EMERGING NEW PRODUCTION SYSTEMS IN THE TRANSNATIONALISATION OF GERMAN CARMAKERS: 

The Case of BMW/Spartanburg and DaimlerChrysler/Tuscaloosa

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The aim of this paper is to discuss the production systems that are emerging in plants that were built up or restructured in the course of the transnationalisation push of German carmakers during the 1990s. Are the German carmakers exporting a 'German production model'\(^1\) to their overseas plants or are they developing new production systems in their new or renewed foreign factories? To what extent are they following a one best way thinking of production systems, for example in the sense of lean production? Or are they following different firm trajectories with distinct production systems?

\(^1\) We distinguish between the terms production system and production model. Meanwhile the first is the specific and empirical configuration of technology, work and organisation, the second focuses on the management concepts, leading ideas and general principles, that are relevant for actions and perceptions related to the former.

PROBLEM SETTING

These questions point at core issues and debates in the research related to the international automobile industry. When during the 1980s the Japanese automobile firms built up their transplants in the US and Europe (mainly the UK), one of the main concerns was, to what extend they would 'applicate' or 'transplant' the so called Japanese production model of lean production and to what extend they would 'adapt' themselves to the specific local setting. This adaption-application-debate stimulated a series of research projects and a part of debates of the GERPISA-network as well (Abo 1994; Boyer et al. 1998, Part II and Part III). This transplants- and adaption-application-debate was closely related to the general question if there exists or could exist a one best way of building cars all over the world.

This idea was strong after the lean production-message of the MIT-Study: "the new best way - lean production - could be transplanted successfully to
new environments” (Womack et al. 1991, p. 84). But it seems that this message was taken more seriously by managers, engineers and practitioners than it was in the field of social scientists. In the GERPISA-network and its first research programme (1992-95) soon it became a common place that there does not exist such an optimum production model that could be transplanted to any different context. It was shown that even in the automobile firms in Japan itself there are different production systems (Part I in Feyssenet et al. 1998), that the Japanese transplants in North America realised hybrid production systems (Part II in Boyer et al. 1998) as well as did a great number of newly established or restructured plants in old and in new emerging automobile regions (Part III in Boyer et al. 1998).

In the light of these debates and findings: What are the specific experiences from the German case? The situation of the German automobile industry prevailing until the end of the 1980s was (adequately) described as follows: "Daimler-Benz is still exclusively a German company in the area of car production; it only has international production sites in the area of trucks and commercial vehicles. BMW and Porsche, finally, are the firms which are most closely limited to Germany in their production and work force" (Jürgens 1992, p. 67). Volkswagen AG was characterised as "the only German automobile company that pursued an internationalization strategy with regard to its production system" and as a "European oriented corporation" (dito, p. 68). This picture is quite adequate for the situation until the beginning of the 1990s. In a recent analysis, Jürgens distinguishes three periods: first, the post-war-model and the crisis 1967 to 1974, second, a new cycle of growth from 1975 to 1990 and, third, the ambiguity of success from 1988 to 1993 and the then beginning crisis, that could indicate a reshaping of the industrial model in the mid-1990s (Jürgens 1998a).

Our argument is that all of the three most important German automobile companies - Volkswagen as well as Daimler-Benz (now Daimler-Chrysler) and BMW - began changing dramatically their production model as well as their internationalisation trajectory since the beginning of the 1990s. After 1993, there were some short signals of crisis, but then and almost during the second half of the decade the German Big Three\(^2\) played a very active and successful role in the international automobile industry. The overtake of Rover by BMW, the Daimler-Chrysler merger and the competition between Volkswagen and BMW for buying Rolls Royce are the most visible expressions and the ‘top of the iceberg’ of these new dynamics of the German Big Three. What had happened and how could we understand this shifting of the German automobile industry?

In other occasions we argued that the German car makers entered into a new internationalisation phase that is not characterised by crisis and decline but by a new ‘offensive’\(^3\) and by strength based on a very specific ‘acceleration spiral’ of (intra-organisational) industrial restructuring, (inter-organisational) new assembler-supplier-relations and transnationalisation as a specific and new form of internationalisation (Pries 1997, Eckardt et al. 1998 and 1999, Pries 1998). Obviously the German automobile industry and especially the traditional German Big Three - Volkswagen, Daimler-Benz (now Daimler-Chrysler) and BMW - did and experienced a ‘globalisation push’ during the 1990s. This globalisation push coincided - and thereby gained its specific dynamics and quality - with fundamental changes and

\(^2\) The term refers to the traditionally so called Big Three of the US-Automobile industry: General Motors, Ford and Chrysler. The term German Big Three was thought to refer to the formerly German owned most important automobile companies Volkswagen, Daimler-Benz and BMW. But with the merger of Daimler-Benz and Chrysler, there do not exist the US-Big Three anymore as well as - strictly speaking - it makes no sense to refer to the German Big Three. Being aware of this problem, we continue using the term German Big Three just to characterise the situation and politics until and during the 1990s. In the same way, referring to the time until the merger with Chrysler, we speak of Daimler-Benz and not of Daimler-Chrysler. Perhaps in the next decade it will be adequate or sufficient to speak of the Global Big Three.

\(^3\) This quite military or even martial term was used since the beginning of the 1990s by many managers. For example, in Mercedes-Benz people began to speak of the ‘product offensive’, of the ‘globalisation offensive’, of the ‘market offensive’ etc., see for example, DB 1995, pp. 42-49.
challenges in the production systems of the three companies (Pries 1999a).

The 'acceleration spiral' of globalisation and production model innovation could be analysed and proved at the level of the company's internationalisation profile (the structures and strategies of the overall consortiums) as well as at the level of specific plant profiles of the most important production sites. In spite of describing the three companies at a more general level, in the following we will analyse and compare three new, respectively renewed, production sites: the BMW/Spartanburg plant in the USA, the Volkswagen/Puebla plant in Mexico and the Daimler-Benz/Tuscaloosa plant in the USA. Based on the findings of our own empirical research and case studies in these plants, we will discuss the following questions: What type(s) of production system is (are) emerging in these new sites? Is there a certain hybridization of German, Japanese and local elements? Is there a certain convergence between the three plants? What factors (situative, contingent, actor strategies, trajectory, learning organisation effects etc.) could explain their differences? What are the real and/or possible impacts of these new sites on the overall company strategy towards its production model?

Concerning these questions and in order not 'to reinvent the wheel' but to start from the 'state of the art' it is worth to remember the conclusions from the first GERPISA-programme. In their final chapter, Boyer et al. 1998 draw the following concluding remarks (pp. 374-9):

- There is no necessary convergence on 'one best way'.
- The 'universalist' message of 'lean production' must be questioned.
- Technocratic analysis of production systems is not enough.
- There is no pure productive model to imitate.
- Why imitate what is already changing or partially obsolete?
- It is not possible simply to define a single most efficient model and then diffuse it.
- A variety of models will continue to coexist and flourish.
- The role of transplants has become critical in global competition.
- Reverse learning may be as important as diffusion.
- The dynamics of hybridization remain an open question.
- Hybridization is a learning process.
- Hybridization goes beyond the issue of transplants.

It will not be possible to discuss all of these twelve 'lessons for the future' here, but it is helpful to keep them in mind for the following reading of the case studies and the discussion of some selected issues we will present later.

**RESEARCH DESIGN**

The data and empirical findings presented here derive from an empirical study that was realised in the Research Group for Work and Industrial Sociology at the Institute of Sociology of the University Erlangen-Nürnberg and sponsored by the German Association for Scientific Research (DFG). The main objective was to study some selected plant profiles of new and restructured factories of Volkswagen, Daimler-Benz and BMW in the USA, Mexico and Brazil. As plant profiles we understand the specific combinations of (1) the production system, (2) the company structure and capital strategy and (3) the product structure and market strategy. In a multi-sited consortium the different plant profiles depend mutually on one another, and the concrete level and forms of inter-dependence define the characteristics of the overall international consortium. Therefore an international consortium and its specific internationalisation profile could be characterised by (1) the consortium-wide production

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4 Andrea Eckardt, Holm-Detlev Köhler and Ludger Pries (responsible) formed the core of the research team; Gert Schmidt and Rainer Trinczek co-operated in discussion, field work and institutional 'bindings'; Thilo Heyder, Matthias Klem and Sylvia Korell participated as research assistants.
system, (2) the consortium wide company structure and capital strategy, (3) the consortium wide product structure and market strategy, (4) the spatial hierarchy of authority and competencies between the plants and (5) the spatial division of functions and processes between the plants. This concept of internationalisation profiles allows for a more detailed typology of international consortiums than other concepts like those of multinational, transnational, international and/or global companies. Although the concept of internationalisation profiles is fruitful and makes it possible to 'locate' the different plants in the larger consortium context, the main objective of the study was to analyse empirically plant profiles of some outstanding single factories.

With this conceptual framework we took up some elements of former studies (Pries et al. 1990 and Pries 1991) and of the international debate on international, multinational and transnational companies (Köhler 1999) and especially on the international automobile industry (Eckardt et al. 1998). Concerning the framework and conclusions of the first GERPISA-program that there are three ideal-typical 'profit strategies' in the international automobile industry based on six possible 'profit sources' (volume, diversity, quality, innovation, flexibility, and the reduction of costs at a constant volume) we preferred a wider and more open approach. Wider in the sense that the overall company's 'profit strategy' (or 'company structure and capital strategy' as we call it) has to consider not only aspects of the 'product structure and market strategy' and of the 'production system', but also the spatial aspects of the distribution of plants, resources, functions and authority inside the overall international consortium. This led us to the distinction between plant profile and internationalisation profile and to concentrate our empirical research on the former, trying to embed the plant profiles in the overall internationalisation profiles of the consortiums and to detect the latter in the former.

A more open conceptual framework means that we looked for patterns of 'successful profit strategies' at a lower and more concrete level than did Boyer/Freyssenet 1995 in their (necessary) attempt of generalisation. We developed a quite differentiated scheme of variables in various levels at the three different dimensions of plant profiles (company structure/capital strategy, product structure/market strategy, production system) and started with the conjecture that, on the one hand, there are relations of 'elective affinities' between the concrete values of the variables on the different dimensions and levels, and, on the other hand, there is no economic, technological or organisational determinism that defines ex ante the 'necessary' or 'only possible' combinations. Even the six 'profit sources' (volume, diversity, quality, innovation, flexibility, and the reduction of costs at a constant volume) allow for 15 possible combinations of two elements. In order not to 'close our glasses to early', we opted for a conceptual frame that allowed us to detect a wide range of possible combinations.

Based on this conceptual framework, in a first phase (August 1997 to February 1998) interviews with experts of the three companies (VW, DB, BMW, mainly in the headquarters) and of other organisations (Trade Union IG Metall, Association of the German Automobile Industry VDA, other scientist etc.) were made in Germany. In a second phase (March 1998 to September 1998) we performed full case studies in two plants in the USA, in one plant in Mexico and in one plant in Brazil. Additionally we made short studies in two other plants in Mexico and in three other plants in Brazil. In total we made more than hundred recorded and transcribed interviews with experts, the majority in the American continent. In a third phase (October 1998 to May 1999) additional interviews and further data collection were done, and information was checked and verified with the interview partners.

**CASE STUDIES**

In the following we give some brief descriptions of three selected plants we studied. Due to the fact that for any specialist in the field it is quite easy to identify, for example, a "German plant that was opened in the year 1994 in a Southern State of the US
to produce a Roadster vehicle”, we denied the attempt to treat the three factories as anonymous entities. But confidential information was left out or used in a way so that the origin and the related factory could not be identified. Due to the fact that some general information about the Volkswagen plant in Puebla/Mexico is published already or being published (Pries 1993; Pries 1999b; Dombois/Pries 1999) and that some empirical findings of our recent research are available as well (Pries 1998), in the following we will present the case studies of BMW-Spartanburg and DB-Tuscaloosa. The findings of Volkswagen-Puebla and other cases will be included in the final considerations.

**BMW Spartanburg**

Apart from the small assembly facilities that BMW had in South Africa, the Spartanburg plant in the USA is the first fully integrated production plant of this company outside Germany. This implicated and reflected a major shift in the overall firm philosophy that was based on a *made in Germany* production strategy (BMW means Bavarian Engine Factories) and a market strategy oriented towards the premium segments of the sportive middle and upper class automobiles. The company's overall philosophy could be characterised as high quality, high product flexibility (in time and scope) and high flexibility as well of the production system. The latter was guaranteed by a combination of a medium technological level, open and flexible work organisation and highly committed semi-craftmen. What would happen under these circumstances in the new Spartanburg plant?

**Consortium wide and local embeddedness**

The decision and announcement of opening the plant was made in June 1992 (therefore globalisation of the consortium began at the beginning of the 1990s and not until after the crisis of 1994). Production of some BMW cars of the 3-series began in September 1994, and exactly one year later the first Z3 sportive Roadster model was produced. The factory was an *all new plant*: new country, new facility site, new product, and new production system. The latter was an explicit aim of the new plant: to make experiences with new and Japan oriented production systems. This distinguishes the starting point of the BMW-Spartanburg plant from the Japanese transplants of the 1980s. Meanwhile the latter came with a clear and successful production model (and products already produced in Japan or elsewhere), the former aimed just at learning from other production experiences (and make a completely new car).

On behalf of the production system as a whole, the BMW consortium did not make many prescriptions. The guideline was to use the new plant as a type of laboratory for new production methods. From the beginning there was a certain orientation towards the Honda-production model focusing on high product and production flexibility and high innovation. This led to the recruitment of a great number of managers from the Honda and other Japanese transplants. The strategic decisions on location, products and investment were taken in the headquarters in Munich/Germany, the operative design of the production model and system was developed in a mix between the headquarters and the US-American managers with experiences in Japanese transplants. One of these managers said: "we decided to have a mixture so we brought in American know-how from some of the Japanese transplants, in particular Honda and Toyota and then we brought in Germans. Why? Because we needed liaison to Munich."

From the beginning the plant made efforts for its local embedding and to appear as a South Carolina company in a relatively dense and traditionally industrialised but non-union-region. The regional unemployment is low (less than two percent). Stimulated by special financing programs, about two thirds of all employees drive a BMW car. Another factor that reveals the efforts of local economic and social-cultural integration is the Visitor's Center with many activities that not necessarily are related directly with automobile production.

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5 Extensive descriptions of the three cases will be published after cross-checking informations and conclusions with involved experts.
**Product structure and market strategy**

The Spartanburg plant produces the different models and series of the sportive BMW-Roadster. Although it appears as one model, concerning the body specifications (length and distance of axles, body distance to road, special strengthening of certain body parts etc.) we have to speak of five different car models: Z3 Roadster 1.8-2.0 litre, Z3 Roadster 2.8 litre, M-Roadster, Z3 Coupé, and M Coupé. At the moment of our research, there were four different motors available for the models, twelve outside colours, ten inside colours and three options for inside materials (textiles or leathers). Starting from 1999, the plant produces also the new M5 Sports Activity Vehicle. Taking into account the overall annual production of about 60,000 cars, the broad scope of models and variations reveals the core of the consortium wide BMW product structure and market strategy: to produce highly individualised, high quality sportive cars.

Concerning the production objectives and strategic orientations it is interesting that from the beginning the plant in Spartanburg was thought to produce 40% of production for the local US- and NAFTA-market and 60% for exportation towards the World market. The Spartanburg plant is the only factory in the BMW-consortium that produces the Roadster models and more recently the X5-SAV. This differs completely from the strategies of all other international automobile companies: to use the relatively high waged US-context to produce German-imaged cars that are in its majority oriented towards exportation all over the World! The highly differentiated product structure and the corresponding 'economies of scope' obviously require a highly individualised and flexible production system.

**Technology**

The technical production system includes body shop, painting and an assembly line. 18 first-tier-suppliers - many of them German originated *global players* - were located in an industrial park nearby, and the share of added value by the BMW plant is low at about 25 to 28%. The assembly line has the innovative form of an @ (beginning outside and ending in a spiral circle at the center) that facilitates the direct communication between different areas and stations of the assembly line. There are only 18 industrial robots indicating the overall regular or low level of automation. Daily production is of about 220 units (of an installed theoretical capacity of 300 units per day). At the beginning there were not planned any buffers, in 1998 there existed few buffers between body shop and painting (18 units) and between painting and assembly (120 units). But the suppliers were forced to recompense the rigidity of the production system with their own and extensive buffers (see also Martin 1999).

**Work Organisation**

Concerning the work organisation there are four level of hierarchy (managers, co-ordinators, supervisor and team-members). A work team consists of an average of 60 team-members and is divided in about three to five pots. Due to the high requirements of flexibility the variation of working contents is about 60% of the whole work tact, that means that a unit which requires a lot of working time represents 60% more time in some working places than a unit with few operations. As the technical equipment is rigid (transportation by a ground-chain-drive without separate boxes, no computer aided line re-balancing), the work organisation - that means: the teams and pots - have to absorb the flexibility requirements of
the production system. Tact-times are of about 3.7 minutes, with a high product variation and job rotation at the level of the pots errors and defects seem to be natural. For the plant it is hard to fulfil the quality audits and aims. Relative much re-work is needed, there are about 80 re-working-workplaces and 26 quality inspectors.

**Workforce**

The plant has about 2,000 employees, 1,400 of them working in two shifts in the assembly lines. Very few of the team-members had experiences in automobile production before. There is only one wage-labour-category for team-members, a second one for technicians and a third one for staff-employees. Payment follows the 'pay for skill'-logic taking into account the number of jobs a person is able to do. The average hourly wage was at about 19 US $ at the end of 1998. The firm pays an annual bonus that depends on the overall plant results (not on individual performance), it is normally about 5% of the annual basic wage, in 1997 this bonus was 8.5% due to the good plant performance. In general, the interviews revealed a high commitment of the team-members with the company, although some managers criticised the 'slow Southern swinging rhythm of doing the work'.

There exists no union representation in BMW-Spartanburg, but the UAW local 5841 has organised some regional suppliers. The aim of the plant management explicitly is to prevent becoming a 'bargaining unit' in the sense of the right-to-work-legislation. Therefore the management tries to control and reduce at a minimum the rate of work accidents, which often is a good 'entry port' for a union. The plant also pays relatively high wages and impedes all formal acts that could lead to a union campaign (like workers injuries, giving the working teams union-like authorities etc.). By this way, even if there is no formal union representation, the pressure of the unions and of collective bargaining agreements reached in other parts is always very present and was tangible in many interviews with managers.

**General characteristics and problems**

The plant profile of BMW-Spartanburg combines the traditional company philosophy of individualised high quality and high scope production with some radically new elements such like the strategic orientation of the plant as an export platform for all the World and the Japan-oriented production system. The latter was thought from the beginning as an experimental system testing extremely decentralised, not formalised and at the same time highly 'lean' and flexible production relations and processes. German product, quality and technical standards were merged with Japanese or 'transplanted Japanese' work organisation mechanisms and US-American style of job-oriented management and work. The mixture of these three different 'philosophies' or 'basic principles' certainly had some strength and success: in very few time this all new plant reached quite considerable levels of production. After five years of an already broad range of different products, in 1999 the plant began producing additionally the new X5 Sport Activity Vehicle.

But there are also some structural problems. Until the moment of the empirical field research (summer 1998) the plant could not fulfil the internally defined quality aims. Productivity was not optimised as expected, and a lot of re-working was even necessary. To a certain extend, the different 'philosophies' clashed, and their coexistence - besides the obvious synergy potentials - created tangible tensions. The general Japanese and in concrete: the Honda principles of decentralised and few formalised organisation of production and work with flexible responses of high qualified and highly committed workforce were contradictory with the German and in concrete: the BMW principles of highly formalised technical prescriptions for the product and the processes and also with the US-American job-mentality and semi-qualified, middle-aged workers without previous automobile experiences.

At the beginning of the plant operations there were created high expectations of teamwork and decentralised decision making. According to some of the interviewed persons, this led to a kind of team orientation where nobody is responsible for anything.
As a manager pointed out the basic principles of the production system: "And again, it was very theoretical and philosophical about the way it should be done. No buffers for example. And in the body shop for example when we started there, we had, it was basically one continuous line from the start to the end with no buffers."

At the moment of our field work, therefore we noticed - more implicitly than directly expressed - severe concerns and tensions on how to combine the 'economies of scope' of the realised production system in the Spartanburg plant profile with high productivity and high quality. Some of the interviewed experts were also worried about how to get some degree of formalisation, responsibility and accountability in the working process. There was no clear model thinking in the sense of a 'Japanese production model' or a 'Honda production model' or a 'BMW production model'. The interviewed managers expressed different points of view, different ways of attributing success and failures (for example, very tangible differences between 'German principles' of management and an 'American way' of doing the things) and opposing manners of re-constructing the short history of the plant.

In a very general view, we encountered two ideal-typical and opposed ways of interpretation. The first point of view could be described as: 'Our plant has been very successful in building up an all new plant in a very short time, and one important reason is the mixture of an hybrid production and management system that combines Japanese, US-American and German traditions and methods'. The opposite standpoint can be characterised as: 'The plant was successful in building up in few time a new production site, but the success was at least in part due to the good engineering and managing work done outside of the plant. The production system in Spartanburg began as quite idealistic and philosophic model thinking that was oriented to much in de-centralisation, -de-formalisation and a kind of collective responsibility that led to individual irresponsibility, lack of productivity and the BMW quality standards'.

According to these two opposing ideal-typical interpretations vary the learning effects that represents or could represent the Spartanburg plant for the overall BMW-consortium. Therefore, there is no simple and mechanic way of mutual learning between the plants of a consortium but a complex and power- and interest-influenced struggling and playing for an adequate interpretation and realising of reality.

**Daimler-Benz Tuscaloosa**

Similar to the BMW consortium, the Daimler-Benz-consortium was defined and defined itself as a premium segment producer that export high technology and high quality automobiles made in Germany all over the World; therefore, until the 1990s Daimler-Benz had no important production plant for cars outside Germany (only small CKD-facilities in many countries all over the World and specialised subcontractors like in Steyr-Daimler Puch in Graz/Austria). In contrast to BMW, the Daimler-Benz consortium had a world-wide network of trucks production, namely in Brazil and in the USA with the Freightliner company. From the beginning of the 1990s - at not only after the crisis of 1994 - the Daimler-Benz consortium began its 'globalisation offensive'. The announcements of new factories in Hambach/France and in Tuscaloosa/USA were part and result of these globalisation efforts that led to the merger with Chrysler in the year 1998.

**Consortium wide and local embeddedness**

The decision to open a new production plant in the USA for a new type of vehicle was taken in April 1993 and Tuscaloosa was announced in September 1994 as the location for producing a new Sport Utility Vehicle, the M-Class. This reflects the very intensive search and investigation during more than one year. The plant began its production in May 1997, and - similar to the case of BMW-Spartanburg - it represented an all new experiment: (partly) new country (due to the existence and experience of Freightliner), new product, new production system, new plant. From the very beginning the Tuscaloosa project could rely on the know how and material and personal infrastructure of the truck company freightliner. The plant project could also take profit from the BMW experiences in Spartanburg. A part of
the original Tuscaloosa team came from Freightliner, but managers were recruited also from all other automobile companies. After the critical experience of BMW to recruit managers 'aggressively' from some other companies (mainly Honda and other Japanese transplants), Daimler-Benz tried to negotiate or at least communicate with the companies where they were going to 'hunter heads'.

As indicated by the large time of searching an adequate locale for the new plant, Mercedes-Benz realised an excessive location bargaining with the State and Community authorities of various places. Although the connection to an overseas port is more complicated than in the case of the State of South Carolina, and although many positive factors favoured this state, the decision was made for Alabama (due to concessions but also to the fact that for reasons of prestige Daimler-Benz could not follow its rival BMW in the same state).

**Product structure and market strategy**

In contrast to BMW that had planned its factory in Spartanburg as a platform for world-wide exports, the strategic market orientation of the new Daimler-Benz plant in Tuscaloosa was the USA-market. The USA were (and are) the most important market for Sport Utility or All Activity Vehicles, and therefore production of the new Daimler-Benz SUV M-Class - that was developed on the basis of the G-Car produced in Austria and with a completely new 'hat' - was located strategically in the USA. From the beginning it was planned to sell at least 60% of the Tuscaloosa production in the USA. This philosophy to have production presence in the most important markets seems to be successful: 70% of buyers of the M-Class units produced in Tuscaloosa are new clients for Daimler-Benz. A great share of these new customers obviously would not have been gained with a product made outside the USA. From Spring 1998 units were exported also to Europe, were production of the M-Class began in 1999 in Graz/Austria due to the exit and demand of the vehicle.

Annual production in Tuscaloosa was planned for 65,000 units. In contrast to the BMW-Spartanburg plant, Daimler-Benz concentrated from the very beginning on only one model with few variations. In the year 1998, there was only one type of body (with two roof variations) with two different motors, seven different outside and two different inside colours plus two distinct inside finishing materials. Comparing with BMW, the product structure was relatively simple and very similar to a typical Japanese transplant (with annual production of about 60,000 to 80,000 units of one model). In the same way the market strategy corresponded more to the typical case of a Japanese transplant (orientation mainly towards the local regions of the new plant and not to exports) and differed from the BMW-case. Of course, entering into details there have to be made some refinements. For example, starting in 1999 the Tuscaloosa plant assembles in total five different motor types and differentiates the scope of variations. But the basic strategy remains: much of the high priced and highly differentiated M-Class units will be produced in Graz/Austria, the Tuscaloosa plant concentrates on standardisation of products and processes - as will be shown in the following.

**Production system**

Based on the characteristics of product structure and market strategy it is understandable that the production system of the Tuscaloosa plant is oriented more in Toyota than in Honda. In interviews and other documents the plant management underlined the strategic orientation of the plant as a concentrated learning process, but not as a radical experimenting. The focus is on standardisation of processes and rhythms. Little more than one year after beginning production the plant management resumed and concentrated the production system in a documentary movie with eight pillars:

- **Safety:** that means preventing work accidents, a very important issue from labour law, and union intervention that often begins with conflicts on work accidents,
- **Training:** as guaranteeing all principles of the production system, it is ongoing and everybody's responsibility, mainly as - standardised - training on the job,
Clean plus S: that means, first, keep the workplace and work area clean, but, second, also to organise all work instruments and the workplace in general in a standardised manner to secure predictability, repeatability and process standardisation.

Quality: that means mainly built in quality and the facility to stop the process in case of severe quality problems.

Visual management: refers to make transparent the performance of each work place and work team, but also to visualise the standardised operations and processes.

Pull system: means to reduce buffers in the process and to have the parts in the line right in the moment and sequence they are needed.

Standard Method and Procedure (SMP): that means standardisation of all operations in forms/sequences and times they have to be done, standardisation comes 'from above' (Master Process Sheet, worked out by engineering department) and 'from below' (improvements by team-members, mainly in reducing non-added-value-times) and

Continuous improvement: that refers to the 'continuous reduction of costs' by identifying and reducing waste and non-added-value - the focus is not on 'quality of work life'.

Technology

The Tuscaloosa plant integrates body shop, painting and final assembly. The assembly line is designed in a quite traditional U-form. Production capacity is of 280 units per day, the only buffers are between body shop and painting (80 units) and between painting and assembly (30 units). Production automation is much higher than in BMW-Spartanburg, in total there are 50 industrial robots, 40 of them in body shop. The share of value-addition in the plant is of about 27%, and a unit lasts about 10.5 hours in final assembly.

In general, the technical aspects of the production system reveal a relative traditional and 'lean' design. Technical facilities have a clear structure, displays in all lines inform about production and quality goals and real status. In the assembly line units are transported by a continuous chain, there is no disconnection of this transportation between areas, although these are distinguished by 'station lines'. The overall design coincides completely with the above mentioned general strategy of a learning plant but not an experimental plant.

Work Organisation

There are five levels of hierarchy (President, Vice-Presidents, Managers, Assistant Managers, Group Leaders and Team-members). One group has about 30 team-members, and each group consists of about five teams. So the teams are composed by five team-members and one team-leader (who is chosen by the assessment center, is a type of foreman but has no disciplinary functions). Work place related 'Master Process Sheets' (MPS) define all value-adding operations in the product, they were developed in engineering departments (originally mainly in Germany) and define exactly the sequence and times for each operation. They hang out in each working area. Tact time was about 4 minutes and aimed to be reduced to 3.6 minutes. Totally there are only 15 work stations for rework. Teams life is concentrated on fulfilling production norms and making proposals of improvement.

All team-members are trained in reading the MPS's and in developing proposals in the context of continuous improvement. These proposals are fixed in the Standard Method and Procedure Sheet (SMP-sheet) in each working station. These SMP-sheets include value-adding and non-value-adding activities, and the improvement process of team-members concentrate on the latter. Proposals of improvement have to be signed by the Group Leader (in the case of non-value-adding activities) or by the Manager (in case of value-adding-activities) and also by the corresponding authorities of the second turn. By this way, the MPS's are 'enriched' and amplified continuously by the SMP-sheets. The system of standardisation of work and process related proposals of improvement is one of the most interesting aspects of the Daimler-Benz/Tuscaloosa production system. It combines continuous and decentralised improvement 'from below' with a continuous process of selection and standardisation.
Workforce

There were in total about 1,500 employees in the Tuscaloosa plant as in autumn 1998, with a relatively high share of women of about one third. The vast majority of the team-members had no former experiences in the automobile industry, man of them did no industrial work at all. The average age is 34 years, this reveals the plant politics to recruit a broad and representative selection of the local workforce. Fluctuation and absenteeism are very low (about 0.5%), and the hourly wage was about 19 US $ for team-members. Salaries are oriented in the increases of the Big Three although a little lower then there, but higher than the regional average. As in BMW, a yearly productivity bonus is paid. Work is done in two turns with 7 hours and 55 minutes effective working time. After two years, all team-members gain the same maximum wage level, there are 15 days of paid vacations a year.

The plant has no union representation, although the UAW realised a campaign for organising the company. In the highway between Tuscaloosa city and the plant there are big announcements of the UAW directed towards the Daimler-Benz workers. Like in the case of BMW the indirect influence of the UAW was tangible in many interviews with managers. The case turned much more complicated with the Daimler-Chrysler merger due to the fact that Chrysler is a 'bargaining unit' controlled by the UAW that now claims the organisation and representation of the Tuscaloosa workers.

General characteristics and problems

In general, the Tuscaloosa plant of Daimler-Benz is definitely a successful mixture and hybridisation of German product philosophy and of Japanese, and here especially of Toyota's production philosophy. As was outlined in many interviews, the innovative and successful application of standardisation and documentation methods in the work process could represent a severe challenge of the traditional Daimler-Benz production principles. The traditional Daimler-Benz production system was based on the philosophy of craftsmanship and high production and work flexibility based on a low level of standardisation. If the Tuscaloosa plant could prove that it is possible to combine high flexibility in production with high standardisation in processes - than this could end in a 'backward learning from the periphery to the center' and threat the overcome production system with a lot of implications for management and labour (see Springer 1997).

At the moment of our empirical field study it was an open and unresolved question, if the Tuscaloosa plant would stabilise in this sense as a successful learning company or if the first one or two years of its functioning were few for really judge the overall outcomes and possible 'backlashes' within the consortium as a whole. The initial success of the Tuscaloosa production system was due to an 'Americanisation' or 'Japanisation' of the production principles with parallels to the Toyota-model: concentration on few product variants and optimum of process standardisation for continuous improvement of overall performance. This varies completely from the traditional Daimler-Benz philosophy of high product variety and high production flexibility. Therefore it will be interesting how the new system works when the announced amplification of product structure and therefore necessarily the flexibilisation of production process (due to the maintenance of the scale of overall production) will be realised.

COMPARISON AND PRELIMINARY CONCLUSIONS

From the beginning of the 1990s, the German automobile industry made a considerable globalisation push that could be seen in the restructuring of older overseas production plants in the case of Volkswagen and in the opening of new production facilities abroad in the case of Daimler-Benz and BMW. The outlined case studies of the Daimler-Benz Tuscaloosa plant and the BMW-Spartanburg plant reveal similarities and differences. In comparison with the Japanese transplants of the 1980s, in both cases the German consortiums realised quite risky and innovative all new plants in the USA that from the beginning were designed a hybrid plants combining Japanese, German and US-
American experiences. During the 1990s both plants seem to be very successful in their new developed products and in their new production systems as well.

There are quite considerable differences concerning the learning (Daimler-Benz) or experimental (BMW) character of the plants and the US-concentrated (Daimler-Benz) or world-wide (BMW) strategic market orientation. The production system varies between a radically decentralised, little formalised, highly process-flexible one that remains critical in terms of productivity and quality in the case of BMW and a more ’traditional’ Japan-inspired one with high performance but lower product and process-flexibility in the case of Daimler-Benz (the theoretical model variations in the case of BMW-Spartanburg are of about 7,000, in the case of DB-Tuscaloosa of about 60!).

In the case of BMW there could not be observed many ’trickle back’-effects in the sense of learning effects from Spartanburg to the German headquarters or plants; probably it is just the other way round that the BMW-headquarters send the message ’stop experiments, bring up efficiency and quality’. In the case of Daimler-Benz the Tuscaloosa plant seems to have some effects on the discussions about production systems and production principles in the sense of higher process standardisation.

For reasons of place it was not possible to include here other case studies such like the Volkswagen-Puebla plant in Mexico. But taking into consideration the two cases presented here as well as our own research findings from other cases we could give some preliminary answers to the questions outlined at the beginning.

No one best way of production model but of production principles

Meanwhile the Japanese companies applied a world-wide successful ’production model’ that was coined lean production to their overseas transplants - obviously with all the differences in the concrete production systems - and adapted this production model to a certain extend to the local conditions, the German Big Three realised a new type of mixture and hybrid production systems with a strong German part in product and production technologies and quality standards, a strong part of Japanese principles in process and work organisation and a US-American part in the work orientation towards an ’illustrated job thinking’ that differs from the German craftsmanship and from the Japanese totalitarian company thinking.

Taking the investigated plant profiles as a whole, on the one hand there is no one best way of a rigid or definite production model the plants are trying to realise. But, on the other hand, there are clear one best way production principles that all firms are following.

These leading production principles are: horizontal and vertical integration of functions, team work organisation, visual management, built in quality processes, pull system of procurement, continuous improvement. They could be found quite everywhere in all plants we studied and they are at the heart of the very complex and highly formalised Audi-Production-System (APS), the Rastatt-Production-System (RPS) or the Tuscaloosa-Production-System (TPS). Referring to these production principles, and not to lean production as a coherent model, it makes sense to say: ”they could be transplanted successfully to new environments” (Womack et al. 1991, p. 84).

By this, we take a position in between the MIT-hypothesis of lean production as a one best way production model on the one side, and the GERPISA-thesis of distinct firm trajectories and non-related production systems, on the other side. Boyer et al. (1998) are right stating, that there is no necessary convergence on ’one best way’, that the ’universalist’ message of ’lean production’ must be questioned, that a technocratic analysis of production systems is not enough and that there is no pure productive model to imitate.

But it is also right that the production principles mentioned above represent some new, universalistic and global recipes for modernisation of production. It we differentiate between models, systems and principles of production, a lot of disputes could be arranged easily.
No export of a 'German production model' but mutual learning and struggling

The effect of the new production systems and production principles on the overall consortium-wide production systems and production principles and perhaps even (on the fight for) a homogeneous production model is more complicated than the metaphors of exportation or re-importation of production models could catch. Learning processes from the centre (of the headquarters or Germany) to the periphery could be proven as well as learning processes the other way round from the periphery to the centre.

At the same time, there are different power and interest groups fighting for their corresponding version of reality and the conclusions they think have to be drawn for the company and consortium as a whole. The most important seems to be that the power of definition of conditions and situations is located and structured in a very specific and hierarchical manner. Even if a peripheral plant is quite successful in internal and external benchmarking, there are different ways of influencing this (for example, by the global procurement process or global distribution of investment and production resources) and of perceiving and interpreting it (for example, by ascribing certain results to plants or to the headquarters). The conclusion drawn by Boyer et al. 1998 that "reverse learning may be as important as diffusion" is correct, but reverse learning in the 1990s seems to be an equally hidden and 'contested terrain' than diffusion and export of models.

Struggling forward in spite of model thinking

In spite of a static thinking in hermetic and closed production models, in the new and in the restructured overseas plants we observed a type and mixture of muddling through and struggling forward. This has to do with a quite complete change in the conditions under which management has to act in nowadays comparing with the situation twenty years before. At least for the Big Three of the German carmakers, the 1990s brought a sequence of very fast changes in internal strategies and models as well as in external market and localisation conditions.

There is much indicating that, compared with the period of prosperity and more or less continuous growth and even with economic crisis and decline, the 1990s brought an increasing in market imponderabilities and a qualitative change of the general scenery of the international automobile industry. Market saturation in the old economies, globalisation of production, procurement and marketing, concentration from about fifty world-wide automobile companies to a handful or dozen of global car producers, radical shortages in product cycle time (from about eight or ten years to the half of this), qualitative changes towards forward sourcing and 'reflexive engineering' and declining relative importance of the car production itself in comparison with the forgoing Research and Development and engineering processes as well as with the following marketing and adventure- and lifestyle-organisation: all these factors lead to the declining importance of fixed and closed production models. In times of rapid change a strategy of struggling forward oriented in some production principles and general 'philosophies' is more important than an orientation in static production models.

Obviously there are some concrete and really existing production systems that serve as models and orientations for others. This is true for the NUMMI-plant of General Motors and Toyota in the USA and for the Eisenach plant of Opel in Germany (Jürgens 1998b). But as changes occur faster, there seems to be little and less time for model building. In the same way, the realised overall production systems at company and consortium level - or even at country level - tend to 'dilute' themselves and loose its stable character. Therefore, the conclusion that "a variety of models will continue to coexist and flourish" (Boyer et al. 1998, p. 376) perhaps has to be qualified: a variety of production principles in the sense of action leading ideal-typical features will continue, concrete 'lead production models' such like NUMMI or Eisenach will alternate with each other and company- or consortium-wide production models will become more fluid and unstable in time and space. It seems that at the turning point of the century we live in a transition period without fixed production models but
more or less fluid and changing production principles. Corresponding to the firm trajectory, the realised and defined weaknesses of the company as a whole and of its parts, the situation of each plant, the market segment of production and other factors different 'cocktails of production principles' are mixed. For example, besides the more or less generalised production principles mentioned above, in the Tuscaloosa plant as well as in the Audi production system the principles of standardised work place organisation and standardised work processes played an important role. This was not the case in the BMW-Spartanburg plant nor in the Volkswagen-Puebla plant.

It seems that we are living in a period of 'great transformations', perhaps in a decade the dust will have gone down and the World will be clearer again. But at this moment we have to live with the uncertainties. In spite of disputing the existence of one or three or five production models, it could be more fruitful to think in action guiding production principles, in concrete empirical production systems and in perhaps new production models emerging in the future.

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