The product development process as a measuring tool for company internationalisation? The case studies of DaimlerChrysler and Volkswagen

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Abstract: The article proposes to use product development processes (PDP) as a measuring tool for analysing firm internationalisation by mapping the spatial distribution of resources, functions and competencies in international companies. It first summarises the 'state-of-the-art' of PDP approaches and the most important topics and findings of recent PDP research. Then the PDP is discussed in the context of describing company internationalisation by the method of *following the product during the development process*. Two case studies from the German automobile industry – the creation of the New Beetle/Volkswagen and the M-Class/DaimlerChrysler – are presented according to the four main and interrelated stages of concept creation, product planning and preparation, product development and production preparation. Finally, both cases are compared, structural pending problems of both case studies are discussed and suggestions for future research, using the new approach, are made.

Keywords: competencies; functions and resources; German automobile manufacturers; globalisation; internationalisation; product development process.

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1 Introduction

Product development processes (PDPs) [1] are normally analysed as processes of organising technological innovations and their transformation in tangible goods and services. From a sociological perspective the PDP can be described as a process of *reflexive organisational structuration*: it is a process of actions within and between organisations that is based upon available resources, rules and norms. It creates something new by enabling the organisation to overcome routine action by transforming internal and external resources and practices.

In other contexts, we defined business companies in a sociological sense as 'action units of the double transformation of reality' [2]. On a first level, companies transform raw materials and other inputs in organised processes, and based on a division of labour, into goods and services which can be sold in markets. This process of production and marketing of goods and services can be called the *simple transformation of reality*. The *reflexive transformation of reality* refers to the recursive process of thinking about and deciding *what* and *how* to produce *for whom*. Whereas the simple transformation of reality is focused on the execution and realisation of defined goals and processes, the reflexive transformation of reality is engaged in the reflection about and the redefinition of these goals and processes.

In this sense, the product creation process is part of the reflexive transformation within a given company. The organisation has to make decisions about how to react to market needs and customer demands with the available resources. This leads to the use of available technical knowledge and design resources to develop new, company-specific products. Thus, available resources as well as existing rules, symbols, power structures and ideas are relevant for the definition and development of new product concepts. However, these existing organisational assets must be transformed for something qualitatively new to emerge. Therefore, PDPs are at the core of the intersection of simple and reflexive transformations of reality.

During the 1990s the *generation of new products* was crucial for the German automobile manufacturers Volkswagen and DaimlerChrysler [3]. The launch of the New Beetle (Volkswagen) and of the M-Class (DaimlerChrysler) reveals *new product strategies* towards specific market niches that are, on the one hand, coherent with the overall company traditions, images and profiles and, on the other hand, respond to new customer preferences and market conditions.

Interestingly, both product innovations – although at the core of the company's identity and image – were developed in the context of an exclusive *transnational* cooperation and manufactured, not in central production sites in Germany, but abroad and even overseas! In the case of the M-Class, production even began in an *all new plant* in the USA while the New Beetle is manufactured in a *renewed plant* in Puebla/Mexico. In sum, product launching and the corresponding production of the new models reveal not only new product strategies but also seem to represent qualitatively new *business and internationalisation strategies* [4,5].

The purpose of this article is to increase the understanding of company internationalisation and to use the PDP as a tool in this endeavour. In the following, first some of the most important recent approaches of the PDP as presented in management and organisational literature will be summarised (Section 2). Then a concept of using the PDP as a *measuring tool* for *company internationalisation* is proposed as a means for

analysing the geographical and social mapping of the distribution of resources, functions and competencies in international *automobile companies* (Section 3). This framework then will be applied to the PDP of the New Beetle (Volkswagen) and the M-Class (Daimler Chrysler) (Section 4). Finally, both cases are compared and pending structural problems as well as some implications for future research are discussed (Section 5) [6].

1.1 Empirical research background

In the cases of DaimlerChrysler and Volkswagen the approach of analysing PDPs seems to be a promising perspective. The revival of both companies during the 1990s could not be explained without referring to the development of new cars and the implementation of new images and product policies. Expanding production facilities for new products abroad is obviously one specific feature of the globalisation process of these companies. In both cases, experimentation with new production concepts was combined with new products that were assembled in new or renewed plants, which served as a sort of laboratory for new production principles.

Both case studies resulted from a research study supported by the German Science Foundation (DFG). The focus of the study was to describe *company internationalisation profiles* by analysing the development process of new car models that – for the first time in company history – were not manufactured at the 'home bases' but abroad [7,8]. At the core of this research project were two tasks: on a theoretical–conceptual level a model of *company internationalisation profiles* was to be developed based on relevant literature from organisational sociology, international social science automobile research and management sciences. Secondly, the changing international company profiles of the three companies, BMW, DaimlerChrysler and Volkswagen, were to be analysed with regard to the distribution of resources, functions and competencies during the years 1990 and 1999/2000. The empirical basis of the analysis was the development and start of production of three new passenger car models.

The companies cooperated during the first stage by granting access to information, interlocutors and admission to their production sites. The main goal of the interviews (qualitative, open guideline interviews; incl. the first phase, a total of 136) was to get a close insight into the procedure and the problems corresponding to the development of these new products. However, for the second round of interviews (in 1999/2000) it was difficult to locate all those who participated in the early 1990s due mainly to the project-orientated organisation of the development projects. Thus, we are able to describe some relevant facts only in the form of an incomplete puzzle based on expert interviews and secondary data.

2 The product development process – relevance and approaches

The development of new products is critical for many firms in many ways. It is regarded as a source of competitive advantage and innovative organisational change – in short, a successful development process and market success of new products is of crucial importance for the survival of firms [9–11]. During the past three decades a growing amount of scientific literature has emerged describing the importance of proficient product development, discussing new ways of organising product developing processes more efficiently and successfully, as well as making it available for use in practice. Thus,

most of the literature was and is published in engineering-, management- or organisational-orientated journals and books. This is surprising as we expected social sciences publications would play a major role in the scientific discussion because the product development process is – without doubt – a social process [12,13] in which many individuals with different interests, abilities and aims participate. However, only the most important studies were the work of members of business sciences oriented institutions. Only 10 years ago, Clark and Fujimoto from the Harvard Business School [14–16] and Womack *et al*. from IMVP/MIT [17] improved our understanding about the impact of efficient product development processes and production systems on the economic success of automobile manufacturers.

The consequence of both studies was a *paradigm shift* in product development because they showed the influences of, for example, the change from sequential to parallel processes, the shift from functional to project orientated development teams, the implementation of project management, the importance of (heavyweight) project managers, and the integration of suppliers and customers, on the success and efficiency of product development projects.

Although they have produced important results, we should also mention a number of other valuable research studies which were conducted in the field of PDP research. Brown and Eisenhardt provided one of the last extensive analytical literature reviews in this area, identifying three major streams of research: product development as *rational plan*, as *communication web*, and as *disciplined problem solving* [9].

They called '*rational plan*' the stream of research in which successful product development is seen as 'the result of rational planning and execution' [9,pp.352–353], which means that 'successful products are more likely when the *product* has marketplace advantages, is targeted at an attractive *market*, and is well executed through excellent *internal organisation*' [9, p.352, emphasis in original]. The latter is defined by carefully planned predevelopment activities, executed by well-coordinated cross-functional teams and supported by senior management [9, p.353,18,19].

The *communication web* approach focuses on the communication and information flow in and between organisational units and individuals, especially among project development team members, arguing that this stimulates the performance of product development processes [9,p.354]. There are two theoretical streams. One is an information-processing approach emphasising the importance of frequent and appropriate communication that leads to a more comprehensive and varied information flow. The other one, is a resource focused perspective which emphasises 'that frequent political communication leads to higher performing development processes' [9,p.358] by increasing the resources (e.g. budget, personnel, equipment) for the team.

Finally, Brown and Eisenhardt labelled all those research studies '*disciplined problem solving*' in which a (successful) product development process is analysed as a balancing act between relatively autonomous problem solving by the cross-functional project team, at the project level, and the discipline and visionary thinking of a heavyweight project leader who is strongly supported by senior management, at the executive level [9,p.359]. It also highlights the role of communication within the teams and the organisation of their work emphasising overlapping processes (e.g. simultaneous engineering) and predevelopment activities, such as anticipated conflict resolving. An example for this stream of research is the often cited Harvard Study of the automobile industry by Clark and Fujimoto from 1991 which we will refer to in the following section.

The 'integrative model' of Brown and Eisenhardt combines the common aspects of the three approaches. The basic idea behind their model is that *multiple players* (project team, project leader, senior management, customers, suppliers) in different interrelations and a special work organisation (concurrent and integrative processes; communication) influence *product effectiveness and process performance,* leading to the economic success of a product development project [9,p.366]. A first general result of all these research streams, and even of the integrative model of Brown and Eisenhardt, is that they aim at analysing the *factor*s influencing the *efficiency* and *success* of a new PDP. The main concern of these studies is the pragmatic question of how to improve the PDP itself.

However, what we want to analyse is the internal *structure(s)* and *procedure(s)* of a PDP. The most detailed description of the structure(s) and procedure(s) of PDPs until now has been the version of Clark and Fujimoto [14,p.36]. Therefore, we decided to adopt their process model and combine it with our own particular research interests: to understand the PDP as a *structure* of specific spatial distribution of competencies, functions and resources as an *indicator of the quality of company internationalisation* in the automobile industry.

3 The product development process as a measuring tool for company internationalisation

In a more and more global and transnational world, PDPs have to be studied, not only using a functional engineering or economic approach, but also in a spatial perspective. How is a PDP distributed across different places and spaces? Which types of problems are solved by internationalising PDPs and which new challenges arise from this? We can also take the degree of PDP internationalisation as an indicator of the qualitative transnationalisation of a given car-maker. In this sense, the internationalisation of a car-maker is not only measured by the share of foreign investment, turnover, production or employment, as is the case in the majority of related studies. For instance, Michael Porter differentiated international companies according to the degree:

1 of geographic concentration/dispersion of assets; and

2 of centralisation/decentralisation of coordination.

Rob van Tulder developed a typology of company internationalisation trajectories based on micro-economic data [20,21]. In contrast, other scholars focused mainly on the distribution of 'soft' factors like culture, norms and values [22].

C. Bartlett and S. Ghoshal proposed an integrative framework where the configuration of values and habits; the role of overseas dependencies; and the development and diffusion of knowledge, are the central axes for distinguishing between international, global, multinational and transnational companies [23]. Following and analysing the PDP in its specific spatial distribution of competencies, functions and resources between single firm locations could be understood as one alternative measuring tool for company internationalisation since it allows for a dynamic, process-oriented perspective on the role each company locale plays in the structuring of knowledge, capacities, rights and duties and assets.

In this context *competencies* are defined as the rights and abilities to make decisions about processes referring to the development of new products in a given plant of a given international automobile company (e.g. the right to decide on product changes, investments, the attribution of tasks to realise etc.). *Functions* refer to the substantial tasks that are necessary to realise the entire PDP (like R&D, engineering, pre-production or manufacturing). *Resources* refer to the specific means of a given plant in a given automobile company of participating in a specific PDP.

The spatial distribution of competencies, functions and resources should be analysed according to the four aforementioned phases during the creation of a new product: concept creation, product planning and preparation, product development and production preparation: see figure in Reference [14,p.36]. In brief, and in an ideal manner, it means that *concept creation* refers to the search for market targets, new developments and rough technical outlines of the new project. *Product planning and preparation* relates to the selection of the main components (prototype), the layout of the car (first model), the styling (clay model) of the car and first tests of the new concept. It leads to a definite decision about the future of the project. If a product project is accepted, the next step is *product development*.

The most important part of this step is the building of a construction prototype which can be transferred to a pre-production shop. The last step is *production preparation and production development*, which includes the building of pilot cars, pre-production, 0-series and serial production. Although four main steps in the creation of a new product can be described analytically, Clark and Fujimoto [14,p.37] point out that the development process consists of many different steps that can take place in parallel and/or simultaneously and which are not clearly separated from each other. This is a circumstance which also became obvious in the case studies.

Additionally, and most important for the internationalisation problem, is the fact that these different steps are not necessarily concentrated in one place but distributed over different plants and even countries. Therefore, 'following the experts' not only in the headquarters' development departments but also in the different plants involved in the specific PDPs of the M-Class and the New Beetle allowed not only for the reconstruction of the different phases of the PDP in time, but also for the analysis of its structure and dynamics in space. 'Following the product' [22], or *following the product during the development process* by 'tracking' the people and their *roles* and *responsibilities* during the single phases of *product materialisation* and *completion* in time and space, was taken to be a promising way of analysing the organisational change of large global players of the automobile industry and their internationalisation trajectory. These paths defined the design of our study.

4 Case studies

As indicated above, and for reasons of space, only two case studies are presented, and the PDP of the BMW Z 3 was omitted (see Table 1 for an overview of Mercedes M-Class and Volkswagen New Beetle). Nevertheless, the general finding that PDP analysis could be a promising strategy for measuring companies' internationalisation profiles also holds true for the BMW Z 3 case [8,23].

Table 1 Similarities and differences in the Product Development Process of the Mercedes M-Class and Volkswagen New Beetle

	Mercedes M-Class	*Volkswagen New Beetle*
Similarities		
Location of plant	Overseas (Tuscaloosa/USA)	Overseas (Puebla/Mexico)
Product Strategy	Creation of a niche model (SUV) and complementary product assortment (see also e.g. A-Class and V-Class)	Creation of a niche model (fun car) and complementary product assortment (see also LUPO and forthcoming TOUAREG)
Internationalisation Strategy	For world market entry via USA	For world market entry via USA
Organisational structures	Function groups, intercultural exchange, simultaneous engineering, integrative process	Integration of Mexican engineers into the technical development department; multiple groups of engineers and technicians
Distribution of competencies, functions and resources	Development centralised in Germany; not at first: since series production some product responsibilities in periphery	Development centralised in Germany, but transmission of product authority from Germany
Differences		
Basic concept creation orientation	Customer driven: extensive customer and market research	Personality and design driven
Platforms and origins	Completely new car but built with technical knowledge from G-Wagon engineers	Golf-platform (A4-type; modified)
Production System	A hybrid *Toyota-inspired, 'lean' production-system* with US–American elements. Focus on standardisation, operations and time units. High input of teaching and learning processes ('enwidened taylorism')	From fordistic, standardised mass production to lean, technically adapted, highly-flexible, quality mass-production

4.1 Volkswagen New Beetle

The New Beetle of the Volkswagen Group was launched in 1998 and could be considered a symbol for change in many aspects. First, its design is reminiscent of the legendary old Beetle: one of the most successful cars in the world. During the second half of the 20th century more than 21 million old Beetles were produced as a popular, economic and resistant, almost utility vehicle in many countries and several continents. Although the New Beetle takes the curve contours of the old Beetle, it is a high-tech car based on the A4-platform (which is the same as in the Golf series). It was launched not as a utility, but as a fun car. So the product itself and the corresponding market strategies reflect the shift from needs-driven to fun- and emotion-driven customers.

Secondly, as it is based on a platform common to a high range of other cars (VW-Golf, VW-Bora, Audi-A 3, Audi-TT, Seat-Toledo and Skoda-Octavia), the New Beetle also reveals new production strategies of the overall Volkswagen group. These production strategies combine an optimum of *economies of scale* (in terms of common parts, modules and systems developed for and assembled in a general platform) with an optimum of *economies of scope* in terms of diversity of customer preferences and production flexibility. The New Beetle also reflects, thirdly, a fundamental change in the company structure and internationalisation profile of the – almost traditionally highly internationalised – Volkswagen consortium as a whole, because production of the new model was launched, not in the core plant in Wolfsburg/Germany, but in the peripheral plant of Puebla/Mexico. For the first time in the history of the Volkswagen group the production of a completely new and world market orientated car started outside Europe. How was it possible to organise the – successful – revival of the Beetle product idea? Why was the production launch not located in the very historical centre of the old Beetle production? Does the beginning of production in Puebla reveal a strong decentralisation of functions and competencies?

Since the beginning of the 1990s some vague ideas and general concern about ‘how to make the Beetle world market capable again’ [24] existed. In 1993, CEO Ferdinand Piech and the Chief Designer agreed to develop a car study with a mix of old Beetle charm and a futuristic look. At this moment, neither the specific market niche nor the production strategy were clearly defined. It was just one of a multiplicity of car studies which were initiated, presented and then frequently stored away. Then in January 1994, a car study was presented at the Detroit Auto Show known as *Concept 1*. It was just a design study without any technical basis or plan:

> “What we did there simply had no foundation, no package study, nothing. We just wanted to see if we could find something and we just showed that. And then people said: Oh you have to build that immediately! You remember, some people in the Detroit show signed us a check and said ‘I buy that thing. If it is ready you just have to cash the check.’ ” [25,p.9]

So *Concept 1* received unexpected attention and acceptance at the Detroit show – what had begun as a simple design idea ‘back to the roots’ turned into a more and more serious plan.

During 1995, the car study was presented at the automobile shows in Tokyo and Geneva, and due to the continuing positive resonance, the board decided to develop the *Concept 1* into a series car in the same year. The corresponding production was calculated at about 270 units per day. *New Beetle* production development was unique in that it did not follow the general scheme of developing a complete car project first (including technical specifications and a 'package list') and then presenting it to a customer audience. It was just the other way round: a rough design study was presented to the public, and the technical development was specified afterwards: 'Then we tried to put it (the *Concept 1*-car study, the authors) on a platform and then to make a package study. Compared to a standard procedure this is the specific' [25,p.10]. In September 1995 the duty list of the *Concept 1* was fixed by the Volkswagen board, and the Volkswagen plant in Puebla/Mexico was chosen to be the first site to initiate production [24,p.379].

The decision to produce the New Beetle in Mexico was not uncontested. During 1995, the market prognostics for the new car grew from one auto show to the next, wherever it was presented. Planning for the number of units to be produced daily increased from 270 to 600. This made the project attractive for a number of interest groups. The General Works Council in Germany claimed at least part of the production volume for Wolfsburg: as the historical birthplace of the famous old Beetle, the Wolfsburg plant – shaken by needs of structural adjustments due to the market crisis of 1993/94 – should be at the centre of the *New Beetle* production as well. At the same time the Mexican Volkswagen plant – in a joint action of management, workers and their union – fought hard to obtain the contract for producing the new model. Over one million signatures for the production of the (still called *Concept 1*) new car were collected among the regional population, national distributors and their networks. At the same time (and just some days before the General Board decision favouring the Mexican plant!), the Mexican government made substantial concessions in terms of import tax reduction for imported Volkswagen cars in exchange for the production location of the *New Beetle* at the Puebla plant [24].

Once the decision was made to produce the *New Beetle* and to produce it in Puebla, the product development team in Wolfsburg/Germany was formed under the leadership of some Volkswagen-R&D managers, who coordinated the engineering activities. Involved in the process were some Volkswagen Wolfsburg specialists, a growing number of Volkswagen México engineers who came to live and work for some months in Wolfsburg, and a strong working group of specialists from a Wolfsburg engineering company. They all participated to a large extent in the engineering process. In 1995, eight Mexican engineers came from Puebla to Wolfsburg, and in 1996 the Mexican New Beetle group in Wolfsburg grew to about 30 people from the Technical Development department whose stay in Germany was financed by the Mexican plant [25,26]. Thereby, the process of detailed product development, the test of prototypes and production system planning were all organised in Germany by a diverse – German and Mexican, Volkswagen internal and subcontracted – group of engineers and technicians. Beginning in 1997, hundreds of highly qualified Mexican workers were prepared in special courses in the Volkswagen – Puebla training centre for the production launch of the New Beetle. They were selected cautiously and had to meet some basic requirements, such as a college degree, a maximum age of 30 years, and they had to pass a lot of tests in the *Assessment Center*, which was used for the first time to recruit manual workers; only one out of every three who applied was selected for the new production line [27].

Pilot cars were produced and checked in 1997, and pre-production and 0-series were realised in the Puebla plant in autumn 1997. Serial production started in December of that year, but then it was not before the second half of 1998 that full production was reached. On January 5th 1998, the *New Beetle* was presented at the Detroit auto show as a serial car model. This was the first time in Volkswagen history that a new car was not presented first in the domestic market but abroad. At the beginning of 1998, the production volume for that year was planned at 50,000 units and for 1999, 100,000 units [28]. A considerable number of parts were produced in Germany and shipped to Mexico. Some 25 important and defining components of the chassis came from the Wolfsburg plant, where they were produced for platform A4 models worldwide [29].

The market launch of the New Beetle was very successful in the northern USA and in Western Europe as well. In 1998, there were almost 100,000 orders in Europe. In the USA the *New Beetle* became a new cult or fashionable car. It was sold more than 110,000 times in 1998, which represents about 90% of all New Beetle sales. The *New Beetle* fever was so strong during 1998 that the Volkswagen group declared they were looking into a new production site in North America, considering places in the USA and in the Northern or Eastern region of Mexico. There was also a strong demand among Volkswagen workers in Germany to produce the *New Beetle* in Wolfsburg; the corresponding decision was postponed until the real demand could be calculated. At the end of November 1998, the car was officially introduced to the German market. The price of the most basic model was about 17,500 euros, and the average price of a more or less fully equipped car was about 22,500 euros – which many customers considered too high. At the end of the 1990s, *New Beetle* enthusiasm decreased in Western Europe, especially in Germany, because of the price and weak engines.

On the other hand, in North America, mainly in the USA, the New Beetle continued to be a fun and fashionable car. In 2000, the total product responsibility (approval of parts, component improvements, face liftings etc.) for the *New Beetle* was given to the Puebla plant. This was the first time that a non-German production site was given such an authorisation for a world market product. It revealed the increasing engineering and production capacity of that facility. In this sense, the PDP of the *New Beetle* also reflects a strong development process at the Puebla plant and in the Volkswagen group as a whole.

To summarise the PDP of the *New Beetle*, we can first note that the product development did not follow the typical sequential steps:

1 concept creation

2 product planning

3 product preparation

4 production preparation.

Rather, it was a circular and parallel process of concept creation, market presentation and product planning. Usually the technical specifications (axles and wheels distances, engines etc.) had been defined first and then the body ‘hat’ developed (or perhaps design and planning had proceeded in tandem). In this case, the design was fixed first and the engineering and planning had to follow. Though it is not unusual for automobile manufacturers to present design studies on international auto shows to demonstrate their potential skills of building innovative cars, in this case Volkswagen was simply surprised

by the tremendous verve the renewed version of the famous Beetle had caused: probably the world was ready for a New Beetle.

As underlined in many interviews, it was the design, which resembled the old Beetle, that defined the parameters for engineering in a qualitatively new manner. Therefore, product development was organised definitely as a market-condition and customer-need detecting process, with a strong emphasis on *world market orientation*. Several international auto shows in 1994 and 1995 raised market and production expectations, leading to the – now seemingly exaggerated – idea of opening a new *foreign* production site and to the strong rivalry for production shares between different *international* production sites within the company.

The PDP could also be characterised as *de-centred* or *pluri-centred*, because there was not one exclusive strategic headquarters which organised and controlled the total process. At some moments the German headquarters or – more exactly – some CEOs on the board encouraged the product development process, at other moments it was the Mexican plant as a whole which moved the New Beetle project along. The PDP could be characterised as *knowledge decentralisation* due to the very fact that the Puebla plant developed capacities and knowledge resources which now located the plant in a strengthened position in the overall power and status structure of the Volkswagen consortium. This was possible through a longer and larger process, from production of the A2- and A3-models up to the demonstrated competence of technical, organisational and social knowledge in the Concept 1/New Beetle case.

Finally, the PDP was a *contested procedure* due to the different interest and power groups involved. As long as the New Beetle development process was just a 'nice' idea, there was a lot of indifference and a lack of interest within the group. When the Mexican plant workers and managers began collecting the more than one million signatures needed to bring the production of the Concept 1 to Puebla, a lot of people in the group were amused. The more positive the feedback on the new car model was, the more interest groups and plant locations considered themselves to be candidates for the production. These conflicts crossed through the capital – labour conflict line. Management *and* works councils at different plants competed against each other in order to get the investment and the jobs associated with New Beetle production [30].

4.2 The Mercedes-Benz M-Class

The Mercedes-Benz M-Class – a product of the DaimlerChrysler group at present time – was launched in 1997 in Tuscaloosa, Alabama (USA) and is, as Chairman Jürgen Schrempp called it, 'a living example of the then – Daimler-Benz Globalisation Strategy' [31]. In various aspects it reflects the *four offensives* of the Mercedes management board to become the global leader in profitability and innovation by the year 2000 [32,33]. So the PDP of the M-Class has to be seen in context of the following.

4.2.1 Development of new products

The M-Class belongs to a new generation of models that changed the face of Daimler-Benz during the 1990s. The aim was to double production from about a half a million to more than a million cars (including every car from the Mercedes-Benz department from Smart to S-Class) by spending about 5 billion euros within a decade. With the new

A-, C, E-, M-, and V-Class models and the sportive SLK the company reacted successfully to increasing market segmentation and individualisation of customer needs by expanding its product range [34].

4.2.2 Improvement of productivity

An ambitious offensive was started to approximate Mercedes-Benz to the worldwide benchmarks in productivity by reducing deficits in time- and cost-competition and by establishing lean processes and structures in the manufacturing process. One of its results was the production system which was developed for the Tuscaloosa plant based on the Toyota lean production system.

4.2.3 Going global!

This meant finding new markets to expand into building cars *in* foreign countries to be *in* prospective markets, and evading tariff barriers and currency fluctuations. In sum: a new quality in the internationalisation of the value chain. The M-Class was the first new Mercedes-Benz not built in Germany – it is not 'made in Germany', but 'made by Mercedes-Benz' in Tuscaloosa/Alabama, USA. It is mainly manufactured *in* and *for* the US market, the largest in the world [35,36].

4.2.4 Initiation of learning processes

The whole product development of the M-Class was a large learning process for Mercedes-Benz in general, and specifically for Mercedes-Benz US International Inc. (MBUSI), in the sense that new paths for the creation and production of the car were chosen. Beginning from the US-customer orientated design and development and ending in – as a part of the MBUSI Production System – enabling people who never built cars to assemble a high-quality Mercedes car.

In 1991 and 1992 several studies were ordered by the Daimler-Benz management board. The aim was to explore which *markets* and *segments* the company could have potential to grow in, because its existing car products did not seem to suffice the *needs of the customers,* which had become more and more individualised. Thus, referring to coming models, one future goal became meeting customer demands. In March 1992, a project team headed by Andreas Renschler [37] was located in an office trailer at an old railroad yard next to the Untertürkheim facility. The team was given the task of studying the feasibility and opportunities of developing a Mercedes-Benz *sport-utility vehicle (SUV)* and the possible locations of such production. One of the leading ideas was to think about a renewed version of the then 15-year-old G-Wagen. However, after analysing the conditions and customer needs of the USA – the world's most important market place for SUVs – the project team came to the conclusion that the cost-, sales- and price-targets could only be met with a new car. In sum 'the goal was to create an evolution of the sport utility, a true off-roader, but with the passenger car attributes of a Mercedes-Benz (. . .) and priced in the mid-$30,000 range when launched' [38]. It should be built in the *USA* to meet the demands of the primary market place.

The top management of Daimler-Benz accepted the project and entrusted Renschler with its realisation in October 1992. The beginning of the project was officially scheduled for January 1st 1993, and the start of production was aimed for January 1997. Renschler's most prominent supporters were his mentor Werner and the then head of development at Mercedes-Benz, Dieter Zetsche. Despite this strong support some members o

management, the board and some heads of departments were not unanimously positively disposed towards the M-Class project: 'The project team was loosely sent out by the headquarters and they have let them go, because they have not been taken seriously' [39].

Renschler put together a *project team* with experts from all relevant departments in order to develop a new car and build a new factory. For the internal organisation of the project structure he used two innovative 'tools' which were known at Mercedes-Benz from the C-Class project developed 2 years earlier. One of the tools was the method of *project management*. The other tool was the implementation of *function groups*. Beneath an eight-headed managerial team, so-called *function groups* were installed as internal coordination units – cross-functional teams responsible for the development of a particular component or system of the M-Class. The fundamental relevance of the function group organisation was to ensure close communication, interaction and frictionless information flow between the relevant internal and external (e.g. suppliers) actors in the development process.

A separate company was established for the M-Class project [40]. All project members worked full-time and closely together during the first project stage in Germany. Some of the people selected were also members of the study group, while others were from the USA. Integration of the US-American project team members did not succeed in general, and some partly organisational problems occurred:

> "The regular time frame wasn't followed or something. So, it was kind of new for everybody. For me, I really had no training, cultural training or anything like that, when I went over there. They put me on an aeroplane, they sent me there." [41]

However, that was the exception. Otherwise it would not have been possible to finish the project successfully. Probably there was a hint of organisational problems when the M-Class team tried to reduce development time by 'front-loading' PDP steps that traditionally would take place in a later stage of the PDP.

During the development process, site selection for the new factory officially started in the USA in April 1993. Andreas Renschler headed a location team which consisted of some members of the project team and which was supported by members from Mercedes-Benz' US sales company, the US subsidiary Freightliner, several Daimler-Benz US subsidiaries and Flour Daniels, a company which had consulted BMW earlier on its search for a plant location in the USA [42]. Only 5 months later – in September 1993 – the location was found. In a contest of 50 US states only Alabama remained, and Tuscaloosa became the home of Mercedes-Benz' new SUV plant.

While the core development project team worked in the offices in Untertürkheim and Sindelfingen, the styling of the M-Class was a process that involved three – competing – teams: one at the Mercedes design centre in Sindelfingen, one in the advanced design studios in Irvine/California (USA) and one in Tokyo (Japan) [43]. In the end the model of the German team headed by Dieter Futschik was chosen [44]. While the US model was thought to look too off-road, Futschik's model seemed to get the targeted balance between an off-road vehicle and a Mercedes-Benz sedan.

After the design freeze in February 1994, *development* of the M-Class started. This process was primarily conducted in the form of *simultaneous engineering*, in order to reduce development time, and was completely located in Germany. About 220 development engineers (150 Germans and 70 US-Americans) from different departments of Mercedes-Benz partly, who were hired in the USA, with background experiences from

different US and Japanese car manufacturers [45,46], were involved in the process, as were several experts from 18 so-called system suppliers. Overall, approximately 65 suppliers were selected to work together with the project team on the development and production of the M-Class. Eighteen of them were responsible for large subsystems or modules (system suppliers), complete dashboards (cockpits), finished seats, etc. [31,p.66]. The system suppliers worked intensively together with the project team in the function groups.

These function groups were responsible for single modules or systems and had to keep within the limits in terms of costs, quality, and weight. About 15 cross-functional teams combined 10–12 experts from marketing, finance, controlling, purchasing, logistics, production, quality, engineering as well as design and development with representatives of the suppliers [31,p.65,47,48]. Although the M-Class is built up in a modular way, with even the stampings being supplied, the heart of the M-Class – engine and transmission – comes from Daimler Chrysler plants in Germany.

Development work was organised as a paperless project, which meant that most of it was done on CAD-workstations in order to make the coordination between design and construction, and, construction and manufacturing between, more efficient and transparent. The latter point was quite critical. To shorten development time and to facilitate manufacturing of the M-Class, pre-production – as part of manufacturing preparation – had to be highly integrated into the development process. In fact it was – more or less – successful when pre-production was done in Germany. Interview partners mentioned problems related to the parallel use of CAD and drawings, the impossible or late access to them and the slow internal procedure of publishing component modifications:

> "But our department pre-production didn't have a budget for a CAD system and didn't have any ability to use a CAD system and didn't have training to pull things up in the CAD system. (. . .) The other thing was that development was done a lot by the suppliers. So in a lot of cases all those drawings, CAD and every thing with it, the supplier wasn't really available for us to really review." [49,p.6]

The development process seemed to fail totally: for example, when the pre-production shop (PPS) was set up in Tuscaloosa. With the transfer of the team from Germany to Tuscaloosa and the increasing spatial distance from the headquarters, the pre-production unit was separated more and more from the information flow. This became obvious when prototypes were transferred to Tuscaloosa in autumn 1995 to enable the pre-production team to prepare the serial production. In general, the measure of internal complexity referring to communication, information and coordination of work increased with the set-up of the Tuscaloosa plant. A special problem became the changing and further developments of parts. When the team in the pre-production shop began to complete the pre-production prototypes, it often found constructional faults which were already solved by the development department but had not been communicated to the pre-production shop in the USA:

> "The usual thing was – (. . .) – we would say: 'We put that in a car and it doesn't fit.' And they would say: 'Yes we know, we've known that for 2 weeks or 2 months. We've already designed a new part, you'll see the design will come out in the next week.' But then we would have to wait 3 more weeks to get that part – or a month. We would get that, we would order that special part, spend a lot of money and made whatever, we would get it and put it in and would say: 'Hey, there is a problem now with the part that goes on.' And they say: 'Oh, yea, we saw that, we changed the design.' You know, so we were always behind." [49,p.22]

Even today there are still competencies referring to single systems and modules of the M-Class which are not located in Tuscaloosa. As a member of the PPS told us, the responsibilities are still not divided evenly. Some groups like 'body parts' have almost total design responsibility for the current product in Tuscaloosa. However, design responsibility for other parts still lies in Sindelfingen until the parts are transferred to Tuscaloosa. Other parts like 'electrical parts' are completely the responsibility of Sindelfingen.

While Mercedes-Benz designers and development engineers were busy refining the M-Class in Germany and at test sites around the world, the foundations for the *plant* and the *production system* for Mercedes-Benz US International Inc. (MBUSI) were set up in early 1994 not far away from Tuscaloosa. Managers and engineers were hired from nearly every US and Japanese manufacturer present in the USA, including Ford, GM, Nissan or Toyota. Thus, a kind of melting pot emerged reflecting different experiences and cultures from different automobile manufacturers. A disadvantage of this melting pot was that it often led to controversial discussion about the right way of solving problems. A good example is the then VP Operations and current CEO and President of MBUSI Bill Taylor: in many of the interviews conducted during the first project phase, it was emphasised that Taylor especially exerted a dominant influence over the project (see also [8,p.128]).

It was also he who used his experiences from Toyota and Ford to establish a special production system ('MBUSI Production-System') for Tuscaloosa, which differed completely from any system ever used before to build a Mercedes. The system can be characterised as a hybrid *Toyota-inspired, 'lean' production-system* with US-American elements which is specialised on a *low-variant, high-outsource-orientated product* [50,51]. It matched the special demands of a *workforce* that had no automotive experience. So MBUSI had to look for team players with good education and certain technical and problem-solving skills. About 160 of the best of them were sent to Sindelfingen in the spring of 1995 – and that is important – not to learn to build a car in general but to learn in particular to build a Mercedes. These workers became 'multipliers' for the other workers (so-called team members) in the plant [32,p.77]. They were accompanied by German 'Meisters' from the Sindelfingen mother plant, who supported these 'multipliers' in coaching the other team members in building the M-Class. Many of the details of the production system proved so successful that it was introduced in several other DaimlerChrysler plants in Germany.

In December 1996, the production trials ended with some 75 vehicles produced, tested and evaluated. In February 1997 'Job 1' rolled off the line. Market introduction of the M-Class in the USA and Canada was in September 1997, 8 months after the chassis of the series model was presented at the 1997 Detroit Motor Show and only weeks before it was presented in Frankfurt (European debut) and Tokyo (Asian debut). In March 1998, the M-Class went on sale in Europe. These facts marked a milestone in the globalisation process at Daimler-Benz. It was the first time in the history of the company that a new Mercedes car was first presented and then went on sale *outside Germany*. Three months later the 50,000th M-Class rolled off the line. In February 1999, number 100,000 followed; the 200,000th M-Class was produced only 1 year later. Since then more than 250,000 M-Classes have been built.

In August 2000, DaimlerChrysler announced its intention to invest US$ 600 million to expand the facility, creating 2000 new jobs and a second production line. Supported by news, both in a German newspaper and on the official web-page of DaimlerChrysler, we assume that within the coming years the second production line will not only be used to temporarily double the amount of production, but also to provide a line for another car model [52,53].

To summarise the PDP of the M-Class, we can characterise it as a simultaneous-integrative, customer-/market-orientated, contemporaneous, centralised and pluri-located learning process. This process is characterised by a strict project orientation which was an innovation for the former Daimler-Benz company at that time and which validates Clark and Fujimoto's criteria for effective and efficient product development. However, what statements can we make about the quality of the internationalisation process at DaimlerChrysler during the 1990s, referring to the spatial distribution of competencies, functions and resources in the PDP of the M-Class?

For the internationalisation of the Mercedes-Benz car division – and our study and concerns refer only to this – it was helpful to resort to the internationalisation experiences of other company parts (e.g. Mercedes-Benz of North America, Freightliner, AEG-Westinghouse). Referring to the M-Class project, the qualitative measure of internationalisation is, in turn, limited as between 80 and 90% of the development process was done in Germany. However, for the first time in the history of the company, the concept of a new product was internationally orientated, because it was primarily based on the requirements of foreign customers in a foreign market. Additionally, many of the experiences that were gathered in and between Sindelfingen and Tuscaloosa reverberate in learning processes for other locations of the company.

For the production of the M-Class a new plant was built in a foreign market with a foreign workforce (from team members to engineers and managers), but with the experience of already internationalised (US-American) company subsidiaries. Exchange of inter-organisational and inter-cultural knowledge and experience played an important role for team members right up to management level in developing an internationalised product. This was not only advantageous, as it was complicated by interlingual barriers and different socio-cultural backgrounds.

Referring to human resources, it is not only an indication of internationalisation that an international workforce (blue and white collar) was hired. Even the new 'transnational social spaces' [54,55] the employees of Mercedes-Benz and their families opened up in their travelling back and forth between Sindelfingen and Tuscaloosa are a qualitatively strong indicator for company internationalisation.

In sum, internationalisation in this case is a continuous process rather than 'zero-sum-game': Mercedes-Benz has not only built a new plant but also new capacity. The location is still developing. A US-American (Taylor) is the current CEO of MBUSI. Competencies to change parts of the M-Class are limited but have increased in the last years. The plant is expanding and a new product seems to be planned for the future to strengthen the company's standing in the US market. A slight tendency of de-centralisation of competencies and functions is observable.

5 Conclusions and prospects for future research

Comparing the two cases – New Beetle and M-Class – some conclusions for the PDP dynamics and internationalisation profile of the companies can be drawn (see Table 1). Both products were the pioneering products in their respective companies, first and foremost built for the world market and built exclusively at overseas plants [50]. Both products stand for a new market segment and a qualitative internationalisation shift in each company. In both cases the new niche cars served as 'ground-breakers' for other

models of the same company in the most important part of the world market – the USA. Finally, and what is perhaps the most interesting fact, both products were planned and developed in new organisational structures marked by interdisciplinary and intercultural, project- and cost-unit-orientated teamwork. Typical problems occurred because traditional paths were left open and people from different professional and socio-cultural backgrounds had to work together. In both cases, the main development work was centralised at the German headquarters – with an interesting deviation at VW.

While in the case of Puebla (Volkswagen de México) the peripheral plant succeeded in strengthening its position regarding development capacities for a whole model line (New Beetle), success was limited at the Tuscaloosa plant (Mercedes-Benz). The latter remains predominantly a production location, though it continues to be awarded more responsibilities for single parts and modules of the M-Class. The future will show if the Mercedes-Benz headquarters will ever relinquish full responsibility for a single product to a plant abroad. In 2005 the life cycle of the M-Class will end and the successor will show how many competencies Mercedes-Benz is willing to delegate to Tuscaloosa. However, the differences between the New Beetle and the M-class, concerning the delegation and decentralisation of competencies, can be explained by the fact that Volkswagen de México is a renewed plant with years of experience while, in contrast, the M-Class is manufactured in a green-field location.

Both cases reveal that PDP is not only an engineering- and market-driven process involving following a 'rational plan', or taking a 'disciplined problem solving' approach. Nor is it simply the product of an efficient 'communication web'. PDP has to be analysed in the context of power structures and power games involving strategic actor groups inside and outside the organisations. Generally there are different views on the pros and cons of a specific PDP project. For example, older managers, who were successful with a certain PDP, tend to advocate continuity in products, underlining the re-identifying value of brand and product continuity. New and young engineers could gain power and increase their profile by promoting innovative products and PDPs. In every organisation there are different strategic options and their corresponding promoter groups and even product structures are based on strategic decisions and games [57,58].

Analysing these negotiation processes will be an interesting subject for future research. Studying PDPs in general is a promising research strategy, not only for engineering and organisational research approaches, but also for sociological analysis of decision-making, power structures and strategies, and internationalisation profiles of companies in general. Thus, PDPs should not only be seen as courses of rational action, but also as embedded in economic organisations comprised of rational as well as natural and open systems [59]. In this context, the distribution of resources, competencies and functions over the host and foreign plants in international companies is an important research topic that allows deeper insights into the globalisation dynamics of economic organisations than does the simple analysis of, for example, the foreign shares of turnover, production or employment. Besides 'following the product' and 'following the value chain' [60], 'following the product development process' could be a promising research strategy for multi-sited processes. In times of globalization, PDP analysis allows for new ways of following knowledge production, products and value chains.

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References and Notes

1 In the following we will mainly use the short term 'PDP' for Product Development Process and 'PDPs' for the plural form.

2 Pries, L. (1998) *Betrieblicher Wandel in der Risikogesellschaft. Empirische Befunde und konzeptionelle Überlegungen*, 2nd ed., München/Mering: Rainer Hampp Verlag.

3 This also holds true for BMW, which nevertheless is not dealt with in this article. Mercedes-Benz now is one car brand of the DaimlerChrysler consortium; but as we discuss mainly the decade of the 1990s, when Mercedes-Benz was part of the Daimler-Benz consortium, and the DaimlerChrysler merger did not interfere in the product development process of the M-Class, we will use the term Mercedes-Benz here and speak of a German company, although this is quite difficult after the DaimlerChrysler merger.

4 Referring to the current state of debate about carmakers' internationalisation strategies see [5]. His paper will introduce the forthcoming GERPISA volume on the strategies of internationalization in the auto industry.

5 Volpato, G. (2002) 'Carmakers internationalisation strategies: an overview', *La Lettre Du GERPISA*, No. 158, pp.2–5.

6 This research was realised as a cooperation between the Institute of Sociology (Prof Dr Gert Schmidt) at the Friedrich-Alexander-University of Erlangen-Nuremberg and the Department of Social Sciences at Ruhr-Universität Bochum (Prof Dr Ludger Pries). It was supported by the German Science Foundation (DFG) under the project title 'Internationalization Profiles of the Big Three German Automobile Companies BMW, DaimlerChrysler and Volkswagen during the 1990s'. The GERPISA network supported in the CoCKEAS-context this research as well. We would like to thank our colleague Christian Sandig (University of Erlangen-Nuremberg) for his critical reading and discussion and for a review of the English version of the original paper. Finally we would like to thank the anonymous reviewers of IJATM for their valuable and important suggestions.

7 During the first stage of the research project (Oct. 1997 until Sept. 1999; the second phase ended in May 2002), empirical data was collected at various manufacturing plants run by BMW, Daimler-Benz and Volkswagen in Brazil, Mexico, the Unites States and Germany. The data verified the hypothesis that underlay the research: the building of new locations of production and the restructuring of existing manufacturing plants overseas revealed a qualitatively new phase of internationalisation during the 1990s of the Big Three German Car Manufacturers. By reconstructing the profiles of the local overseas plants, their growing weight within the total company structure could be demonstrated, as could the new strategic orientations of these production units within the respective regions. For details see [8].

8 Eckardt, A., Köhler, H.-D. and Pries, L. (2000) 'Auf dem Weg zu global operierenden Konzernen? Fallstudien zu den Internationalisierungsverläufen deutscher Automobilkonzerne in den 90er Jahren. Abschlussbericht zum Forschungsprojekt', *Betriebliche Produktions-Konfigurationen und -Leitbilder in der globalisierten Standortkonkurrenz. Eine vergleichende Untersuchung der Pkw-Endmontage deutscher Automobilkonzerne in der Bundesrepublik Deutschland, den USA, Mexiko und Brasilien*, Erlangen.

9 Brown, S.L. and Eisenhardt, K.M. (1995) 'Product development: past research, present findings, and future directions', *Academy of Management Review*, Vol. 20, No. 2, p.344.

10 Schilling, M.A. and Hill, C.W.L. (1998) 'Managing the new product development process: strategic imperatives', *IEEE Engineering Management Review*, Vol. 26, No. 4, p.55.

11 Cusumano, M.A. and Nobeoka, K. (1992) 'Strategy, structure and performance in product development: Observations from the auto industry', *Research Policy*, Vol. 21, pp.265–293.

12 Regarding the product design process as a social process, see [13].

13 Karlson, B. (1994) 'Product design, towards a new conceptualization of the design process', unpublished *Doctoral dissertation*, Royal Institute of Technology, Department of Industrial Economics and Management, Stockholm.

14 Clark, K.B. and Fujimoto, T. (1992) *Automobilentwicklung mit System. Strategie, Organisation und Management in Europa, Japan und USA*, Frankfurt/Main: Campus, p.67 [reprinted from (1991) *Product Development Performance*, Boston, Massachusetts: Harvard Business School Press, pp.1–6].

15 Clark, K.B., Chew, W.B. and Fujimoto, T. (1987) 'Product development in the world auto industry: strategy, organization and performance', *Brooking Papers on Economic Activity*, Vol. 3, pp.729–771.

16 Clark, K.B. and Fujimoto, T. (1989) 'Reducing the time to market; the case of the world auto industry', *Design Management Journal*, Vol. 1, No. 1, pp.49–57.

17 Womack, J.P., Jones, D.T. and Roos, D. (1992) *Die zweite Revolution in der Automobilindustrie. Konsequenzen aus der weltweiten Studie des Massachusetts Institute of Technology*, 7th edn., Frankfurt/Main: Campus [reprinted from (1990) *The Machine That Changed the World*, New York: Rawson Associates].

18 An example for this stream is [19].

19 Gupta, A.K., Wilemon, D. and Atuahene-Gima, K. (2000) 'Excelling in R&D', *Research Technology Management*, Vol. 43, No. 3, pp.52–58.

20 Porter, M.A. (1986) 'Competition in global industries, a conceptual framework', in *ibid*. (Ed.) *Competition in Global Industries*, Boston: Harvard Business School, pp.15–60.

21 Van Tulder, R. (1999) 'Rival internationalisation trajectories', in Eckardt, Andrea/ Köhler, Holm-Detlev/Pries, Ludger (Eds.) *Global Players in lokalen Bindungen. Unternehmensglobalisierung in soziologischer Perspektive*, Berlin: Sigma, pp.53–79.

22 Marcus, G.E. (1995) 'Ethnography in/of the world system: the emergence of multi-sited ethnography', *Annual Review of Anthropology*, Vol. 24, pp.95–117.

23 Pries, Ludger, Oliver Schweer and Christian Sandig (2002) Produktentwicklungsprozesse und Konzerninternationalisierung: Drei Fallstudien. (Manuskript Bochum).

24 Schreiber, G. (1998) *Eine Geschichte ohne Ende. Volkswagen de México*, Puebla: Volkswagen de México, p.312.

25 Interview VWD-1, p.9.

26 Interview V8, p.11 and 13.

27 Interview V3, p.2f.

28 *Handelsblatt* from 21./22.2.1998.

29 *Auto-Zeitung* 1/99, pp.44–51.

30 To explore this in detail would be an interesting subject for our research study (see section 1.1), but it could not be elaborated on here.

31 Lamm, J. (1997) *Mercedes-Benz M-Class. The Complete Story Behind the All-New Sport Utility Vehicle*, Osceola, WI: Mercedes-Benz US. International, Inc., p.5.

32 Haasen, A. (1999) 'M-Class – the making of a new Daimler-Benz', *Organizational Dynamics*, Vol. 27, No. 4, pp.74–78.

33 See also Mercedes-Benz board member for passenger cars Jürgen Hubbert in Lamm [31], p.24.

34 In this context we should not forget the 'Elk-Test' affair involving the A-Class. However, after some technical improvements (e.g. ESP), it became a success story, too (*The authors*).

35 In this case you must not forget the almost 50-year-old history of manufacturing trucks in Brazil, but in our case we only refer to cars and new models.

36 An additional production capacity of currently 25,000 cars p.a. is located in Graz/Austria at Magna Steyr-Daimler-Puch.

37 Renschler began working at Mercedes in 1988 and a few years later became the assistant to the soon-to-be chairman Helmut Werner.

38 MBUSI Press Information (1997) *The Making of the Mercedes-Benz M-Class: New plant, new product, new people, new way of working*. Available from http://www.mbusi.com/pr/overview.html

39 Interview M7. The selected passage from the interview was translated in its essential parts.

40 Mercedes-Benz Project, Inc. It changed to Mercedes-Benz US International, Inc. (MBUSI) in 1994/95 when the first buildings could be obtained.

41 Interview MB-USA-3, p.5.

42 As a result, Spartanburg in South Carolina became home of 3-series production for a short time before becoming the exclusive plant for the Z3-roadster and X5-SAV.

43 What is quite interesting, referring to the design of the M-Class, is that we did not find any indications of the quality of the work of the then new Tokyo studio.

44 The US model resurfaced in 1996 as the AAV show car at the North American International Auto Show in Detroit to present a hint to the upcoming M-Class series-model.

45 The numbers are cited from [46]. One of our interview partners put the number of engineers at 90: MB-USA-2 commentary, p.2. Note that in this case it was not possible to record the interview.

46 Leicht, H.-P. (1994) 'Southern Comfort', *Auto Motor Sport*, 19.

47 Reference [32] specifies the number of members with about, 150.

48 Martin, S.B. (1998) 'Building supply networks in greenfield locations: new german automotive investments in the USA'. *A Preliminary Research Report for a Project Sponsored by The Institut Arbeit und Technik Gelsenkirchen*, Germany.

49 Interview MB-USA-3.

50 Bill Taylor himself prefers to characterise it as 'one piece flow' than 'lean'.

51 MB-USA-1 commentary, p.1.

52 Peter Hannemann informed us of an additional or perhaps alternative SUV model for Tuscaloosa. It was called 'big brother' as it was to be significantly 'bigger' than the M-Class and had no model name yet. He wrote that Mercedes-Benz intended to produce the 'big brother' on the second line in Tuscaloosa and would concentrate its all-terrain-vehicle competencies there. The presentation of the model was planned for the Detroit Auto Show 2002. Indeed, Mercedes-Benz presented a design study termed GST (Grand Sports Tourer) in Detroit, which deviated markedly from a pure SUV. Concept and packaging (e.g. 5.5 litre V8 Mercedes-AMG power plant, 4WD-electronic traction support system 4-ETS from the M- and G-Classes) let us presume that it was intended primarily for the US market and, therefore, might be produced in Tuscaloosa.

53 Hannemann, P. (2001) 'Die M-Klasse in XXL. Mit einem überdimensionalen Offroader geht Mercedes neue Wege', *DIE WELT*, May 5, p.A3.

54 Regarding 'transnational social spaces', see [55].

55 Pries, L. (2001) 'The approach of transnational social spaces: responding to new configurations of the social and the spatial', in Pries, L. (Ed.), *New Transnational Social Spaces. International Migration and Transnational Companies*, London: Routledge, pp.3–33.

56 With the aforementioned exception of the small production capacity for the M-Class in Graz (the authors).

57 Chandler, A.D. (1962) *Strategy and Structure. Chapters in the History of the American Industrial Enterprise*, Cambridge/London: MIT Press.

58 Child, J. (1997) 'Strategic choice in the analysis of action, structure, organizations and environment: retrospect and prospect', *Organization Studies*, Vol. 18, No. 1, pp.43–76.

59 See e.g. Scott, W.R. (1986) *Grundlagen der Organisationstheorie*, Frankfurt/Main, New York: Campus [reprinted from (1981) *Organizations. Rational, Natural, and Open Systems*, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.].

60 Marcus, G.E. (1995) 'Ethnography in/of the world system: the emergence of multi-sited ethnography', *Annual Revue of Anthropology*, Vol. 24, pp.95–117.

The directors of development from Audi, BMW, Daimler-Benz, Porsche and Volkswagen agreed to cooperate in this area and founded in 1991 the "Arbeitskreis zur Standardisierung von Automatisierungs- und Messsystemen" (ASAM, Eng., working group for the standardization of automation and measuring systems).Â 2006: First ASAM Solutions Guide published, containing case studies and a directory of ASAM members and products. First release of ASAM CDF. First release of ASAM MDX.Â Those companies, who actively participate in the development of the standards, have an additional "first-to-market" advantage. The strength of ASAM is its large group of System Providers.Â As a consequence, ASAM-compliant tools and engineering services are widely available. ASAM pursues the vision that the tools of a development process chain can be freely interconnected and allow a seamless exchange of data. The standards define protocols, data models, file formats and application programming interfaces (APIs) for the use in the development and testing of automotive electronic control units.Â 2006: First ASAM Solutions Guide published, containing case studies and a directory of ASAM members and products. First release of ASAM CDF. First release of ASAM MDX.Â Those companies, who actively participate in the development of the standards, have an additional "first-to-market" advantage. The strength of ASAM is its large group of System Providers. Nearly two-thirds of the ASAM members belong to this group.