Most of these approaches have in common that they see the communication between members of a specific social system as being basic. "Reality" is continuously produced and reproduced. But the realities are not split up into different worlds, because communication leads to shared visions. The perception of the managers and their decisions must be reconstructed, because they are not ex ante a rational choice.

The interviews were conducted at German suppliers of electronic components and systems for the automotive industry between February and May 2002. The companies were selected from the data base of the German Association of the Automotive Industry (VDA) and in consideration of the problem of separating electronic supply companies from other suppliers (see Schamp 1997, 234f). Because of the explorative character, six companies were chosen for in-depth interviews. In this paper, three case studies are presented which are based on interviews with managers of the company as well as managers of R&D.

In the following, after some comments on the organization of research, development and design in manufacturing industries, some case studies will make clear that the shared visions of management can lead to different paths on how to organize the value chain. There are different kinds of governance that lead to different solutions. Thus, there is no "pressure" towards internationalization, but there are different trajectories.

Engineering

Research, development and design are usually collectively called “engineering”, but often in different understandings (see Jürgens 2000, 164, Malecki 1997, 51-53, VDA 2001, 194). However, it can be said that research is an early stage, development is later, and design is close to production, although the processes are interwoven and seen more as an interactive system rather than as a cycle. The competences of engineering can be divided into competences that are important for the product, and those that are important for the production process, such as machines, tools etc. Although product and process innovations are interrelated – new products need new processes – the competences of engineering are different and sometimes split up among different plants. Usually, the engineering that is necessary for research and development of new products is located close to the headquarters, while the design of the production process is found near to the production plant (Schamp 1996). But this is only a tendency and can be organized differently (Serapio / Dalton 1993). As Delphi shows, there are cases of bringing product-related research to the former periphery. But we cannot only focus on such famous examples as Delphi, and should not only look at the sensational product research. The design of the production process is often neglected (see Fuchs 2002).

If we want to know more about competences in product and process engineering, we must take into account the fact that not only competences of technological knowledge are important but also the competences of steering the organization. There is a need for the qualification of how to organize the process of engineering, too. We have to bear in mind that there is a difference in engineering competences for product development and for process design. But there is, as well, a distinction between competences of organization and of technical performance.

The technical performance for engineering activities is obvious. The competence to organize the R&D process is very important for multinational companies. It is related to the question about the international division of competences and governance in the company. The discussion about governance has its roots in research by social scientists into globalization on the macro and meso level, but is now spreading to research into multinational companies (see Lacertera 2001, Messner 1997, Nadvi / Wältring 2002). Related to the topic of this paper, the supply of automobile components, there are some analyses including hierarchies that had been conducted already before the discussion about governance in manufacturing enterprises. Bertram (1992) suggested a transaction-cost approach and laid the basis for the integration of power and hierarchies in industrial geography, focusing on the automobile industry. Dicken / Hudson / Schamp (1995, 10-14) discussed the automobile industry in Europe and showed that the system of regulation is dependent on the European level as well as on national specifics. Recent research discusses the dependencies and interdependencies in the value chain and the role of regional knowledge, too. Rentmeister (2001) examines R&D companies that are suppliers to OEMs, and Schamp (1997) demonstrates the advantages of a mostly rural area, in which historically specific skills developed which are now fundamental competences for automobile components suppliers. These studies show the close interconnection between the qualification of employees, but also in a broader sense the competences of a company, and the specific regional system. As the company is integrated in – often globally organized – value chains, these value chains influence the regional systems as well as being affected by regional conditions. Thus, if we want to analyse the competences of regions or “regional learning”, we have to look at the value chains. For automobile components supply companies the OEMs are very important.

IMPORTANT TRENDS IN AUTOMOBILE COMPONENTS SUPPLY

Electronic suppliers to the automobile industry have undergone recent changes that caused many companies to decide to internationalize R&D. These changes include the transfer of R&D from the OEMs to the supply companies, quality management, and general processes of growth of electronic suppliers for the OEMs:

The transfer of R&D from the OEMs to the supply companies has its roots in the management strategies of lean production which were introduced in the late 1980s. The OEMs concentrate on core competences and define themselves more as a logistics organizer than as an integrated factory. The suppliers have to offer more and more complete systems instead of single components. To do so they need more knowledge. But it would be euphemistic to talk only of upgrading (Humphrey / Lecler / Salerno 2000) with positive effects for the suppliers. In Germany, the suppliers to the automobile industry have to bear a quarter of the costs for R&D in the automobile supply chain. Also in smaller supply companies the costs for R&D are about 7% to 10% nowadays (1999; VDA 2001, 57). In 2010, the cost of R&D could reach 40% to 50% (Rentmeister 2001).

The transfer of competences from the OEMs to the suppliers intensifies business rivalry. While in the early 1990s there were about 30 000 first-tier suppliers in Germany, there are 8 000 today. The fierce competition does not only lead to pressure on prices, but also to the need to produce very good quality. Quality standards have become a factor of increasing importance. In software industries, we talk of CMM levels (Capability Maturity Models) that are an international standard of quality. This orientation on quality can lead to a strategy that avoids internationalization, because the managers orientate the strategy on qualified personnel in the core plants and regions. This is a strategy orientated on safety: they know the qualification of the engineers on the whole, and so they concentrate on these employees to maintain the high quality standard required by the OEMs. But it can also be a guide to a specific strategy of internationalization that is searching for specific regions that already have experienced engineers and technicians.

Internationalizsation needs processes of growth. These were initiated in the electronic supply companies by the tendency to build cars with a lot of electronic components and systems, especially in Europe. Many parts that had been mechanical components became electronic or “mechatronic”. These growth processes led to the strategy of internationalization not to substitute plants and competences in the core countries by creating new capacities at the periphery, but to a strategy of additional capacities on world level. Many suppliers had already built up plants for labour-intensive production on the global level, and now they have to face the issue of internationalization of high-level competences, too.

REASONS FOR INTERNATIONALIZATION AND PERSISTENCY

Thus, some managers decide in favour of going global. But others keep their R&D capacities in the core plants, especially because of the pressure to provide high quality. The following examples will show the shared visions and the decisions in three companies which had chosen different ways between the limitations of “labour costs” and “experienced employees for a high quality”. The first case study shows the persistency of R&D (which is combined with an internationalization strategy for the production plants). The second example shows an internationalization strategy based on the search for “competent regions”. And the last case study will show a company where labour costs are the most important factor.

In discussing this scheme we have to bear in mind that it is idealized. Most managers are involved in decision-making processes which reflect all three aspects: 1) The management knows the importance of stable labour relations especially in R&D and of highly qualified labour in the centres; 2) the management is looking for know-how in engineering on a world level; and 3) competences are decentralized, or are growing autonomously in the foreign plants. Thus, if we want to discuss globalization and the possibilities for regions to be "sticky" (Markusen 1996) to keep engineering activities, we may not only have to focus on labour costs but can identify different trajectories that are open to political influences, too. In this study, some experts expressed the view that this cautious strategy of internationalization, strongly facing quality standards and know-how, may be more specific to the German automobile industry than, for example, the American automobile industry which has already made further steps in internationalization. The following case studies show different trajectories of the internationalization of engineering.

Case study I: Persistency for saving quality

The company in this case study develops and produces locking systems for the international automobile industry. It was founded in Velbert (Germany) in 1908, a traditional region for the production of keys and locks. In 1920, supplies to the automotive industry started up, and today the most important customers are DaimlerChrysler, Volkswagen, BMW, GM/Opel/Vauxhall and Ford. There are about5 000 employees working worldwide, of which 1 750 in Velbert. Another plant, which also includes R&D, is located near Munich, but the centre of R&D is still in Velbert.

The international OEMs made the internationalization of production necessary. But highly skilled workers are still important, as the company finds in the Velbert area with its long tradition of metal manufacturing. In contrast to the persistency of R&D at the home base, internationalization of production set in about 20 years ago. In 1983, Shiroki (Japan), a supplier to Toyota, received a licence from this company. Then, plants were built in South Korea, the United Kingdom (Willenhall and Tipton), and in the USA (Germantown, Detroit, Greenville). The Willenhall location was chosen because company management saw the location as a "British Velbert" with regard to the metal manufacturing tradition. The managers have the same opinion about the new locations in Saxony (Germany). Further plants (50% ownership) are located in Sittard (Netherlands), in Katowice (Poland), in El Burgo de Osma (Spain), in Tondela (Portugal) and in Atibaia (Brazil). Furthermore, there are two plants in China (Yantei und Shanghai), in India (Delhi) and a new plant in South Korea (Chonan).

Although production is organized on a global level, the management tends to keep R&D in the German plants. The only kind of knowledge transfer occurs through the international exchange of experts within the multinational corporation. But in the foreign plants there is some movement towards building up competences. This is quite interesting because it shows the possibilities of plants which top management had not conceptualized for the growth of competences. Expansion of competences is beginning in departments close to production, such as the development and design of the production process, but also extending to competences in product development. An important reason for this is changes in the foreign plants that make sense of decentralized knowledge. In this company, things develop as follows: the foreign plants buy the first machines and the know-how for using the equipment from specific firms (for example, other companies within the corporation), and begin to assemble the parts. Already at that stage the factory needs decentralized competences for repair and maintenance of the equipment. By and by the tasks done lead to an integrated factory. The local know-how is supplemented by competences for planning the production

process and meeting quality standards. Finally, the company engineers may feel the desire to develop products of their own. In that case, the engineers only develop some details in the foreign plants; for example, changes to the product for local demand. But, on the whole, we can recognize upgrading processes in the plants, and this local learning is amplified by the general product development in electronic automobile supplies, the increasing complexity of the components, and the sophistication of electronic systems, and this leads to higher qualification requirements (Fig. 2).

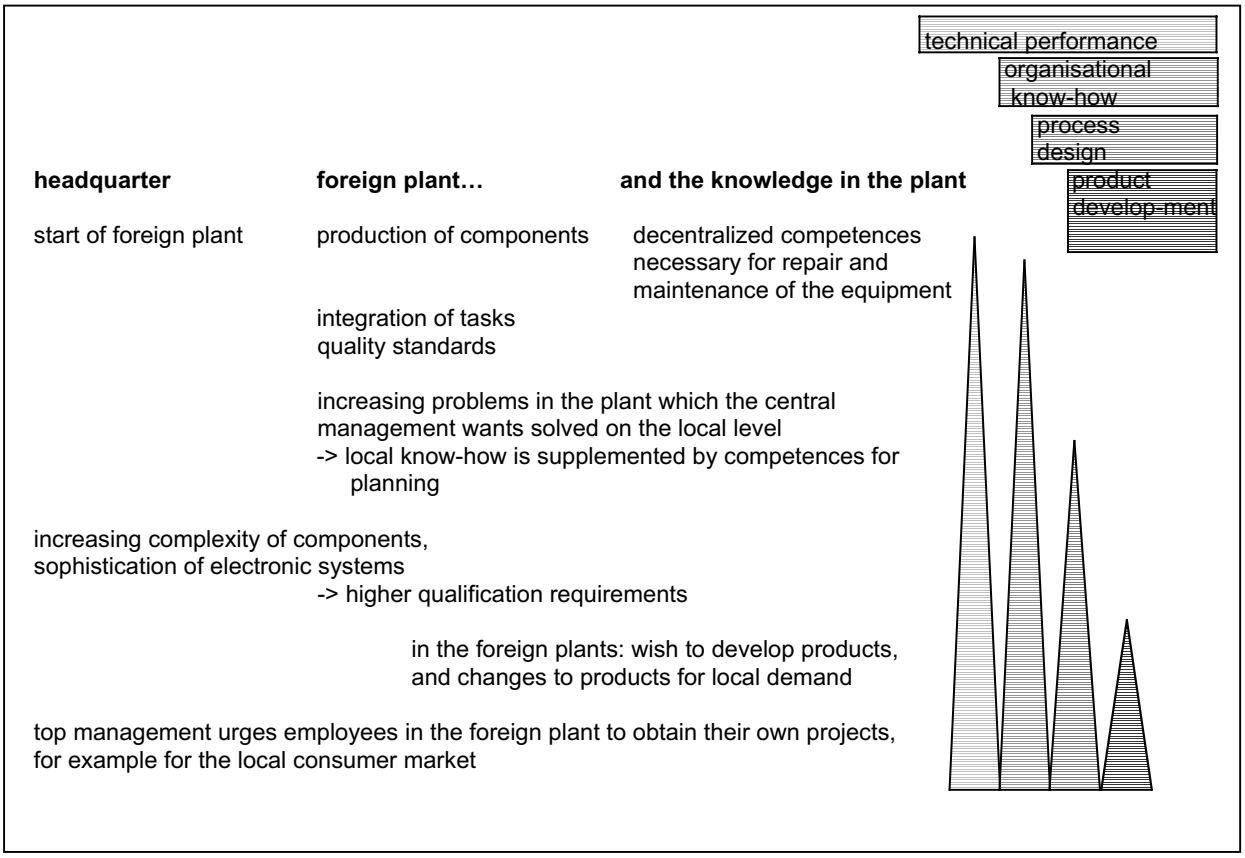


Fig. 2. - Possible steps in the process of decentralization of R&D in the automobile supplier industry

In other companies, top management does not only tolerate the growth of competences in the foreign plants, but supports this tendency actively, or requires this. There was the case of an R&D supplier that built up engineering offices in the country where the company had implemented projects. When the projects had been completed, the engineering offices often developed into self-contained plants of the corporation. But the plants were not so independent that they did not need new projects from top management. In economically good times it was easy for headquarters to give new projects to the other plants. But for some time now new projects are more difficult to acquire. Top management wants to keep the plants in the other countries, and urges the other plants to obtain their own projects (Fig. 2). Headquarters does not allow development in the company´s core business, the automobile sector, in the new plant, but the plant may perform development and design especially for the consumer markets in the specific country where it is located. This is a good example of the growing additional competences in foreign locations without loss of competences in the central locations.

Case study II: Cautious internationalization connected with the search for experts

Another management strategy is the system to internationalize the R&D of their company very actively. In this case, we find a combination of decentralization of competences and the search for cheaper labour costs. This happens in a company which also has its headquarters in a region with long experience of manufacturing and thus wants to keep this asset. The management actively bundles steering competences in the central department for R&D in the headquarters and decentralizes know-how in technological performance. The enterprise develops, produces and sells switches and steering systems for the automotive industry on a second-tier level (and, in a smaller sector, parts for personal computers). The company was founded in 1953 in Illinois. In 1963, the first European company was opened in Germany, two years later the US parent company began developing automobile parts. Since 1979, the German headquarters and R&D are located in Auerbach. Another plant has been operating in Bayreuth since 1969. Because the US part of the company fell into economic difficulties, the German part achieved a strong position within the whole company. Now, in 2002, there are 160 employees in engineering in Auerbach, and only about 60 in the USA. The corporation employs about 4 000 all told.

The structure of the company is that the US parent company in Illinois is linked to a labour-intensive plant in Ciudad Juárez, Northern Mexico. The same role is played by the factory in Klasterec Nad Ohri (Czech Republic) near the border with Germany (founded in 1993). The plants in Mexico and the Czech Republic do not have their own capacities for product development; another factory with a small engineering department is located in Harpenden (United Kingdom). Further plants are two joint ventures (Yokohama, Japan, and Vallaripatti Madurai, India). Even if these plants do not have departments for product development, processes of decentralized competences are nevertheless to be noted. This is an effect of the deliberate bundling of steering competences in the central engineering department. Engineering means precise planning and close cooperation with other plants. The specification and control of the steps is seen as being very important in the central engineering department. Before the project starts, the engineers from the various countries meet face-to-face. They define the technological requirements and draw up the necessary documents. After that, each of the partners performs his work, and then they all meet again face-to-face. By amplifying such international moderation, the company in Auerbach is beginning to concentrate its steering competences. That is the basis for decentralizing further standardized activities.

Still, the management is looking for the best practice. The advantages of internationalization, that the managers share in their common vision, are the highly motivated engineers in India, combined with cheaper labour costs and a flexible labour market. But, according to the managers, the other side of the flexibility coin is the high fluctuation of engineers in India. In contrast, the managers regard stable labour relations as a positive aspect of this system of regulation. Because in Germany employees usually stay for a long time - or their whole working life - in one manufacturing enterprise, it is possible to ask an engineer after a long time span how something had been organized or done. This implicit knowledge is retained in the company. But obviously – in spite of this insight – the management prefers internationalization, at least of standardized tasks, because the plant in India can meet the highest quality standards; it has reached the best CMM level. And this can be done with cheaper labour costs. As a vision for the future, the management suggests a division of tasks: basic research and development will be performed in the German parent company, while development and design, which is closely related to the production process, will be carried out

in the USA, and other standardized functions will be assigned to the plant in India. Production will be done in that plant of the world system that can most profitably do this.

The example shows that labour costs are important, but are not the only factor. None of the analysed companies dares to ignore quality, but if a combination of low costs and quality is possible, this seems to be an attractive strategy to top management. However, this careful way to internationalization can lead to problems for management, i.e. with the employees in the parent company or in the foreign plant. The following company is a case in point because it seems to rate the factor of labour costs as being more important than the companies described before did.

Case study III: Internationalization of R&D as a factor for reduction of labour costs

The company in this third case study was founded in 1967, and has been a supplier to the automotive industry since the early 1970s. The most important products are heaters for seats and, furthermore, cable harnesses and related products. Because different car makers have different seat designs there are a lot of heater types, about 1000 different sorts. This leads to high production costs, and the competition is strong. Although this company is a world leader of seat heaters for cars, it has a hard struggle to keep this position. This leads to efforts to reduce labour costs. Labour cost is still high in this sector, because production of the heaters is labour-intensive. Seat heaters are integrated in textiles, and textile production as a biaxial process sets limits to automation. Labour costs account for about 70% of production costs. This has led to internationalization of production, and – in this case – also of engineering, as shown in the following.

The headquarters and centre of R&D is located near Munich. The company has about 300 to 350 employees working at headquarters, and about 2 600 in the whole multinational enterprise. The production operation, which was formerly located near the headquarters and employed about 100 to 150 workers, was shifted bit by bit – without dismissals - to Pilisszentivan, Hungary. There is a production plant in Valletta (Malta), too, which has grown as a labour-intensive plant. We find a similar structure in North America. The location in Windsor, Canada (50 employees), became a Customer Service Centre for North America, and production was shifted to Acuña, Mexico.

The importance of labour costs can be emphasized by the example of the plant in Malta. This is the first foreign location of the company, founded in 1987. Labour costs in Malta then rose, and since the mid-1990s – although the workers were highly qualified – the Hungarian instead of the Maltese plant became the most important. Nowadays, about 200 employees are working in Valletta (Malta), but 700 to 800 in Pilisszentivan (Hungary). However, labour costs are not the only factor in international competition; good quality is another, which – in the shared vision of company management – can be developed only by employees with a high working motivation. Thus, the management of this company is trying to decentralize competences, including engineering activities, and building up a new R&D centre in Pilisszentivan. This management strategy has led to two counter-productive effects: Especially the engineers at headquarters feared losing their jobs in the long term. Management has to face these fears and try to reassure the engineers, because if this highly qualified labour force were to quit, for example, the company would surely get into difficulties. Thus, a shared vision is not a given opinion, but is dynamic and open to changes. There is also a second counter-productive effect, because it is not easy to decentralize development and design activities, and the engineers at the Hungarian location are not accustomed to longer-term planning and steering processes. But, so management assumed, the

decentralization of engineering competences close to production would be a great advantage for the whole company, because it would minimize some of the detailed work at headquarters. The plant engineers, stemming from the era of a central planned economy, have to learn some steering competences. Engineers from headquarters accompany the implementation of these learning processes by staying in Hungary for the period necessary for this learning process. Thus, we find an example of a deliberate decentralization of some steering competences, which are closely related to the engineering of the production process, from the centre to the "periphery".

CONCLUSION

The last example shows that three aspects are important for management decisions on internationalization of know-how-intensive labour demand: 1) the decentralization of responsibility for planning decisions related to the production process to increase employee motivation in the foreign plant; and 2) to reduce the necessity to solve the many minor problems in the foreign plants at headquarters; and 3) to increase the utilization of capacities in the foreign plants. These strategies can be better understood with the help of network approaches developed by social scientists in recent years (see Messner 1997). The internationalization of R&D means to coordinate, and sometimes to correct or initiate, processes that are sensitive and difficult to control. Managers usually cannot control the work of the engineers which is in large part based on tacit knowledge and organized in social networks between the engineers. There is no formal hierarchy, as in the controlling of accounting that is usually centralisticly organized in the multinational enterprises. The tasks of R&D need cooperation between colleagues and call for exchange of information. Thus, management means convincing the foreign partners by coordination and moderation. Only if this is not possible top managers have to solve the problems; but this is the exception. Most processes are coordination "in the shadow of hierarchy" (Scharpf 1992). Sometimes, communication between the parent company and its foreign plants is difficult, especially if the plants have been in existence for many years. Often, the employees in these old plants are strongly self-confident and will only accept influences from top-management if they are convincing enough. A difficult task for managers is to decide how much steering competence they should keep at headquarters and which competences they should decentralize. It is impossible to keep all steering competences in a big multinational enterprise. But also it is impossible to decentralize all decisions, because this would result in chaos. Managers have to find their own way of decentralization; there is no structural necessity for one specific "trajectory".

Internationalization can, in some cases, include the going global of R&D. But this is not a strong tendency, because quality standards often lead to persistency and the managers´ shared vision about the importance of qualified labour. Thus, qualified labour may be important to improve the "stickiness" (Markusen 1996) of regions. Until now, persistency has been stronger than internationalization in the automotive supplier industry, but this may change in future. This could be the case especially if the OEMs increased their internationalization, as did the German OEMs in recent years (Pries 1999), and the emerging markets require new models (Humphrey / Lecler / Salerno 2000).

This explorative insight cannot lead to representative conclusions, but it does lead to the important aspect of steering R&D in multinational plants and the various interdependencies (and not only hierarchies) in this organizational area. It shows the openness of processes; there is no need for globalization but it is a possibility. And not every possibility of internationalizing R&D means loss of competences in the parent companies, because they

receive more steering competences and can thus improve on their "central" role. At the same time, the foreign plants can learn. The strategy of top management to decentralize competences do not mean a passive role for the foreign plants, but active upgrading efforts by the local management. These processes are coordinated with the parent company. The upgrading processes can begin with development and design for the production process and can end in local product innovations (see Fuchs 2002). Thus, not only "network societies" (Messner 1997) are characterized by reciprocal interdependencies, but also some interrelations within multinational corporations, too.

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