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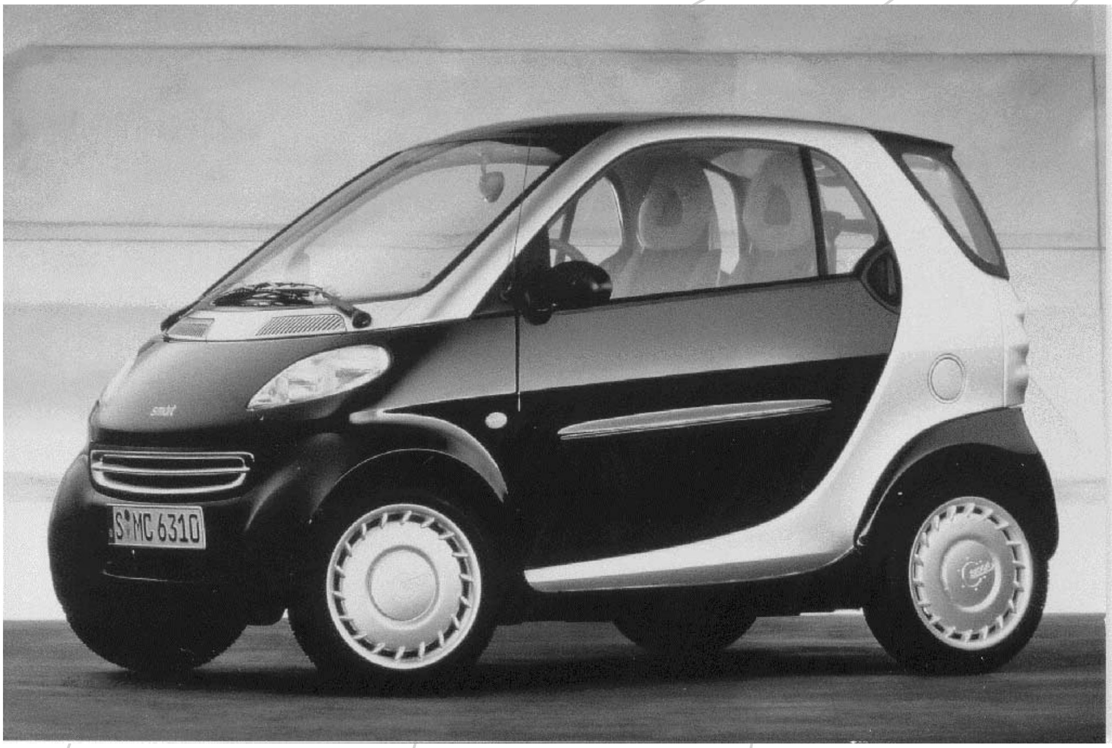
Mercedes-Benz and ‘Swatch’: Inventing the smart and the Networked Organization



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This case was written by Eric Pfaffmann, Visiting Research Fellow at INSEAD, Doctoral Candidate at Hohenheim University, Stuttgart, Germany, under the supervision of Professor Ben M. Bensaou, Associate Professor at INSEAD. It is intended to be used as a basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. All names except those of the senior corporate officers, have been disguised. Detailed financial data are not disclosed by MCC.

In April 1998, just a few months before the start of volume production of the new smart, Mr. Meyer came out of a difficult meeting with Mr. Hoffmann, his counterpart at one of the key partners in the Micro Compact Car (MCC) venture. He was pacing up and down in his office overlooking a row of smart prototypes brought in for testing to Renningen, Germany. In light of the evolution of his relationship with Mr. Hoffmann, he started to wonder whether cooperation with system partners in general were really working. 'Would systems partners be able to deliver in the end? What should we do if one system partner happened to fail us at the last minute?' What are the implications for the whole concept of a modular car and networked organization that Mercedes-Benz created jointly with the 'Swatch' company?

Micro Compact Car: The Joint Venture

The whole adventure of the company MCC started in 1994. It was in April that Helmut Werner, then CEO of the Mercedes-Benz, and Nicolas Hayek, the CEO of SMH (Société Suisse de Microélectronique et d'Horlogerie SA), the company that made the world famous 'Swatch' line of products, agreed on a rather unconventional joint venture in the automobile industry. Mercedes-Benz initially held 51% of the capital and SMH 49% of the remaining. In summer 1997, the German partner increased its stake by SFr 75 million, now holding up to 81% of the joint venture's capital. The headquarters of MCC were located in Biel, Switzerland, the development premises in Renningen, Germany, and the production plant in Hambach, France. The marketing, sales, finance and control functions were centralized in Biel. MCC Renningen started developing the car in March 1994, the site for the plant was selected in early 1995 and inaugurated in October 1997. Volume production was scheduled for July 1998.

Mercedes-Benz owned 38.5% of MCC France, SMH 36.5% and the French association SOFIREM (Société Financière pour Favoriser l'Industrialisation des Régions Minières) owned the remaining 25 %. While MCC France invested up to FF 1.5 billion for the buildings and factory infrastructure, it was the suppliers who invested up to FF 1.3 billion for machines and tools (see Exhibit x). The plant also received FF 450 million in subsidies from the European Union as a recognition for (1) its environment-friendly production system, (2) creating a new market segment, and (3) inventiveness of the concept.

'smart' was the name chosen for the new car, where 'S' stands for Swatch, 'M' for Mercedes, and 'ART' to highlight the inventiveness of the total concept. Micro Compact Car was the name chosen for the company to evoke the revolutionary notion of a small city car. The joint venture was given extremely limited resources to carry out this experimental, yet rather ambitious project. Under stiff financial and human capital constraints, MCC was forced from the very beginning to concentrate on the essential. 'Reduce to the max' was the claim the company used to explain MCC's outsourcing strategy. What he meant was to create a new organizational form, where MCC would sit in the center and coordinate a group of key suppliers who would effectively provide more than 85% of the value-added of the smart.

Mercedes-Benz

Until 1997, Mercedes-Benz AG was a wholly owned company of the Daimler-Benz group. It was the automotive division covering all vehicle segments. Following a major restructuring of the group, Mercedes-Benz as a company was dismantled. The passenger car division and the commercial vehicle division directly reported to the board of Daimler-Benz group, now comprising five divisions: Passenger Cars, Commercial Vehicles, Aerospace, Services, and Directly Managed Business (Rail Systems, Microelectronics, MTU/Diesel Engines). Daimler-Benz remained Germany's largest industrial company and its vehicle divisions represent the largest divisions in terms of employees, revenues and even profits.

Daimler-Benz was created in 1926 by two German automobile pioneers, Gottlieb Daimler and Karl Benz, who decided to merge their companies after World War I. Highly prosperous in the 1930s Daimler-Benz established a strong reputation for high quality and superior engineering products. It was at the beginning of the 1960s that the company developed its image for engineering and manufacturing high quality, prestigious, and safe cars for the premium segment. This has been a key asset of the company ever since.

It was under Helmut Werner's leadership that Mercedes-Benz heavily invested in developing new passenger car models, shortening development time and significantly cutting costs. As an indication, in 1997 the company managed to launch three major new models: the M-Class launched first in the U.S. market, the A-Class and the CLK. The A-Class represented for Mercedes-Benz its first attempt to diversify away from the high end market and enter the mass market segment. These efforts in streamlining operations and strengthening innovation seemed to have paid off. In 1997, the passenger car division boasted DM 53.9 billion in revenues (up from DM 46. 7 billion in 1996) and 715,000 cars in sales (up from 645,000). The car division grew by 15% when average market growth was barely 5%. The German market remained by far the most important one for Daimler-Benz taking up to 39% of total sales with 277,000 units a year, against 122,000 units for the U.S. market and 477,000 units for the whole of Europe (see Exhibit 2).

SMH

The SMH group was founded in 1983 as a merger between Switzerland's two largest companies, ASU AG (Allgemeine Schweizer Uhrenindustrie) and the SSIH (Société Suisse pour l'Industrie Horlogère). The Swiss watch industry went through a severe crisis with the entry of Japanese watch makers and their technological innovations in quartz technology and LCD screens. Within a few years, a company like Seiko became the largest watch producers in the world. SMH response to the Japanese challenge was a technological and marketing innovation known as the 'Swatch'. This was a tremendous success. In addition to the Swatch, SMH carries other brand names, such as Omega, Longines, or Tissot. Development and production were mainly done by ETA SA Fabriques d'Ebauche, a company established at the end of the 19th century, the technological backbone of the group's watch division (see Exhibit 3).

Nicolas G. Hayek was the craftsman of the company's turnaround. He was the mastermind behind the new lifestyle concept behind the Swatch. SMH was now respected as a provocative and innovative company. Check the web page for the Swatch and you will be welcomed by the Swatch slogan: 'Provocation, Innovation, Fun. Forever.' In 1996, SMH sold nearly 102.5 million watches (all brand names included). It achieved CHF 2,789 million in revenues with a headcount of 16,459 employees. It has become the world's largest watch maker.

Nicolas Hayek started to look for ways to further leverage the marketing success of the Swatch concept and the unique competence his company had in marketing and distribution. In this diversification effort, he created an automobile division. He wanted to leverage SMH's proven expertise in designing and building microelectronic propulsion systems and apply it to the automobile sector. Hayek also felt they could make a contribution toward developing environmentally friendly propulsion systems with low fuel consumption. Aware that SMH lacked the automobile expertise, he had approached a few of the key automobile competitors. Renault and Volkswagen declined the offer to join efforts, but Johann Tomforde, an early advocate of the city car concept within Mercedes-Benz was the one with a very receptive ear. The joint venture was signed in 1994 and SMH was expected to contribute its marketing *savoir-faire* to attract the younger consumer segments and to develop innovative sales concepts.

The Background of the smart Concept

Two major developments triggered the search for a new car concept. First, in Germany, consumers had since the early 1980s become increasingly sensitive to the societal costs of individual transportation, e.g., air pollution, energy and materials consumption. Second, individual car use was on the increase and the total number of registered cars as well as the average number of kilometers per capita had risen to alarming levels. In particular, the highly concentrated car park in urban areas was held responsible for negative effects on the quality of life, e.g., daily traffic jams, air pollution, living space taken by highways, shortage of parking space, and of course noise levels. There definitely was a potential market for a car that could alleviate these problems in congested urban areas. Under the strong pressure from consumer and environmentalist lobbies, governments were considering measures to restrict car pollution, control emissions and increase taxation on fuel.

In 1990, Johann Tomforde, then heading the Mercedes-Benz strategic design and car concept department, Sindelfingen, Germany, had been working on a new concept to address these growing consumer concerns. The objective was to create a car with the following features: small size, yet maintaining a high level of passenger comfort and safety; low fuel consumption, using non-toxic, easy-to-recycle materials; and environmentally friendly production process, (Exhibit 4). However, further market research pointed out that consumers were not ready to acquire such a city car unless it offered additional qualitative and emotional utility. Tomforde repeatedly insisted:

> “The reduction of fuel consumption and emissions does not guarantee success. For potential customers, a qualitative leap must be visible, an increased utility.”[1]

He pushed for a stronger marketing statement for the car, in particular an original external appearance to attract attention, a ‘navigation system’ and customized design. The car needed to provide the customer enhanced total driving experience in order to accept this new technology and concept of a city car. To deliver a distinct qualitative advantage, Tomforde pushed his engineers to focus on three concepts: the ‘pleasure to drive’, the ‘mobility concept’, and the concept of a customized design.

The smart

What kind of car people would buy and how could you make money out of a venture like this? These were key questions for MCC. The smart resulted in a significant departure from the usual product offerings from Mercedes-Benz, traditionally focused on luxury cars. The car was supposed to create its own new market in the city car segment niche. It was revolutionary in its technological innovations and the way it was designed and produced. Only 2.50 meters in length,1.51 meters in width, but 1.53 meters high: the car was definitely designed to attract attention. The car had only two seats and customers could choose between two engines. To be on the market by October 1998, with a price tag ranging from DM 16,000 to DM 20,000, the smart would be first distributed in Austria, Belgium, France, Germany, Italy, Luxembourg, the Netherlands, Spain, and Switzerland. Projected sales amounted to 130,000 units for 1999 and nearly 200,000 per year starting in 2000.

The smart would not have been a viable product in the market without some major technological innovations (see Exhibit 4) such as its use of new advanced light weight materials in the engine (only 59 kg, a third of the weight of comparable engines) and the body panels to improve on fuel consumption (the whole car weighs 720 kg compared to 815 kg for the Renault Twingo). In addition, the number of components in the engine turbocharger were brought down to eight instead of the normal 18.

The smart was a tiny passenger car and safety was an even more important factor. MCC wanted it to be superior to other cars of this size. Its engineers were able to use the Tridion-frame technology invented by Mercedes-Benz, a steel-faced body for the car, around which the entire vehicle was designed. They also came up with the ‘sandwich’ design where the engine is located in the rear underneath the passenger compartment. The engine and the gearbox were designed as an integrated power unit de-coupled from the passenger compartment. In the event of an accident the power unit would absorb the likely return shocks to which small cars are particularly prone. A crash box was installed in the front and in the back of the car and was able to fully absorb crashes at speeds of up to 15 kilometers per hour.

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1 Tomforde, Johann, “smart - Vom Designkonzept eines urbanen Kompaktfahrzeugs bis zum Aufbau eines Unternehmens für individuelle Mobilität”. Lecture at the conference “Automobil-Design - Visionen für die Zukunft des Automobils”, Essen, Germany, 28./29. November 1996, p. 7 (Translation by the authors).

Another key feature of the smart, likely to make it a market success, was its customized design and its 'mobility box' concept. Tomforde used to complain that car design has traditionally been an engineers' monologue where the only time the customer could express himself or herself was a the time of purchase. He preferred to have a dialogue and wanted to bring back the customer into the conversation. He aggressively pushed for shorter development time to allow for faster customer feedback and championed a 'modular' design that would allow complete customization. Miss Dessain, for instance, would walk into a smart dealership or visit the smart home-page and custom design her own vehicle. She could independently choose from 4 colors from the body panels, 2 colors from the Tridion frame, or select one of the special colors and many other options. In addition, she could at any time after her purchase change any of these features very quickly (e.g., body panel changes take only two hours) and at low cost. The 'mobility box' offers individualized 'mobility' packages to include car navigation services, such as help functions, traffic information and assistance, and a mobile phone.

The Networked Organization

MCC was under very tough constraints to develop and make the smart. Mercedes-Benz took almost 6 years to develop the new A-Class. There was no way MCC could afford this luxury, since volume production was already scheduled to start four years down the road. The low target price necessary for the smart to make it in the marketplace was also a fundamental challenge for the organization. Notwithstanding the fact that MCC had a limited set of financial resources provided by its two parent companies. The task clearly required a novel approach to product development and production and an organizational innovation was necessary to follow suit on the innovation in the product concept. This meant developing two things: (1) developing a 'modular' car design and (2) creating a corresponding networked organization where MCC would act as a central coordinator of a network of system partners.

The Modular Architecture of the smart

The architecture of a car's design can be defined as a set of the modules and systems. A module would refer to a spatial area of the car, e.g., the cockpit, the doors, the seats, or the drivetrain. Modules are then determined in a way to facilitate the assembly process and minimize assembly and logistics costs and time. MCC defined large modules of the smart that could be outsourced to system partners for development and production. The target of MCC was to optimize logistics and minimize final assembly time to a world-best of 4.5 hours.

Within the spatial modules you would find systems, e.g., the air management system, the brake system, or the wiper system. They are determined by the function they have to fulfill and the components that execute this function. As such systems are defined by the development process. Conflicts are bound to occur between the needs of the development process and the requirements of the assembly process each time some physical component, executing a given function, is shared by multiple spatial modules. Finally, modules and systems are made of parts and components. Parts are typically technologically simple, generic, with a standardized interface and execute a standardized function, e.g., screws or oil seal rings. Components are made of parts and usually would have a distinct, stand-alone functionality.

The Modular Organizational Design

An important consequence of the modular architecture of the smart was the possibility to design an organization where boundaries would set exactly around the technical modules. At the outset, there were five organizational modules: (1) the bodywork and fittings, (2) the cockpit and front-end module, (3) the chassis, (4) the drive module, and (5) the doors, flaps and roof module (see Exhibit 5). Exhibit 6 in addition illustrates the parallelism between the technical architecture of the smart chassis and the organizational structure highlighting the interfaces between MCC and its partner suppliers.

The modular organizational design could not, however, eliminate the impact of some inconsistencies in the product architecture. For instance, to heat the interior of a car, the engine blows warm air into the passenger compartment at different temperatures depending on its own heat level. This warm airflow is also affected by other factors, i.e., the speed of the vehicle or the local weather conditions. In other words, the heating system is a cross-modular function. This implies some incremental and interactive redesigns which affect function design and module boundaries during the development process. The design of the organizational model was based on the premise of perfect modularity, whereby each system neatly fitted into its allotted module, and no system cut across technical module boundaries. In fact, perfect modularity is quasi-impossible for a car since systems such as air-management, acoustics or wire harnessing are inevitably cross-modular.

The integration across modules was difficult as the technical interaction between the modules was ill defined and fuzzy. It also revealed another problem with the modular organization: cross-unit responsibility. Looking at how the 'heating' function was managed showed that nobody was really responsible for the overall integration across modules. Engineers and managers, at MCC as well as the suppliers, were more pre-occupied with their modules and naturally sub-optimized. Mr. Meyer explained: "I was working with Mr. Hoffmann on a consistent tolerances concept within the doors module. Of course, I did not oversee what was going on in the drive module."

After some incidents MCC realized that given the modular design of the organization, the cross-modular functions of the smart would not receive enough attention and care during the development phase. Furthermore, the organizational modularity in itself masked the danger that optimization of the entire vehicle was not promoted with the necessary rigor. The solution was to add a sixth organizational model, called 'electrical connections/electronic systems' that would specifically focus on cross-modular issues. As an overlay structure, MCC also established another cross-module organization, 'total vehicle optimization/vehicle testing' that would look after the systematic coordination of cross-module information flows. The managers in charge were made responsible for testing and the optimization of the entire vehicle and had the same hierarchical level as functional managers within the other organizational modules. They were to settle conflicts within MCC across the various modules.

System Partner Integration

MCC heavily relied on outsourcing, from legally independent suppliers. The successful execution of the smart project was therefore dependent on the level of mutual cooperation and agreement about the division of tasks and responsibilities between MCC and its system partners. Precise process definitions were developed to clarify mutual targets and facilitate coordination and adjustments between MCC and system partners. At the same time, these processes had to allow for greater flexibility and cooperation at the buyer-supplier interfaces. Exhibit 7 summarizes the guiding principles for system partner integration.

Contractual Arrangements

The relationships between MCC and its system partners were based on contracts and rules to which all participants had to agree. The contracts spelled out the rights and duties of system partners and the formal agreements on intellectual property management. The rules defined the fundamental project guidelines, the project organization, and transparency between MCC and system partners. Contracts were separately negotiated with each system partner and were not based on the standard contract schemes provided by the Association of German Automobile Industry (VDA). The contracts stipulated exclusivity rights for the suppliers, i.e., single sourcing principle for MCC, but also expected system partners to assume some of the project's business risk, for instance, by pre-financing of system and module development as well as tools. Contracts also stipulated an obligatory target price that served as the reference for the assessment of any cost deviations likely to occur in later stages of the development process.

Intellectual Property Rights Agreements

This was a critical issue for both sides. MCC wanted to avoid supplier companies exploiting innovations developed for smart with other customers. This would clearly affect the market attractiveness of the smart. MCC therefore decided in some cases to acquire all ownership of the design concepts, even for rejected suppliers' proposals. Rejected suppliers would receive a lump sum compensation upon demand. MCC did not engage in any joint patent registration with any system partner. It would quickly become a source of dispute.

Project Organization

The fundamental guidelines were called 'smart alliance' and allocated in simple terms the basic responsibilities and obligations between MCC and the suppliers. MCC was the smart project leader and played the role of the focal company in a broad network of tight buyer-supplier relationships (even though suppliers assumed part of the risk of the project). Modifications brought to components during the development phase or completion of the quality control of the assembled vehicle needed approval and supervision from MCC.

System partners should develop a three-layer project hierarchy for development and production parallel to the hierarchical structure within MCC, with its function managers, then project managers and finally the board of directors on top. In addition, system partners had to assign function managers and project managers for the duration of the entire project. This should provide the channel for lateral communication between MCC and system partners and clearly identified who would be the contact person responsible for the smart project within each organization. Furthermore, suppliers had temporary desks in Renningen and were asked to produce/assemble their systems on the very assembly plant MCC built in France for the smart.

Conflict Management Mechanisms

Conflicts during the project were anticipated and unavoidable. The basic channel for interfirm conflict resolution was provided by the project organization and its lateral communication bridges. Mr. Meyer was not quite satisfied with some tolerance calculations for the doors' module that his system partner counterpart, Mr. Hoffmann, had just sent him. He went to talk to him directly. "If I had talked directly to his boss, the project manager, Mr. Hoffmann would have felt bad and thought the customer was complaining to his boss about him personally." The procedure prescribed by MCC required that conflicts should be resolved at the level they occur.

Transparency, also conceded by MCC, was instrumental in reducing conflict and supported smooth interactions and trust building in the relationships. Mr. Meyer explained: "We agreed with most system partners on 'open book-calculations' to provide each other with the most relevant data." MCC guaranteed purchasing volumes to the suppliers and gave them access to its market research data from which they could gain confidence in estimated sales volumes themselves. The same applied for the composition of the target price to which system partners were committed.

The Role of Development Protocols

A major tool to control the information flows between MCC and system partners was the so-called 'development protocols'. These included all product-relevant data, and were interactively updated during the course of the smart development. A system partner would only get access to the data relevant to their own development responsibilities and could not see the 'protocol' for other suppliers. In fact, knowledge about the smart was distributed between MCC and the system partners according to the pre-determined task assignments and responsibilities. On the other hand, system partners would only disclose smart-related knowledge to MCC, which was of course, only a fraction of their own knowledge base.

Nevertheless, it was still not possible to force mutual transparency with contracts. Mr. Meyer's experience was that: "Transparency on the side of system partners depends very much on the supplier you deal with. It also depends on the personal relationships you have built with component managers at the suppliers." He also admitted that the degree of transparency varied during the different stages of the project.

Partner Integration during the Development Process for the smart

The concept of the smart and of the organization of MCC were quite revolutionary ideas in the car business and required a fundamental departure from the traditional ways of designing and producing a car. It was critical to develop the proper management processes to deal with the unique aspects of the technical architecture of the smart; the internal modular project organization, as well as the external network of system partners. The smart project was broken down into three phases: (1) concept development, (2) concept realization, and (3) full production (see Exhibit 8). Not surprisingly, the most time-consuming phases of the project were concept realization and production. Each phase consisted of a set of sub-processes which dictated 'what to do when', and how to reach the planned targets. Each phase corresponded to a different team composition within MCC's modular organization. The teams reflected the nature of the major tasks to be accomplished at each development stage and the corresponding domains of expertise required.

Concept Development

There were distinct phases during the concept development of the smart: (1) strategic product planning, (2) procurement marketing, and (3) concept competition.

Strategic Product Planning

Some strategic product planning activities had been carried out by Mercedes-Benz and SMH prior to the foundation of MCC. However, the major work load was carried out when MCC took up its work around April 1994. The main objective was to develop an initial definition of the development protocols. These protocols were to reflect the basic concept requirements of the smart, of which the most important one was to determine how much customers were ready to pay for the car.

This target price was the basis for the calculation of the cost structure for the whole vehicle and for prospective system partners. The procedure estimated how much customers were willing to pay for the key functionalities of the smart value proposition to the market. Each key utility was given a price tag, then each function was translated in terms of its constituant physical components. The result gave the maximum cost allowed for each component. This latter task was typically delicate, as most key functions can be implemented in different ways, with different combinations of components, and required the participations of the most experienced component managers, purchasing specialists as well as benchmarking experts.

In the first half of 1994, Mr. Meyer was heavily solicited for his long experience in door design and his knowledge of the related upstream component markets. This analysis represented the very first contact, newly founded MCC had with external supplier, and in particular the first contact Mr. Meyer had with Mr. Hoffmann.

Procurement Marketing

The procurement marketing phase also started in spring 1994 and partly overlapped with strategic product planning. During this phase, MCC pre-selected up to six to eight potential system suppliers. Those who passed this initial screening were invited to take part in a concept competition and were asked to propose concept studies for their specialty system, or module, on the basis of the customer price targets defined during the strategic planning phase. This was the first time in the smart project that MCC tapped suppliers' creativity and the specialized knowledge they had developed in the domain of their expertise. The quality of a supplier's concept study, even though very important, was not the only key factor in MCC's evaluation. MCC also looked at other factors related to the supplier's general performance, e.g., company size, turnover, plant locations, certificates and references.

Benchmarking and purchasing specialists, component managers supported by controllers would be working together to determine which companies could deliver on creativity required in their new roles within the MCC networked organization. Suppliers were indeed expected to develop from scratch feasible and innovative product concepts within the domain of their expertise. The burden on them in terms of conceptual complexity and creativity, was different from what was usually in the traditional way of making cars. They were used to develop products around pre-existing blueprints or physical components. The system partner's financial stability was also essential to guarantee that it could make the needed investments.

Mr. Meyer admitted:

> "Mr. Hoffmann's company was very promising. They had an excellent reputation for quality in processes and products. Their financial foundation was solid. My colleagues in the doors selection team were also very positive. I have to say that in the beginning I was not sure they would beat to deliver feasible door solutions without receiving precise specifications from us. This was a sensitive issue for us because door development had always been done inside. One of my former colleagues in the Mercedes-Benz purchasing department knew this supplier and strongly recommended them to us. This made a difference and finally Mr. Hoffmann's company was invited to join the concept competition."

Concept Competition

In June 1994, MCC began in the concept competition phase to determine who would be their 'dancing partners'. MCC gave those companies invited to the competition a first development protocol which provided them with the basic description of the product they were asked to deliver. The specifications included the external measurements of the item, its design, the interfaces with other physical components as well as its functional and crash-resistance requirements. In addition, suppliers received the detailed target costs for their parts and the outline of the development contract.

Each candidate was required to present its concept proposal to MCC within a couple of months. Once all proposals were received, MCC started the most critical task, i.e., the evaluation and final selection of system partners and their concepts. The evaluation team included component managers, benchmarking specialists, purchasing agents and controllers.

The evaluation scheme developed by MCC assessed the product concepts with respect to their technical and economic aspects and included both quantitative and qualitative dimensions. In particular, they were assessed against the original marketing and technological targets of the smart. The ‘weight reduction’ target, for instance, was assessed by converting the manufacturing costs of a module into a price-per-kilogram factor and then estimating the weight of the total car. A concept solution with a lower manufacturing price but a heavier weight than competing solutions would be handicapped by its price-per-kilogram factor. Mr. Meyer was pleased:

> “Mr. Hoffmann and his colleagues did very well in this respect. Their door concept had the lowest price per kilogram and seemed to be the most appropriate solution for the complex doors of the smart. This further confirmed my trust in them. After the final assessment was completed, they were given a contract offer.”

Concept Realization

When this phase started in the April 1995, the smart project significantly increased in size and cost. System partners had allocated human and financial resources to the project and were actively involved in implementation. The first ‘peak’ in the interaction between MCC and its system partners took place at the beginning of the concept realization phase when concepts had to be translated into products and when MCC asked its partners to locate their project teams on MCC’s development facilities in Renningen.

Engineers from both sides were starting to cooperate. First of all, they had to learn how to interact and coordinate across their firm boundaries. This was not easy for them. They had to develop and get accustomed to new rules of conduct. It took about one year for MCC to get people inside and outside ‘on the same wavelength’. Their cooperation centered around the sequential fulfillment of all functions and the related target costs agreed upon. Neither the system partners nor MCC had earlier blueprints to work from. Components as well as the production equipment, e.g., dies and tools, had to be built from scratch. The main documents on which system partners and MCC-module teams based their development activities were the development protocols.

Optimization of product functions at the concept realization phase often implied some design changes for supplier components. Yet, agreeing on design changes was one of the most difficult parts of managing relationships in the network. Design changes opened the door to price negotiations. All system partners had signed a contract in which target prices and function execution were set in writing, and suppliers were only entitled to demand a price increase when they delivered a functionality at a higher level of performance than the contracted target value. Conversely, if they under-performed in a functionality their price would drop below the stipulated target costs.

Conflicts were common as it was difficult to determine whether a design change would bring an increase or decrease in function performance. Typically system partners would insist that the design changes provided some improvement in functionality.

This was where the organization structures and conflict management mechanisms were put into action, as experienced by Mr. Meyer and Mr. Hoffmann when they had to develop consistent tolerances. As Mr. Meyer explained:

> "Tolerances have to be defined for the doors and the frame into which the doors to be installed in such a way that these tolerances compensate each other and guarantee integration. At the beginning, the tolerances worked out by Mr. Hoffmann and his team did not fit. I already got on quite well with him, and found him to be a nice person, but I had difficulty explaining to him what I really needed from him. I would make suggestions but he would come up with his own proposals."

Clearly, managing coordination and conflicts within the network required some elaborate and transparent evaluation scheme. MCC used the concept of 'value-analysis,' similar to the process used for the determination of customer target prices. With this technique MCC would examine whether supplier solutions deviated from stipulated target values. This would apply to supplier products as well as development and production processes.

As indicated in Exhibit 9, design changes could be initiated by either a system partner or an MCC module team, but the supplier had to work out an appropriate solution. MCC component managers could nevertheless make suggestions, the supplier had the discretion to accept or refuse. If no agreement could be reached, MCC would conduct detailed value analyses on costs and functions and eventually system partners and MCC had to agree upon a solution (which could also imply further changes). The changes were then included in the development protocols with which both MCC and its partners had to comply. Any revisions would become the basis for the next phase of improvements and changes.

Production

The production phase was scheduled to start in July 1998. The manufacturing and assembly process at the Hambach-plant in France was characterized by a quasi dissolution of the boundaries between MCC and its system partners (see Exhibit 10). There was a risk for MCC components managers, for example, experiencing some conflict in their role. They had been in direct contact with the supplier on a daily basis, they knew most about the supplier problems and could identify with the interest of the supplier instead of enforcing MCC positions.

Which supplier would be asked to manufacture at the new Hambach-plant and which ones would be asked to produce and ship from their existing factories? Determining factors included the specificity of the deliveries to the smart, the potential for economies of scale, the level of additional investments required and the complexity of the logistics. For instance, the body of the smart and the Customized Body Panel System (CBS) were completely smart-specific for which no prior manufacturing facilities existed. Manufacturing the car body and the CBS-parts away from Hambach and delivering them JIT to the final assembly plant would have significantly increased the complexity of the logistics and costs. Conversely, system partners for engines, axles, and seats had no intention to set up new manufacturing facilities at Hambach. They integrated the additional production volumes into their existing facilities and could realize scale economies.

Full production was to start in a few months, but for Mr. Meyer there are some fundamental questions left to answer, in particular if the smart project is a financial success. Does the approach really achieve the desired results in terms of innovativeness, lead times, and costs?

In the long run, wouldn't the networked organization approach destroy an automobile company's ability to initiate and integrate innovation? Would MCC be able to maintain its focal position in the network even without the backing of Mercedes-Benz? In fact, MCC as system integrator did not build and maintain technical knowledge about products and processes. This was done by supplier companies. What could and what should Mr. Meyer do if Mr. Hoffmann does not deliver?

Exhibit 1
Financial Structure of MCC

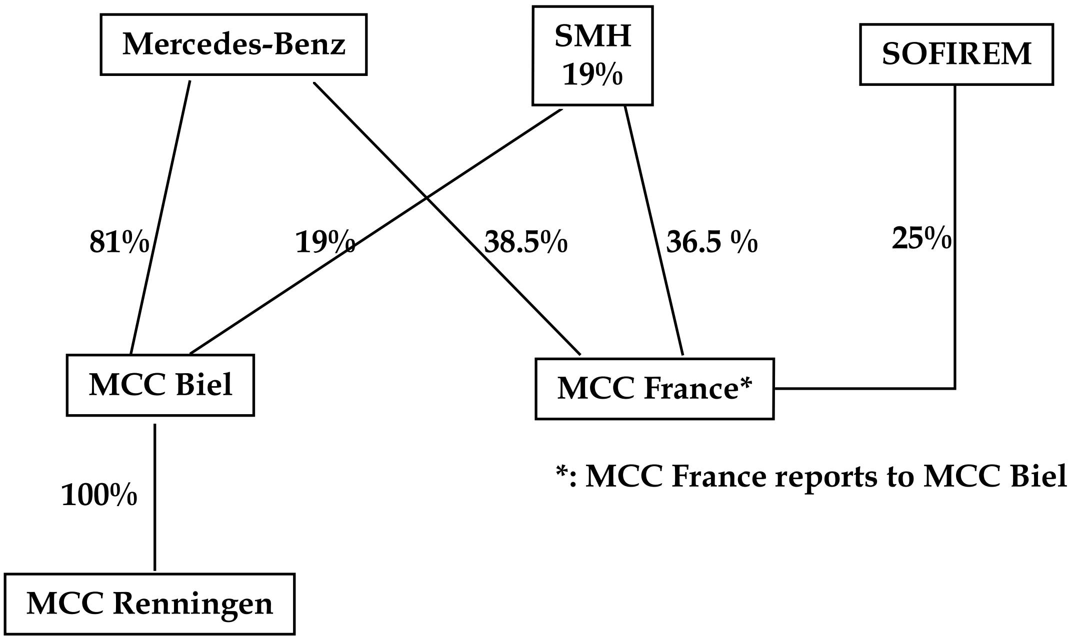
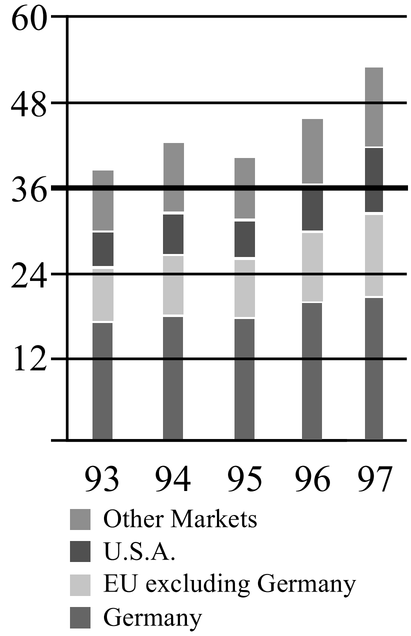


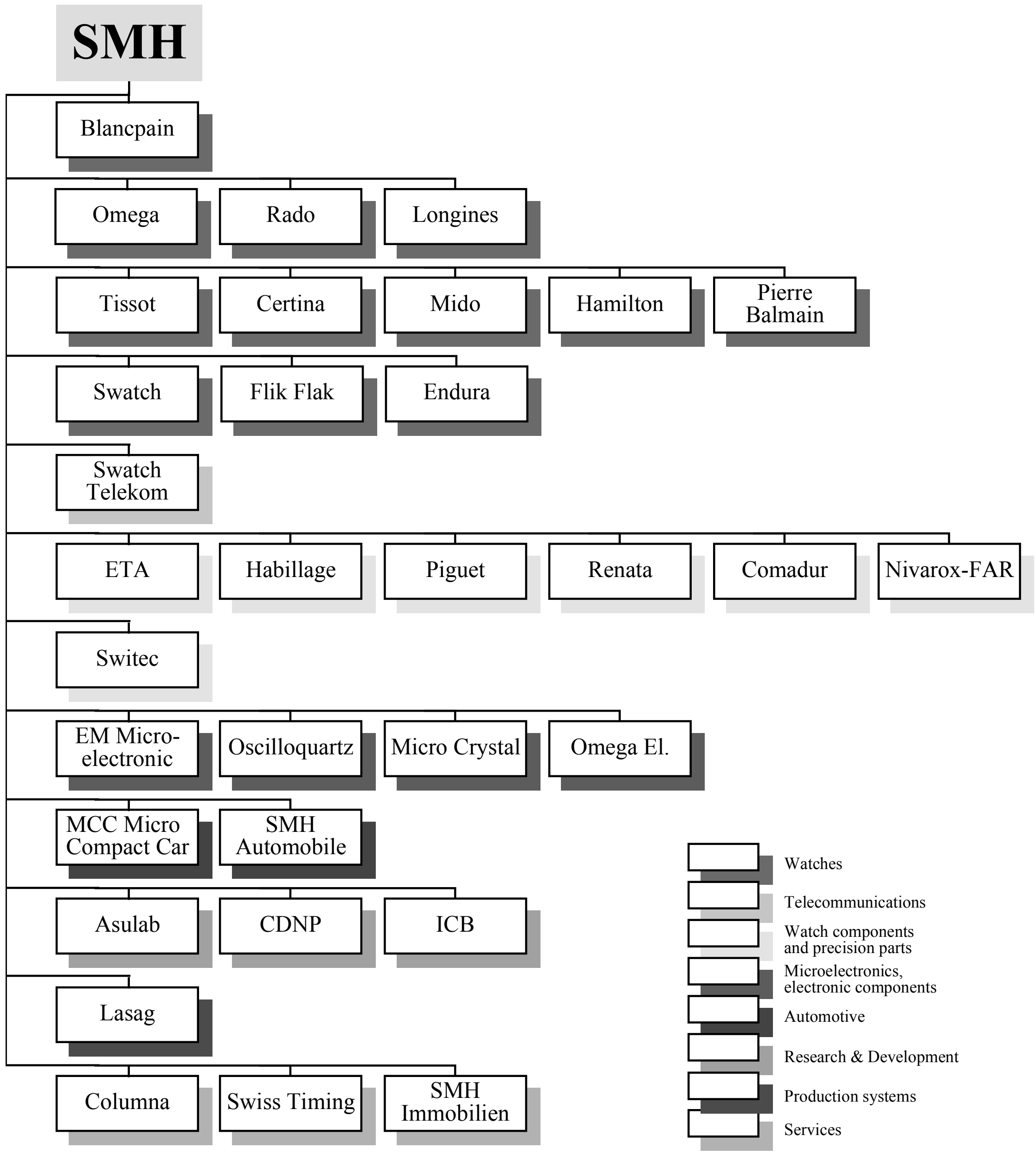
Exhibit 2
Revenues of the Daimler-Benz Passenger Cars Division by Regions

Revenues by Regions
in Billions of DM



Source: Daimler-Benz Webpage

Exhibit 3
The SMH Group



Source: Web page ETA SA Fabriques d'Ebauches

Exhibit 4
Innovations of the smart

Fields of innovation	Major implementations
(1) Energy consumption	Reduced fuel consumption to below 5 liters per 100 km and reduced weight to 720 kg is achieved by innovations in the drive module; application of advanced lightweight materials; integration of functions inside technical components (e.g. the car engine).
(2) Passenger safety	Passenger safety is addressed by the interaction of the Tridion-frame: Steel-faced body of the car, around which the entire vehicle is built; Power unit: The engine and gearbox are designed as an integrated power unit that is de-coupled from the passenger compartment; Sandwich construction: The engine lies at the rear and underneath the passenger compartment In event of an accident this power unit absorbs the likely return shocks to which particularly small cars are prone; Crash box: Security boxes that are installed in the front and in the back of the car and are able to fully absorb crashes at speeds of up to 15 km/h; Traction and stability system (TRUST): Electronic power management that acts on the engine and gearbox control units to keep the speed transferred to the driven wheels under surveillance and diffuse critical situations.
(3) Passenger comfort	Tridion-frame and sandwich construction maximize the available space and visibility for two passengers. Seats and control panels are designed according to ergonomic principles.
(4) Customized design	Modular car design allows a variety of parts that vary in color and/or material. Parts can be easily replaced. In particular Exterior “Customized Body Panel System” (CBS) consists of plastic bodywork components that cover the Tridion-frame. CBS-parts can be replaced within two hours; Elements of the car interior such as trim panels, fittings and upholstered parts including seat upholstery.
(5) Environmental compatibility	Low emissions due to its low fuel consumption; Car parts can be recycled to a degree of 95 %; Non-toxic and regenerating materials are used; Environmental friendly production methods are applied such as the powder coating of the Tridion-frame.
(6) Mobility-related services	Delivery of individualized mobility packages that go beyond the actual vehicle. Major components are the “Mobility Box” of the vehicle that offers help functions, traffic information, or assistance in finding the best way to the destination as well as a mobile phone; De-coupling of car usage and car ownership: The smart is meant to be a city car for short distances. MCC therefore plans to provide smart cars at airports and train stations in major European cities, as well as larger Mercedes-Benz vehicles for holiday trips.

Exhibit 5

Organisational Modules of the smart

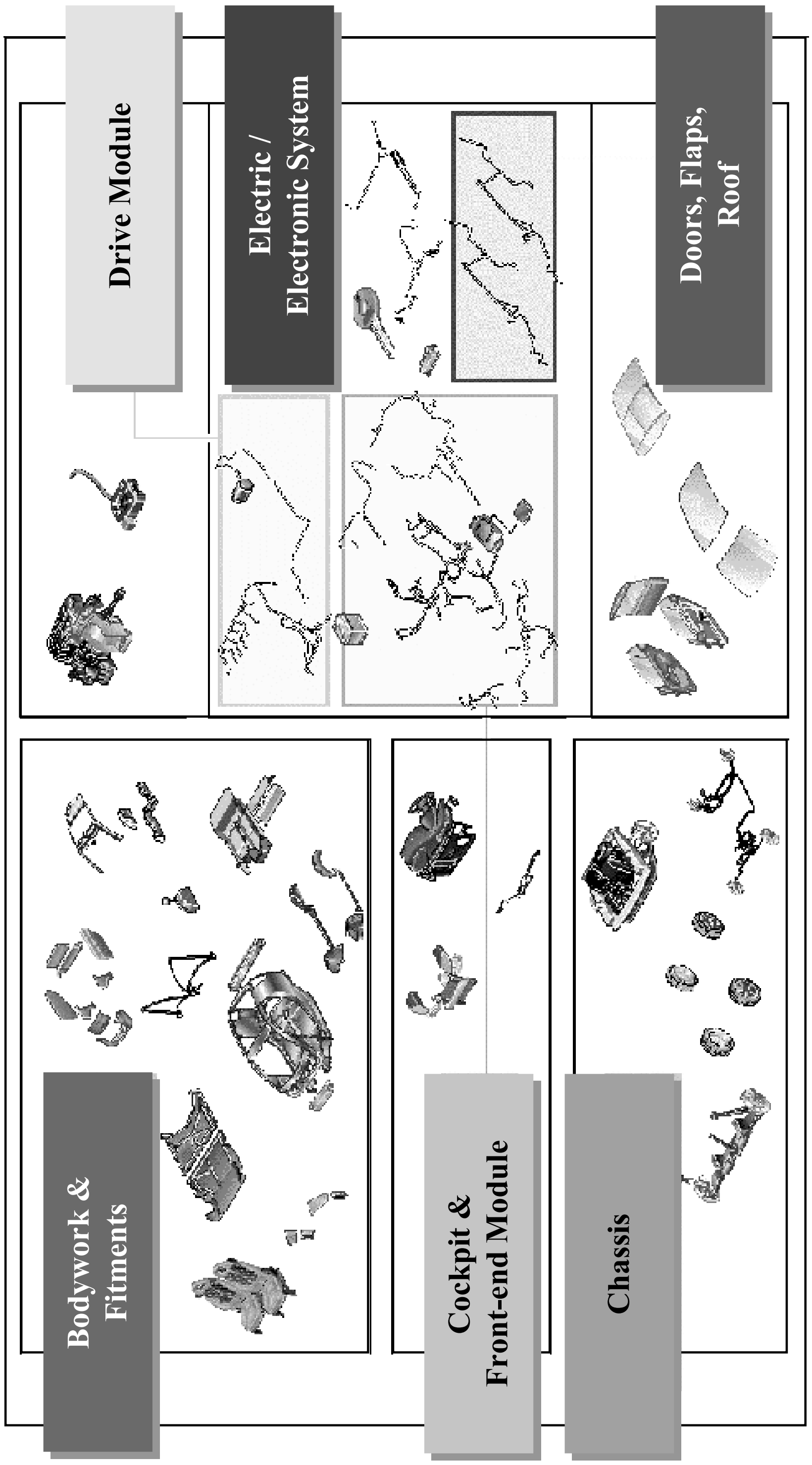


Exhibit 6

Illustration of the Isomorphic Interfirm Modular Organisation for the Chassis Development and Production

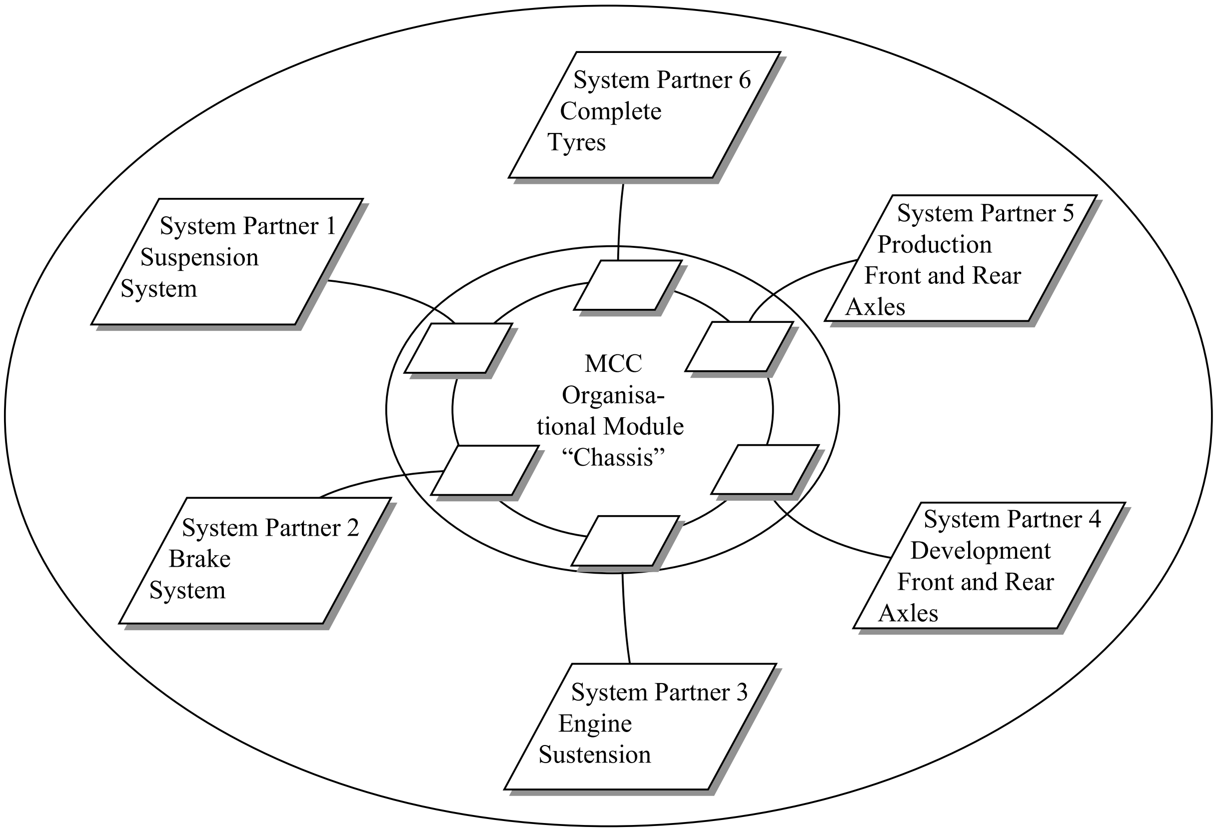
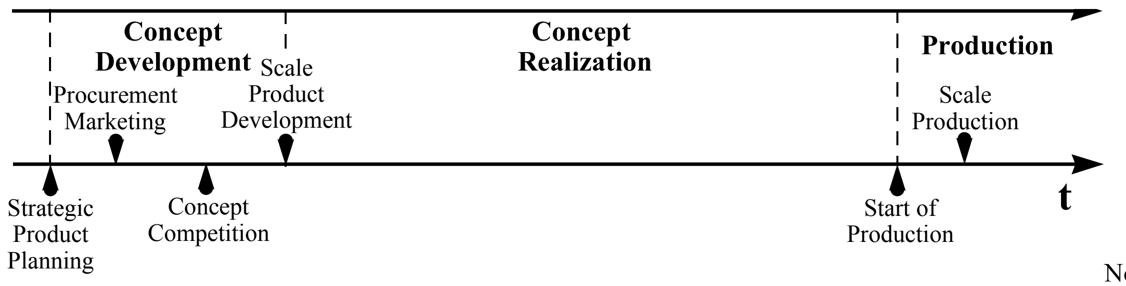


Exhibit 7
Principles of System Partner Integration

Measures	**Agreements**
(1) Supplier contracts	(1) Single sourcing (2) Lifetime-contracts (3) Minimum purchasing volumes (4) Profit margins per unit (5) Obligatory target costs of each product developed by a system partner
(2) Intellectual property management	(1) MCC acquired ownership of the design concepts contained in rejected suppliers' proposals (2) MCC claimed ownership rights for patents where the underlying innovations concern the security and the competitive advantage of the smart, regardless of whether they were developed by suppliers or by MCC (3) Patents that are based on generic product and process innovations are registered by the supplier who developed them. The property rights remain exclusively theirs
(3) Fundamental guidelines	(1) MCC controls the entire process chain (2) Supplier companies invest in production equipment, machines, and tools and operate their business on their own behalf according to the development and production contracts (3) MCC provides plant surfaces and industrial services (4) MCC is responsible for the general context conditions that ensure that suppliers could smoothly execute their tasks
(4) Organizational structure	(1) System partners should set up and maintain a project organization that mirrors the organization of MCC. (2) System partners must assign function managers and project managers for the duration of the entire project. (3) System partners locate their offices on the development premises of MCC during particular development stages
(5) Control of information flows	(1) Open books-calculation (2) Development protocol (3) Conflict management

Exhibit 8
Structure of the Development Process



Note:
Exhibit 8 indicates the time duration of each phase (except for strategic product planning and scale production), but should not be interpreted as an exact time schedule. Also, the starting and termination times of distinct development phases tend to overlap. Therefore, Exhibit 8 should be seen as an approximate representation of the development process structure.

Exhibit 9
The Interface between MCC and System Partners during Concept Realization

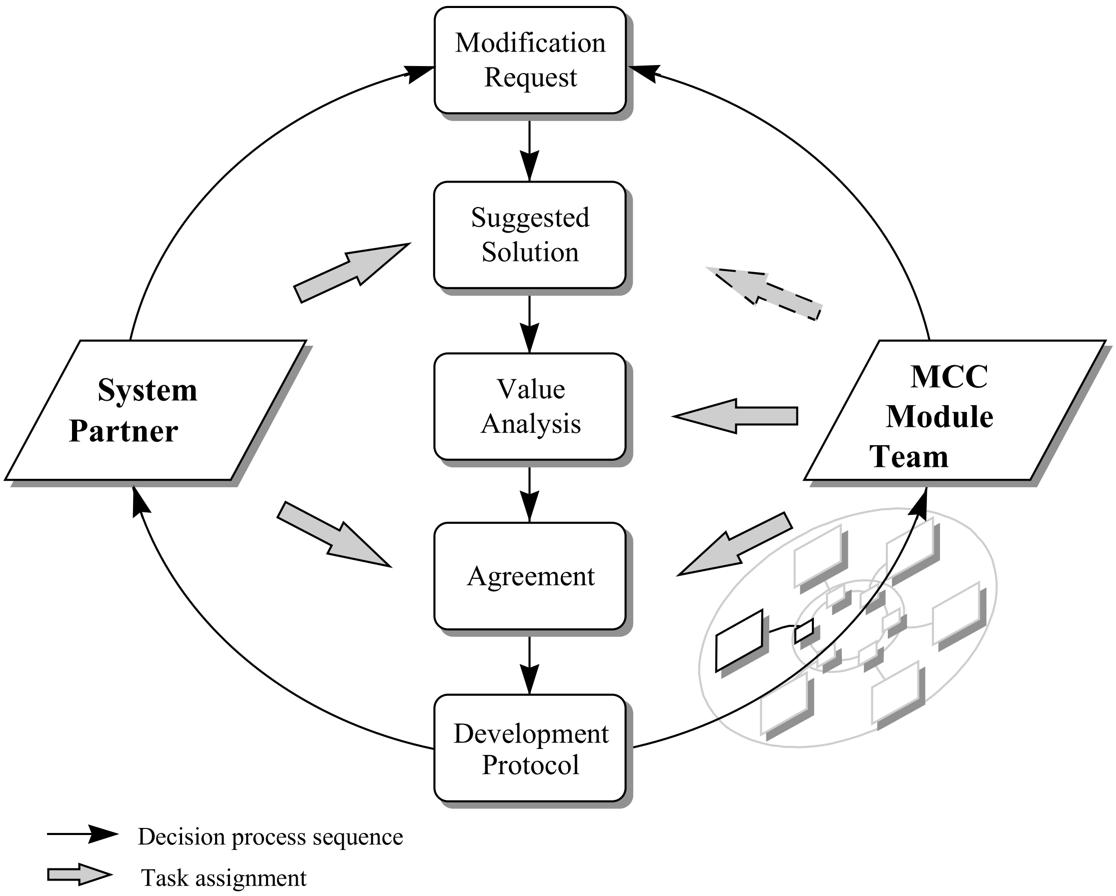
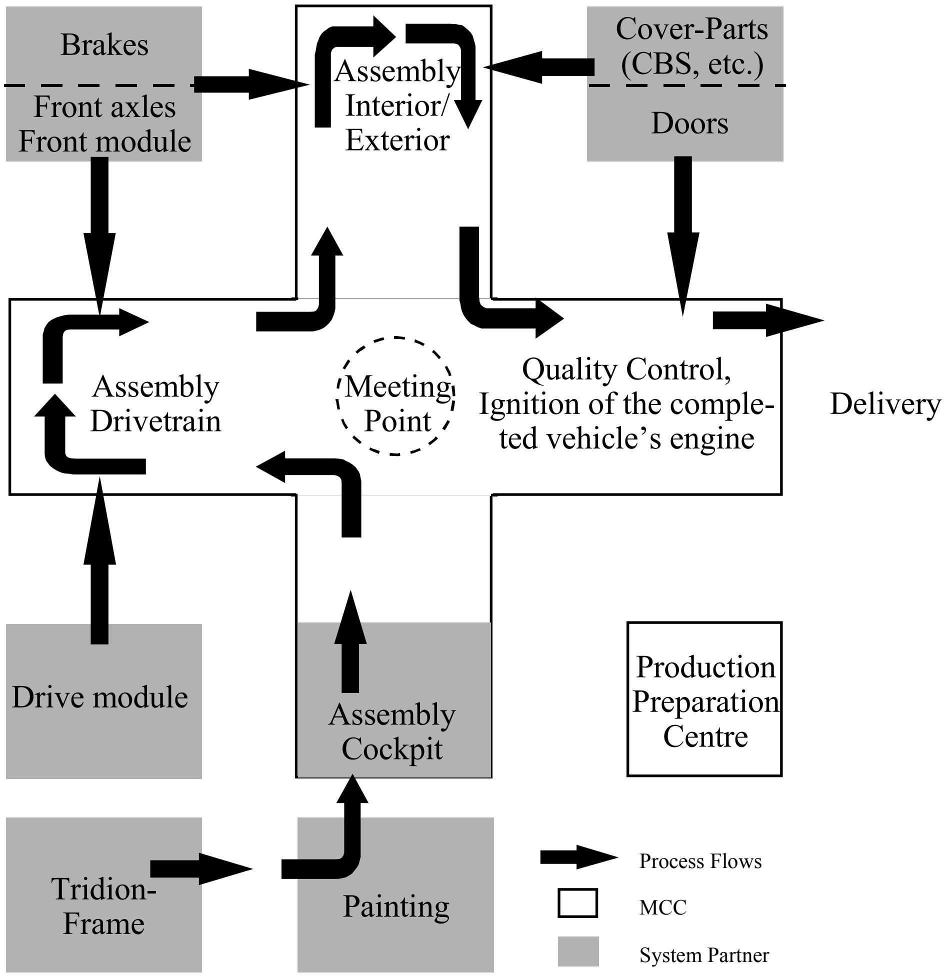


Exhibit 10
Organisation of the Collaborative Production Process

The organization of the final assembly process corresponded to the modular product and



organization architecture of the smart. As Exhibit 10 indicates, MCC performed the core assembly that took the form of a cross, or in the term of MCC, a "plus". The core assembly of MCC was the focal point of the production plant. The cross was surrounded by the system partners who were self-dependent for the manufacturing and assembly of their modules. The cross shape of the assembly line allowed the system partners to be correctly located on the assembly line for the installation of their modules. As can be seen in Exhibit 10, "the assembly process followed the product", beginning with the welding of the car body, and moving on to the painting of the frame. The next assembly steps were "engagement" of the car body and cockpit, the installation of the drive module, front module, brake system, and exterior as well as interior system-modules. The assembly process of the smart was completed by quality control and the ignition of the completed vehicle's engine.