Challenges for the automotive industry in an on demand environment

Seven areas of strategic action

Executive brief

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Introduction

The automotive industry is facing new and pressing challenges. Globalisation, individualisation, digitalisation and increasing competition are changing the face of the industry as we know it. In addition, increasing safety requirements and voluntary environmental commitments by the automotive industry will also contribute to the changes ahead. Size is no longer a guarantee of success. Only those companies that find new ways to create value will prosper in the future. The purpose of this paper is to present a short overview of the automotive industry today and highlight challenges facing the industry. Based on this perspective, we will discuss strategic levers enabling OEMs to transform to on demand enterprises.

Methodology

The information, data and opinions presented in this paper are based on a series of interviews that IBM Business Consulting Services held with automotive industry experts, who gave us the benefit of their extensive knowledge. This information and data were complemented by our evaluation of industry studies and reports on various aspects and developments in the automotive industry.

The evolving automotive landscape

The global automotive industry is subject to a range of factors that are increasing complexity and influencing the economic options available to automobile manufacturers. The majority of these factors interact with one another and have strong interdependencies. However, some of these factors are market-induced and, consequently, cannot be influenced directly by the automobile manufacturers. These factors include:

- *Globalisation, regionalisation and market convergence* – Due to the effects of liberalisation, national markets are increasingly globalised. This gives OEMs the chance to expand to new markets, but also increases the threat of new entrants or increased competition in traditional markets. For example, European OEMs currently face an aggressive sales offensive by Korean OEM Hyundai. The reverse side of globalisation is regionalisation, which means that local tastes and consumer preferences have to be considered by companies. The concept of a standardised "world car" as promoted by Ford a few years ago would not succeed in today's world. Another problem for an OEM is market convergence due to digitalisation of almost all products and value-add processes. On the market side, the increased pervasion of products with digital technology leads to new vertical and horizontal partnerships between all kinds of companies (e.g., IBM as a value-add partner for the automotive industry), thus increasingly eliminating traditional industry limits. This eventually raises the question for a company as to who is a partner and who is a competitor in the company's field of business.

- *Increasingly diversified consumer aggregate patterns of behaviour* – Consumers no longer accept standardised products, but want products that satisfy their individual requirements. Target groups thus have to be downsized by companies so customers will be attracted by the products offered. However, because of the increased global competition with a stronger focus on price and not on brand loyalty, consumers generally do not reward companies for their more individualised products.

As a result of these factors, automobile manufacturers have new demanding requirements within their field of activity:

- *Accelerated modification and diversification of the product portfolio* – The OEM has to shorten product lifecycles in order to react to individualised and fast-changing consumer demands with innovative products. In the past, an average product lifecycle in the automotive industry was eight years; today, lifecycles are much shorter, or at least the product's design is often modified after just two or three years on the market. With development costs for a new model remaining on the same level or even increasing, this concurrently means a shortening of amortisation time for the OEM and, potentially, lower profits.

- *Pervasion of automobiles with digital technology* – In 2002, digital technology in cars already averaged 22 percent of the total value of a car, with a forecasted increase to 35 percent of the total value in 2010.[1] But for an OEM, the integration of hardware and software into automobiles represents the predominant accelerator of increased functionality coupled with increasing complexity. This complexity results in overstrained car development departments, product failures, a cost explosion with respect to guarantee and warranty costs, and impact on customer satisfaction.

- *Increased pressure for innovation and flexibility in development and manufacturing* – OEMs' development departments are not just overburdened by the complexity of digital technology, but also by the shortening of product lifecycles. Another aspect is the increasing number of parallel development projects since OEMs develop more and more niche models for special target groups. This certainly requires the use of new development techniques such as virtual reality. For example, this technique enabled BMW to shorten the development time of its Z4 model to just 30 months.[2] On the production side, flexible assembly lines become a key success factor to enable OEMs to react quickly to individualised consumer demands. However, flexibility cannot be ensured only by using new technology. Completely new production concepts have to be developed to systematically manage the complexity in car production. This eventually requires outsourcing of responsibilities and activities to a variety of cooperation partners, thus demanding new ways of managing cooperation partners or even the development of business webs.
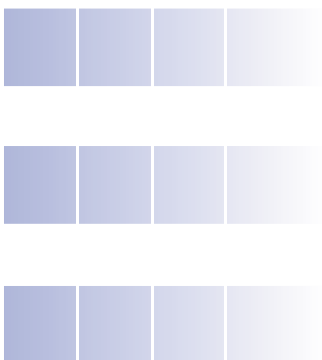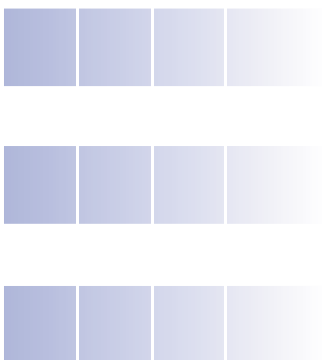
The on demand challenge

The 64-million-dollar question is if an OEM can remain competitive in the face of the turbulent transformations taking place in the automotive industry. The answer is a clear YES! The key to success lies in being *focused*, *responsive*, *variable* and *resilient*, which can be accomplished by converting to an on demand company.
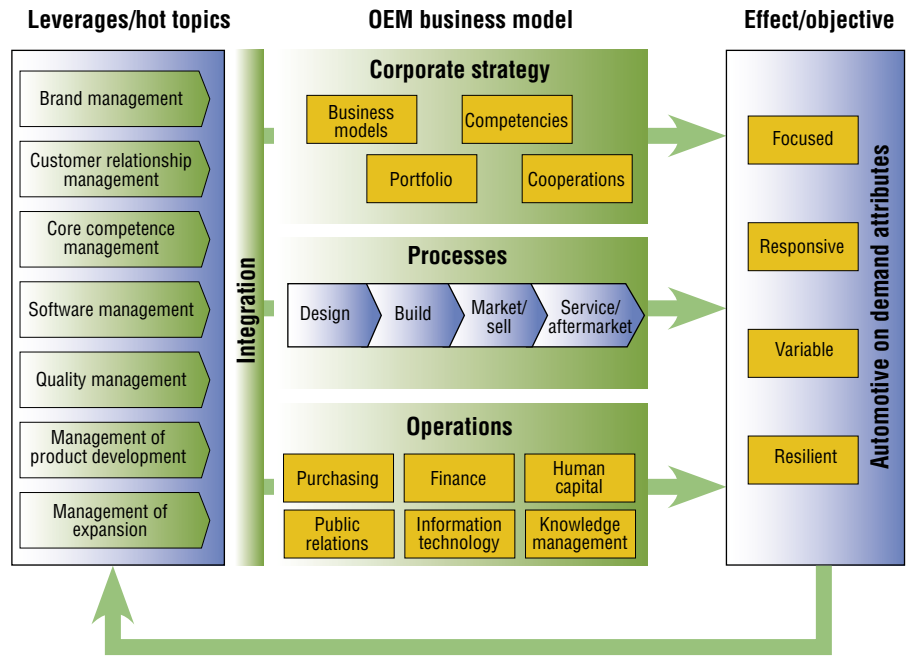
Adaptivity to an ever-changing environment has become the core business demand, requiring problem-solving tools and methods to be identified, selected and implemented "on demand." *Focused, responsive, variable* and *resilient* are different behaviours required to become more adaptable, behaviours whose features correspond with the exigencies of the business objective. If you are hungry at lunch time, you will *responsively* take a break so that you can afterwards again *focus* on your work. The vitamins in the salad you had for lunch make you *resilient* against influenza. Thus you can *variably* adjust to different weather conditions on the way back home without catching a chill. Transforming this analogy to business, a car manufacturer has seven major strategic levers to enable such adaptive behaviour (see Figure 1):

- *Brand management* – Brand management strategies help make an OEM more *focused* and able to differentiate its products from the competition.

- *Customer relationship management* – Customer relationship management (CRM) helps a company become *focused* on customer requirements and wishes and *responsive* to changes in aggregate patterns of customer behaviour.

- *Core competency management* – Core competency management allows a company to *focus* on its internal strengths and become more *variable* and *resilient* by entering into strategic partnerships with suppliers with competencies in new technologies or niche operations.

- *Software management* – Software management is key to making a company *focused* on software standardisation and strategic partnerships, which, in turn, help the OEM become *variable* and *resilient*.

- *Quality management* – Quality management (QM) will, by becoming a cross-functional and cross-company concept over the whole value-add chain, help ensure that companies grow their maturity in *resilience*.

- *Product development management* – Managing product development together with a *focus* on broadening competencies in new technologies will help enable OEMs to become more *variable* by the optimisation of collaborative engineering. Increased *resilience* can be achieved by standardised processes and the extended use of virtual testing. Decentralised and regionalised development activities will help lead OEMs to increased *responsiveness* to customers' desires.

- *Expansion management* – Management of expansion into new geographies and cultures requires that OEMs are *focused* on the requirements in these new markets and *responsive* to changing market conditions and requirements.

Figure 1. Seven major strategic levers enabling aggregate patterns of on demand behaviours for auto companies.

Leverages/hot topics	OEM business model	Effect/objective
Brand management	**Corporate strategy** — Business models, Competencies, Portfolio, Cooperations	Focused
Customer relationship management		Responsive
Core competence management	**Processes** — Design, Build, Market/sell, Service/aftermarket	Variable
Software management		Resilient
Quality management	**Operations** — Purchasing, Finance, Human capital, Public relations, Information technology, Knowledge management	
Management of product development		
Management of expansion		

Integration

Automotive on demand attributes

Source: IBM Business Consulting Services analysis, 2004.

What must an OEM do in terms of these strategic levers to convert the capabilities to strategies, processes and operations? Let us take a closer look at the on demand levers. Examples of strategic actions and already established strategic patterns in the automotive industry that are contributing to the OEM's on demand transformation follow.

Brand management

The OEM's brand image is a key factor that enables consumers to differentiate their product from those of their competitors. Generally a strong brand image can provide a kind of uniqueness to the product. In an over-stimulated automotive world with increasing similarities between individual vehicles, such a brand image represents a rock for consumers to hold on to, giving them cognitive and emotional support to navigate through the diversity of products in the market.
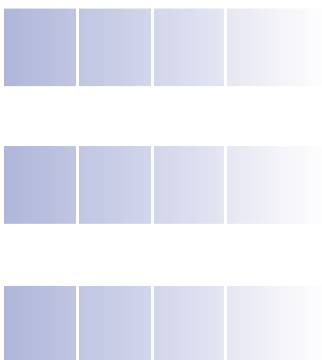
A premium provider with premium brands is in a valuable position for an OEM. This is not just due to differentiation aspects on the customer side, but also to enhancement of the company's stock value, since brand value is seen as an intangible asset nowadays and has become increasingly important for a company. These two aspects underscore the fact that currently all OEMs are strengthening the back end of the value chain to focus on a core value-add area. Initially, OEMs' motivation to create a premium image became apparent with some major strategic moves in the industry:
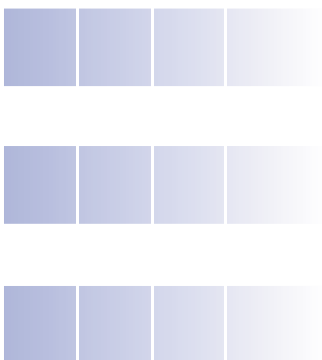
- With Volkswagen's Phaeton, the company did not just want to close a gap in the segment of upper-class vehicles, but also intended to transform its whole brand image from a mass market to a premium market supplier.

- Ford made a strategic move into the premium segment by acquiring the premium brands Aston Martin, Jaguar, Land Rover and Volvo.

- Entirely new premium brands were created, as Honda did with Acura, Nissan with Infiniti and Toyota with Lexus.

Moreover, some traditional premium manufacturers have moved into the lower end of the market to develop new valuable segments by leveraging a strong brand image in these new business areas. Some well-known examples are:

- DaimlerChrysler's A-Class and Smart
- BMW's Mini and the 1 Series.

Finally, even mass manufacturers have moved down-market to reach new customers as Toyota did with the Scion brand in the USA. However, brand trans-formation and brand extension require holistic brand management targeting and the creation or retention of unique brand images. What tasks does an OEM face to accomplish this?

First, one has to distinguish between cognitive and emotional customer awareness of the brand concerned. A high cognitive awareness means the customer's perception of a brand known for special product features – for example, Peugeot's traditionally strong position in diesel technology. On the other hand, a high emotional awareness corresponds with a customer's perception of a brand for a certain life-style or feeling associated with the product. For example, by featuring a retro design, Chrysler's PT Cruiser tries to arouse feelings of the American life-style

in the 1950s. A premium brand such as BMW or Mercedes-Benz is characterized both by cognitive and emotional brand awareness. For example, the brand Mercedes-Benz is recognised for its constant stream of product innovation, as well as for prosperity or a luxurious life-style. With both cognitive and emotional awareness influencing customers, it makes sense to establish a theme park concept. This concept adds the usual sales aspects of a showroom and a presentation of a brand with the objective of enhancing the OEM's brand images and, therefore, customer loyalty and brand values. An example of an OEM establishing a theme park concept is BMW, who is currently establishing a "brand temple" in Munich to create a "mythical aura" around its brand by combining exhibition elements with cultural events and personal customer support. And, within its "metropolis concept," for major urban areas' new Mercedes-Benz centres link product with brand presentation by a common architecture highlighting so-called "brand galleries" with exhibitions of brands, motor sports and design.

OEMs who do not possess both cognitive and emotional awareness should rather focus either on a selective product or on selective emotion-focused positioning. GM's brand Opel, for example, failed with the theme park concept in Germany due to a lack of visitors in its centre in Rüsselsheim. As a consequence, Opel again puts emphasis on sightseeing of the production lines and car delivery, which stresses a product-focused positioning. Emerging brands with low brand image and market strength such as Hyundai, Kia or Daihatsu in Europe are a special case. The brand management strategy of these OEMs should first of all focus on increasing brand awareness before considering product- or emotion-focused positioning or even a theme park concept.

Finally, it must be stated that the theme park concept implicitly requires a high brand image and clear differentiation from the competition. Especially high-volume manufacturers will have to invest a lot of effort to transport their message and convince potential customers of their unique selling proposition. If OEMs realise a theme park concept without sufficient cognitive and emotional brand awareness, they will become stuck in the middle. It remains to be seen whether Volkswagen's theme park concept in Wolfsburg ("Autostadt") and in Dresden ("transparent factory") will sustainably transform the brand's image from a predominant mass market manufacturer to premium manufacturer.
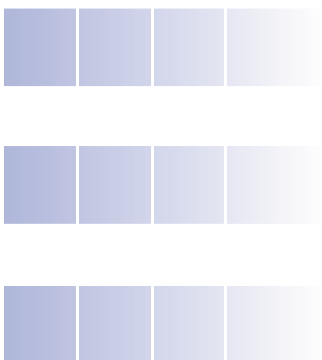
Customer relationship management

CRM has become a buzzword in the automotive industry. However, CRM is not always clearly understood. CRM can be defined as an organisation-wide activity to improve customer *focus* and *responsiveness* by systematically gathering and using customer data at relevant customer touch-points and in preliminary value-add activities. According to a recent IBM study, Audi, BMW and Volkswagen have already implemented activities that have been especially successful in certain CRM areas.[3]

Current steps being taken in automotive CRM include optimisation of multichannel approaches, strengthening of financial services, optimisation of dealer management and integration of CRM with supply chain management (SCM). These steps are discussed below.

Optimisation of multichannel approaches

A multichannel approach addresses the development and integration of relevant customer touchpoints in the customer lifecycle, from the first negotiations with the dealer through online configuration and order, delivery and after-sales support. Thus, multichannel CRM means complementing traditional channels such as direct mail, telephone or the dealership with new communication technologies such as the Internet, Short Message Service (SMS) or telematics. "Multichanneling" helps improve the OEM's focus on the customer since the collection and centralisation of customer data can enhance personalised communication with the customer. Many OEMs, for example, provide a personalised Web page on the Internet and integrate it with front- and back-office CRM applications so the data collected can be profitably used for marketing and sales purposes. Also, product development and production planning can be adapted. For example, a manufacturer could align production planning with customers' needs by collecting and analysing aggregate patterns of online customer behaviour as documented in Web configuration tools.

Strengthening of financial services

Providing financial services has become an integral part of most OEMs' activities. Since such automotive banks do not operate with their own subsidiaries, they have a lean cost structure, enabling them to offer low-interest loans for financing new cars. This aspect should not be underestimated as a sales promotion tool considering the increased competition and stagnating demand in the industry. Financial services also help strengthen customer loyalty – for example, leasing customers of BMW Financial Services receive two complimentary repair shop visits per year.[4] For
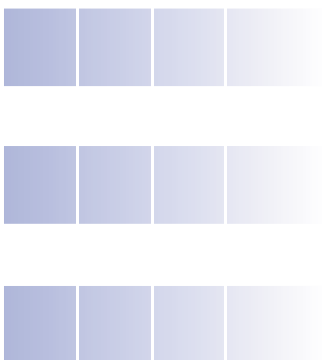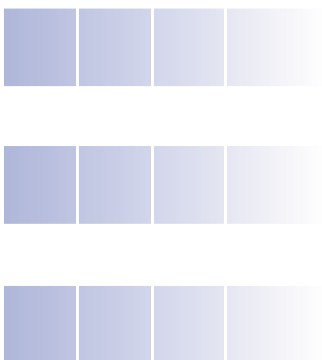
operative CRM purposes, providing financial services facilitates an OEM's collection of sensitive customer data to improve customer *focus*. Of course, this conflicts with banking confidentiality, generally meaning that customer data may not be transferred to a third party. However, DaimlerChrysler defined a way to work around this situation. When buying a car at the local DaimlerChrysler dealer, the customer's credit application is registered by the dealer. In addition, forwarding customer data to subsidiary DaimlerChrysler companies is part of the contract. This procedure is reinforced by corresponding objectives for sales personnel.

The intensity of financial services generally varies in the industry. Whereas the GMAC bank or the Ford bank concentrates on car financing, the Volkswagen, BMW and DaimlerChrysler banks are comparable with regular commercial banks. The Volkswagen bank, for example, offers giro accounts and extensive capital investment opportunities. The DaimlerChrysler bank in Germany does not just govern 655,000 leasing and financing contracts but also has 186,000 customers in the capital investment segment.[5] The bank is especially interested in the 30 percent of customers who do not yet drive a DaimlerChrysler car, so personalised measures derived from the DaimlerChrysler bank may be used to help gain those customers as potential DaimlerChrysler car buyers.

The OEMs' banks also evolve as an important link for the fleet management business with companies. Especially for premium manufacturers, this business has become an emerging business segment. For example, in Germany, sales to companies account for 60 percent of BMW's sales.[6] In this field, car banks provide bundled products consisting of leasing, insurance and mobile services, thereby offering the business customer one-stop shopping for mobility.

Optimisation of dealer management
The prerequisite for any successful CRM in the automotive industry is good operating relationships among OEMs and their dealerships, the customer interface per se. No other touchpoint in the automotive customer lifecycle has a more intense and personal relationship with the customer than the dealership. The dealer is continuously feeling the customer's pulse and visualising his needs and pains. An effective communication to dealers thus contributes to OEMs' insights into market trends and customer preferences, which can considerably enhance their *responsiveness*.

However, this relationship has suffered as a result of the new European Union (EU) regulations exempting dealerships from the single-brand strategy. Many manufacturers have offered new contracts with lower profit margins, which are being challenged by the dealers. In the case of BMW, all old contracts with the 2,500 European dealers were cancelled in the context of the new EU regulations.[7] The new contracts offered to the dealers, which are now limited to a five-year duration, are a means to impose new standards for such issues as the exhibition spaces. However, the investments necessary to achieve the standards indirectly tie the dealers to the brand and, thus, significantly undermine the purpose of the new EU regulations to increase more competition in automotive sales. An administrative appeal at the EU commission against BMW's new dealer contracts initiated by the BMW dealer association is still undecided (July 2004). In any case, such disputes need to be satisfactorily resolved if BMW (as announced) wants to integrate the dealerships as value-add partners in its CRM concept. The same is true for all other brands ranging from Alfa Romeo to Volkswagen, where similar problems caused disputes between the OEMs and dealerships.

Integration of CRM with SCM
A holistic integration of CRM systems with SCM systems in preliminary value-add activities represents further evolution in an OEM's CRM activities. Such an integration comprises – as outlined above – the transfer of customer data to the development department. Car design controlled by demand profiles provides better capacity planning and thereby can help reduce fixed costs. As a result, OEMs considerably improve their *variability*.

To operationalise these strategies, an OEM first needs to have an overview of all internal CRM strategies. Many manufacturers still pursue parallel yet independent approaches and thus do not follow the demand of integrating all relevant channels into a multichannel strategy. OEMs that have already centralised their CRM need to develop an extensive strategy that incorporates customer-specific national and regional CRM solutions. It is anticipated that only concepts that combine realistic goals with positive economic results will succeed.
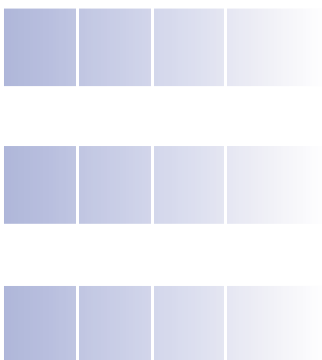
Core competency management

Outsourcing and transferring out of development and manufacturing activities are two of the key ways to master the complexity of product development and production. With increasing in-vehicle electronic content in the future, the question of outsourcing will have a whole new dimension. Outsourcing will be one of the key challenges for the automotive industry, which OEMs can face using the following three strategies:

• Definition of core competencies

• Optimisation of core competencies

• Institutionalisation of meta-competence management.

These strategies are discussed below.

Definition of core competencies

OEMs need to decide what their future portfolio of core competencies will be. A core competency generally drives superior customer value and uniqueness and is also difficult to imitate. To define core competencies, all business components have to be analysed to determine the OEM's most differentiating activities for the future. However, first this requires an overall vision for an OEM's business model that allows a derivation of strategies for business segments and functions.

Despite the OEM's continuing role as a brand manager, concentrating solely on the end of the value chain is not a realistic scenario. This is because the European automotive supplier landscape is still in the consolidation phase. Many medium-sized suppliers do not yet have the level of sophistication to work self-sufficiently on product development issues. Another reason against the OEM's sole core competency in brand management and CRM pertains to the OEM's culture: All OEMs regard themselves as car manufacturers, not just brand managers. However, decreasing participation in automotive value creation and collaborative engineering will not considerably change this culture.

Nevertheless, a paradigm change has to be stimulated in an OEM's organisation with respect to the transfer of responsibilities to suppliers since increasing product complexity is taxing OEMs more and more, resulting in product failures and increasing guarantee and warranty costs. In contrast to product development, especially in car production, many successful approaches of partner integration can already be seen. Ford in Saarlouis/Germany developed a conventional supplier park where the most relevant suppliers are situated close to the final assembly. This scenario optimises infrastructure and transport costs.
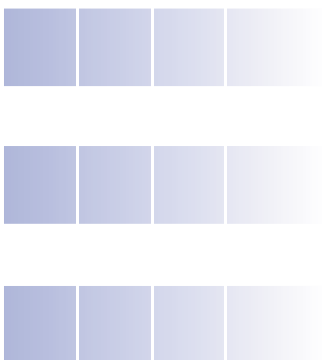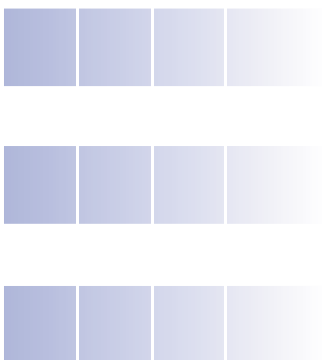
The production of DaimlerChrysler's "Smart" brand cars in Hambach/France goes one step further by integrating Tier-1-suppliers through conveyor belts, thus eliminating any transport costs. In Volkswagen's commercial vehicle facility in Resende/Brazil, an innovative production concept was developed, which could be a positive example for other production facilities. The suppliers not only deliver the modules, they also assemble them. The production facilities in Hambach and Resende also implement the concept of pay-on-production. Pay-on-production means farming out capital equipment and complete processes to a supplier so the OEM pays per unit and saves tremendous investment costs in its own assembly lines. For example, the Ford Fiesta assembly in Germany is financed, built and run by the supplier Eisenmann as a pay-on-production model. Depending on the different stages of partner integration within car production, it becomes obvious that OEMs can significantly leverage their overall *variability* since the use of outsourcing transforms fixed costs into variable costs.

Variability can also be enhanced by completely outsourcing niche models to Tier-0-suppliers, such as Bertone, Heuliez, Karmann, Magna Steyr, Pininfarina or Valmet. Contradictory OEMs do need to build up assembly lines for low-volume products to be able to balance fluctuations in demand and overcapacities. For example, Magna Steyr is not just the manufacturer of the BMW X3, but also was considerably involved in the planning and development phase. Similar approaches can be seen at Karmann, who was responsible for the Mercedes CLK, Audi A4 convertible and Chrysler Crossfire production and also partly contributed to development. Ultimately, any outsourcing of activities presupposes the formulation of a business case since the concentration on core competencies primarily *focuses* on cost efficiency.

Optimisation of core competencies
Once the core competency portfolio has been defined, the next step is to improve the effectiveness and efficiency of these competencies. This process will cause OEMs to migrate from a functional organisation to a process-oriented organisation. A good example of this is the shared service centre concept, as practiced by GM Europe for finance processes in Barcelona. Another example is BMW's CRM program, which implemented not only a new technology but a total reorganisation to improve customer *focus*. Also, DaimlerChrysler's investments in research & development – about 28,000 employees work in this section – can be interpreted as a way to emphasise a core competency with a *focus* on fundamental research (e.g., fuel cell) and the acquisition of specification know-how so the increasingly outsourced development competencies can be systematically managed. This meta-competence management significantly improves the OEM's *resilience*.
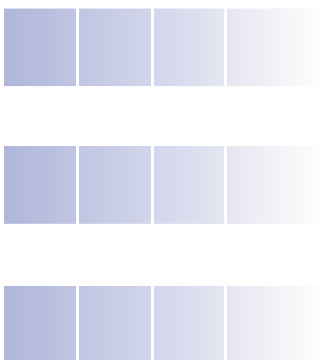
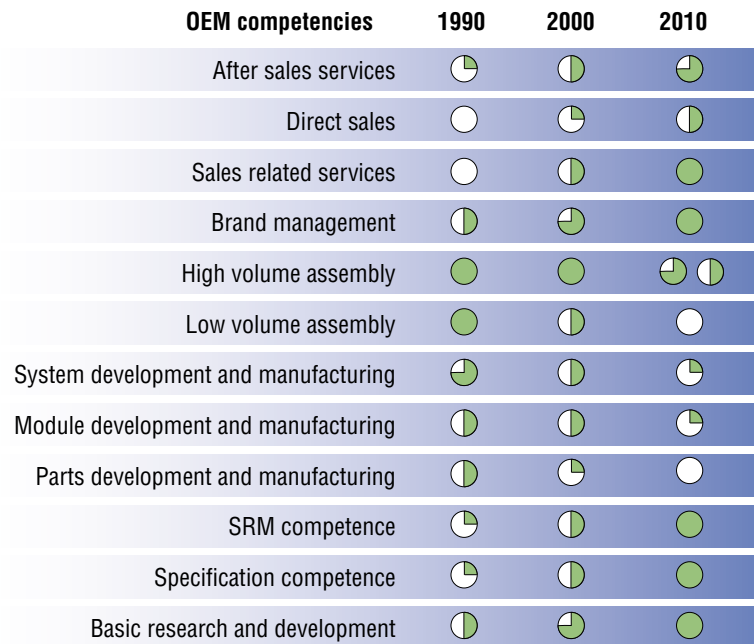**Institutionalisation of meta-competence management**

Meta-competence management comprises management of the internal core competencies in interaction with the competencies introduced by suppliers. The goal of meta-competence management is to create the best possible cooperation among all players in the supply chain, meaning that supplier relationship management (SRM) will become a critical success factor in the automotive industry. However, SRM is practiced with varying levels of intensity. A study by the University of Bamberg/Germany showed that, in particular, in the case of volume manufacturers, supplier satisfaction has deteriorated since 2001 – in spite of the growing responsibility of the supplier.[8] Main points of criticism were high cost pressure and poor payment patterns, affecting morale. Another recent study by the Boston Consulting Group should give those OEMs reason to reconsider their SRM strategy. It was proven statistically that customer satisfaction positively correlates with supplier satisfaction.[9] Hence an OEM needs to institutionalise an SRM that covers the full product lifecycle from component development to risk-sharing in car recalls.

BMW can be regarded as an innovator in SRM – as confirmed by high supplier satisfaction levels in the University of Bamberg study. This satisfaction is attributed to certain measures which should increase effectiveness and efficiency in the joint core processes of collaborative engineering, procurement and sourcing, and material SCM. For example, for the collaboration of suppliers, a standard process model was defined which ended up in an integrative Web-based supplier interface. The supplier portal also represents a central link that can be used to exchange information or to transmit BMW's specifications. Other successful examples for seminal SRM activities are Chrysler's Score program implying an individualised scorecard for each supplier and Toyota's institutionalised "blue sky" discussions with suppliers. Both activities enhance the information flow between OEM and suppliers and the joint definition of objectives, thus making the automotive business web more *resilient*.

The following table compares migration of the OEMs' core competencies, from 1990 to 2000 and projected to 2010, from an industry point of view. This is from a generic perspective and does not consider individual OEMs. Consequently, deviations are possible; e.g., in contrast to most other OEMs, Toyota will probably always emphasise its outstanding manufacturing competencies.

Figure 2. OEM competencies.

OEM competencies	1990	2000	2010
After sales services	◔	◑	◕
Direct sales	○	◔	◑
Sales related services	○	◑	●
Brand management	◑	◕	●
High volume assembly	●	●	◕ ◑
Low volume assembly	●	◑	○
System development and manufacturing	◕	◑	◔
Module development and manufacturing	◑	◑	◔
Parts development and manufacturing	◑	◔	○
SRM competence	◔	◑	●
Specification competence	◔	◑	●
Basic research and development	◑	◕	●

Source: IBM Business Consulting Services analysis, 2004.

Software management

The increased pervasiveness of digital in-vehicle components has become a main feature of today's vehicles – especially in the premium class. Electrics and Electronics (E/E) have been pushing technological innovation in the last decade. Powertrain, chassis or suspension are already permeated by electronics. And where transmissions or brakes are involved, E/E and software quality and reliability become a safety issue. Only if the stability and reliability of the systems are guaranteed will electronics and software pave the way for profitable differentiation. For example, engine power will be controlled by software. Or a vehicle of the future could transmit a powertrain defect back to the manufacturer, who, in turn, transmits a software patch back to the vehicle or sends a message to the in-board monitor with details for the next checkup at the dealer of preference. The objective of software management is to develop and deliver functions that the customer can experience and operate intuitively, that are always available and that, in case of defects, do not have any negative influence on the safe function of the vehicle.
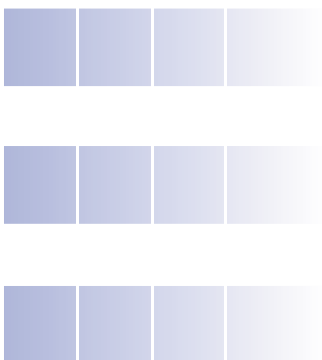
IBM forecasts that 100 million lines of code will be used in cars by 2009[10], a number that, at a Capability Maturity Model CMM level 3, corresponds to 2.3 million software design faults. Without question, these faults will have a negative impact on future quality and warranty costs. To prevent this, the prevailing strategies in automotive software management are:

• Networking and integration of different in-vehicle microprocessors

• Setup of architecture and integration competency

• Definition and integration of strategic partners

• Participation in – and even driving of – standardisation activities

• Development of software functions separate from hardware functions.

The interaction between the various E/E and software architectures requires a clear strategy to consolidate all the functions into a comprehensive architecture embracing all product lines, i.e., a holistic and integrative approach to software management – starting in the development phase through to after-sales support.

E/E and software are not considered a vehicle manufacturer's downright core competency. Yet by extending their competence in the areas of electronics specifications and integration, *focused* OEMs can improve their *resilience*. The integration of external strategic partners and their software is urgently necessary, but the responsibility for developing a robust software development and integration process will lie with the car builders themselves. They have to define, organise and implement the software development process. The manufacturer defines a component's specification and the aspects of integration based on the comprehensive architecture and the consolidation of electronic and hardware development to achieve sound interaction among all architectures involved. A standardised process should be emphasised here to allow cost optimisation.

The enlargement of internal capacities will allow the specification of requirements, effective outsourcing and surveillance of the partners' design processes, and exertion of integration competency. At the same time, those internal competencies can render the manufacturer more *responsive*, because software is the entry gate to innovation, where opportunities have to be realised and transformed into a marketable product. Since development and design are the responsibility of the partners, integrated technology systems are essential.
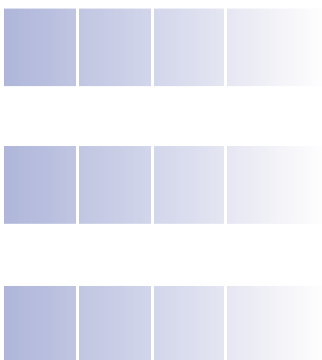
Another major task for OEMs in the future will be to drive cross-industry standardisation activities. Fully recognising the advantages of an open standard for automotive E/E architecture, OEMs and system suppliers founded AUTOSAR (Automotive Open System Architecture). Its objectives are to standardise basic system functions and functional interfaces, provide the capability to integrate and transfer functions and substantially improve software updates and upgrades over the vehicle lifetime. Standardisation activities such as AUTOSAR will unify the parties involved and ease the integration of different microprocessors. Open standards thus contribute to more reliable functions, enhance the OEM's maturity in on demand *resilience* and allow suppliers to develop their applications based on a standard architecture and platform. Since the integration and interrelation of electronic control units are vital, this global partnership will play an important role in mastering software problems. Additional steps forward include systematic test procedures and a software quality and supplier management ideally supported by methodologies such as SPICE (Software Process Improvement and Capability dEtermination) or CMM.

Quality problems caused by E/E and software could further be avoided through the transfer of development standards for high-end computers to vehicle development. The goal should be to develop software functions separate from hardware functions. Thus, the OEM can become even more *responsive*. Successive software releases will drive new functionalities into a given control unit. With software and hardware separated, a software release management process will gain an importance that helps the OEM control the innovation flow through an intelligent release policy.

Implementation of these strategies means organisational challenges for an OEM. Many car producers are not yet attuned to software lifecycles of 6 to 12 months in contrast to hardware lifecycles of 18 to 36 months. Correspondingly, they need learning loops considerably shorter than in mechanics and should more proactively investigate for strategic partners. However, there is a danger in underrating cultural problems both in this integration process and in standardisation boards.

Quality management

Since Ford addressed the Firestone tyre recall in early 2001, the internal areas of Quality, Quality Assurance and Reliability have been complemented by the external after-sales failure costs, better known as warranty costs. The increased content of in-vehicle electronics, mechatronics and software, coupled with ever-decreasing development times and unclear responsibilities will continue to force OEMs to master their quality problems in the near future.
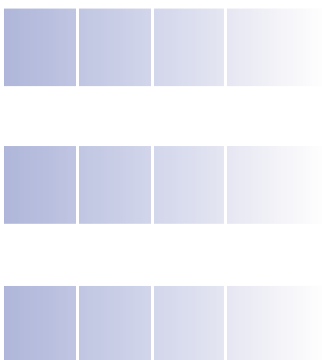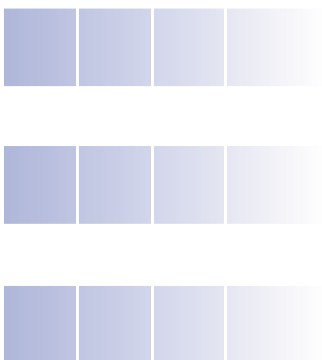
Currently, Quality Management (QM) has three major thrusts:

- Durability and reliability (product focus)
- Perceived quality and customer satisfaction (customer focus)
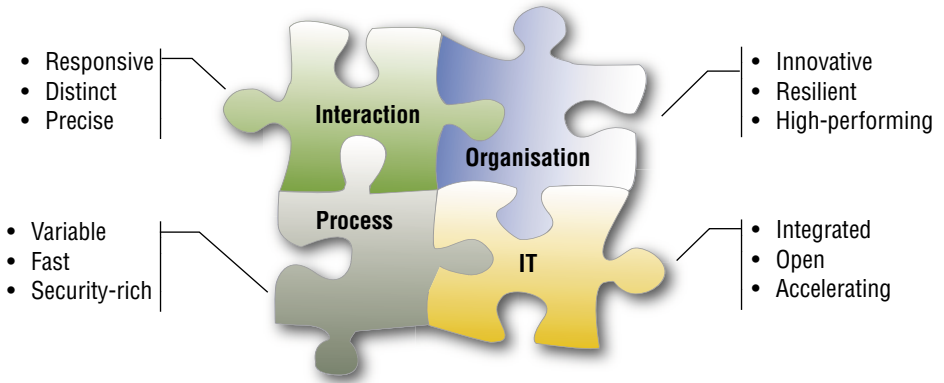- Quality-oriented new products and continuous improvement (production and process focus).

QM is no longer seen as just a cross-function activity driven by the quality and reliability organisation, but as the key building block for all parts of, and players in, the supply chain. OEMs, by defining quality as their ability to create customer satisfaction, adopt Total Quality Management (TQM) as a holistic approach driven from the top-down.

Though QM has had a high priority in various functional areas of car manufacturers for a long time, implementation of a coherent and organisation-spanning quality strategy represents an even higher level of evolution. Prerequisite for an overall quality strategy is knowledge about the interaction of all quality procedures used within a company and by its suppliers. To retain, regain and improve their product quality, OEMs will need to drive QM methods and tools within the framework of their development departments; this will include SRM activities, production systems and knowledge management. OEMs can foster *responsiveness* through virtual / enhanced reality since problems can be recognised and solved very early in the development process before significant investments have been made.

In their production systems, OEMs like Audi, BMW, Mercedes-Benz, Honda or Toyota combine standard processes with management methods and tools. APS, KOVP, MPS or Jellyfish treat issues ranging from problem detection to process stability and customer orientation using a fixed variety of methods, tools and applications. With respect to their collaboration, OEMs and suppliers rank QM as the core process that is crucial to the relationship. Partner integration can be enhanced further with respect to interaction, organisation, process and IT. By gaining influence over suppliers' QM, OEMs will be able to continuously improve the quality of their products (see Figure 3).

Figure 3. Use of QM to enhance partner integration with respect to interaction, organisation, process and IT.


- Responsive
- Distinct
- Precise

Interaction

Organisation

Process

IT

- Innovative
- Resilient
- High-performing

- Variable
- Fast
- Security-rich

- Integrated
- Open
- Accelerating

Source: IBM Business Consulting Services analysis, 2004.

Knowledge management will also increasingly become an integral part of effective QM as a method of administrating a company's entire set of product, process and resources data. *Responsive* companies will collect quality issues and derive key performance indicators for early recognition of problems and continuing quality improvements. Hence, OEMs like Audi, BMW, DaimlerChrysler, Ford or GM / Opel and suppliers such as Bosch push the virtual factory / digital factory, an extreme manifestation of this concept.

In short, by implementing the quality issue into various links of the automotive value chain, OEMs can become more *resilient* as the cross-functional integration of quality procedures removes interfaces, increases transparency of the procedures and helps eliminate potential risks.

Product development management

Product development is the area within the product lifecycle that sets the parameters for cost, quality and time to market. From a customer point of view, the end results have deteriorated over recent years. Increased vehicle complexity has had a negative influence on product quality and customer satisfaction with a corresponding impact on brand image. For development departments, there is potential to improve customers' perceptions in the following areas: individualisation, product strategy, increased efficiency and quality (see Figure 4).
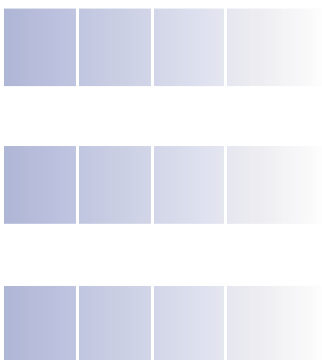
Figure 4. Improvements in customers' perceptions can be achieved through individualisation, product strategy, increased efficiency and quality.
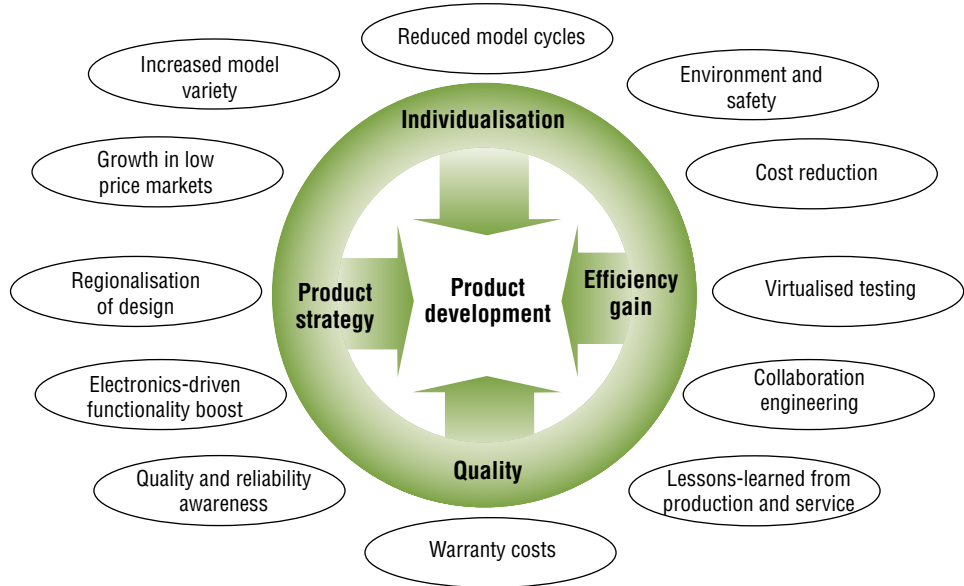

Source: IBM Business Consulting Services analysis, 2004.

The challenges of increasing legal, safety and environmental requirements, product offensives and reduced model cycles constitute different aspects of individualisation that have to be mastered by development departments. Moreover, since many products are rejected by the market, a detailed market and requirements analysis should be performed to determine which functions and models a customer is willing to pay for prior to developing new functions and innovations.

Basically, globalisation is realised either by a marketing offensive in new markets with an OEM's own brands or by acquisition of regionally established brands. Whatever strategy an OEM follows, globalisation will confront it with new customers and different desires. Product strategy has to react to these changes with innovative and high-quality products in an enlarged segment range. Innovation and product quality offer the starting points for differentiation. To increase and sustain *responsiveness* to regionalised markets, decisions have to be made with respect to the installation and coordination of globally centralised and regionally decen-tralised development centres.

Individualisation and regionalisation will lead to more and more simultaneous devel-opment projects that need to be synchronized and managed as a holistic process. Design teams can increase their *responsiveness* and become more *variable* by aiming for standardisation of processes across geographic and project borders.
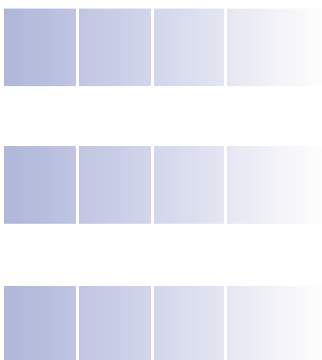
Furthermore, product design should be defined in cooperation with manufacturing experts. This would not only allow a higher level of flexibility among individual manufacturing locations, it would also mean that lessons learned from current quality problems experienced by the manufacturing and service functions could be reflected more strongly in the design phase of the product lifecycle, potentially resulting in efficiency, quality and cost benefits.

For the car manufacturer, organisational design tasks have to be approached with a view to optimising the management of product development. Silo thinking under-mines effective internal communications and must be overcome. The Mercedes Development System (MDS) is an example of such an organisational scheme; its standardisation of development processes constitutes the basis for effective inter-change and thus helps to reduce time investments. Where competencies lie beyond their core area, *focused* manufacturers can enter into partnerships with OEMs and suppliers. For example, OEMs cooperate with each other in engine development. Ford and Peugeot jointly develop new common-rail diesel engines that will be assembled first in Jaguars, and the turbo diesel engine of BMW's Mini One D was a joint development with Toyota. Due to the trend towards modularized cars and growing demand for niche models, the added value of vehicle design will increas-ingly shift to suppliers. By 2015, Mercer Management Consulting expects a suppliers' share in the added value per vehicle of 78 percent for cars produced for the mass market and 74 percent for premium cars.[11] As already mentioned, BMW outsourced large parts of the design and the whole production of its X3 model to Tier-0-supplier Magna Steyr.

This transfer of development responsibilities to strategic partners requires the joint optimisation of collaborative engineering. Optimised collaboration can be achieved by having comprehensive specifications; clear definitions of tasks, targets and competencies; complete requirements management; risk sharing; and open organi-sation, IT, processes and communication. However, optimised collaboration on the whole needs the framework of a multi-project management concept. Another area with a high potential for efficiency improvements is vehicle testing and tooling. It is imperative that the OEMs focus intently on the maturity and reliability of components and systems prior to vehicle testing. Today, many components have an unsatisfactory level of reliability, which, in turn, leads to major problems during vehicle testing with significant impact on the results and project timing. A higher level of virtual simulation
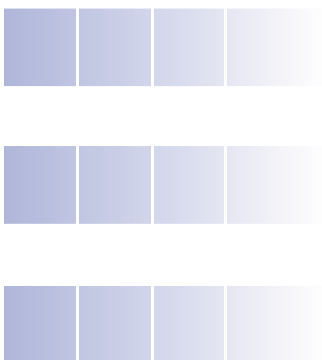
through design software will help reduce the number of vehicles used in development. The benefits of virtual simulation are obvious – allocation of designed space and functional testing by virtual prototyping. If construction data get designed with the aim of virtual testing, manufacturing costs can be significantly reduced by development. But to save time and money, expensive virtual models have to be reused in subsequent model variants. Therefore, the flow of validation data back to the design department has to be increased.

OEMs often lack consistent technical knowledge about virtual testing applications and their benefits. Often, a comprehensive and reconciled strategy for testing and tooling still needs to be developed. However, with such knowledge and strategy, the manufacturer could define an integrated process chain to render virtual testing a standard tool in product development. Collaborative engineering, standardisation of processes and virtualised testing – done to shorten design cycles and prevent cost risks – can lead to a high level of maturity in on demand *responsiveness*. Without open standards, collaborative engineering will neither succeed within the company nor on an intercompany basis between strategic partners. The conveyance of lessons learned to design and virtual testing departments will help leverage the manufacturer's maturity in on demand *resilience*.

Expansion management

Emerging markets have tremendous growth potential for vehicle manufacturers. This is particularly valid for threshold countries and regions at the crossroads between an agricultural economy and an industrial or service-industry economic structure.

Overseas production has two incentives: marketability and cost reduction. Resilient manufacturers analyse and decide on a region as a delivery or a production market. Globally, three regions can be seen as emerging markets: Latin America, Eastern Europe and Asia. Whereas the Latin American markets are traditionally very volatile (e.g., in Argentina and Brazil) and do not have the highest priority within the OEMs' expansion strategy, Eastern Europe has a much higher and sustainable growth potential.

The integration into the European Union of many former communist bloc countries is a key factor for the OEMs' expansion activities. Asian manufacturers, especially, are showing a lot of initiative building manufacturing locations to supply the local markets and as a gateway to the whole European market. The Russian market seems to remain of limited interest for the installation of new foreign production sites: CSM forecasts production growth of roughly 200,000 units through 2009, but
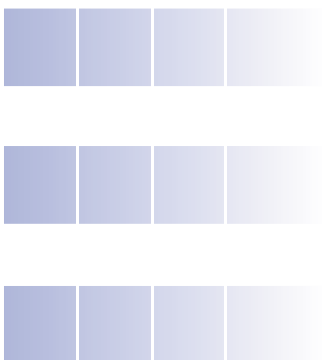
the percentage of sales of foreign cars currently amounts to just about 6 percent.[12] While GM and Ford, already in the country, plan to expand their domestic production, Toyota and VW consider engagements hesitantly in ranges of 5 to 20 years.[13] As Russia will not become an EU member in the foreseeable future, growing sales of foreign cars will largely be supplied from abroad.
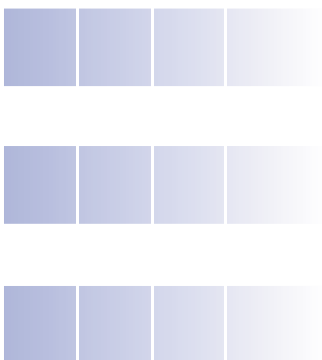
Investments in Eastern Europe help make OEMs more *variable* as the new plants with lean cost structures allow them to provide cars to the whole European market. Yet the real "hot spot" of expansion is Asia. There, economic growth will create large middle classes, but vehicle density is only medium in countries like Korea and Taiwan and very low in India and China. A comparison of vehicle ownership density figures impressively explains China's double-digit growth rates over the past years. While in 2002, the USA had 779 passenger cars and commercial vehicles per 1000 inhabitants, the EU rate was 585 and the global average was just 132. China, however, has only 11.6 commercial vehicles and 4.3 passenger cars per 1000 inhabitants.[14]

Figure 5. Vehicle ownership density in Europe, Asia and the Americas.[15]
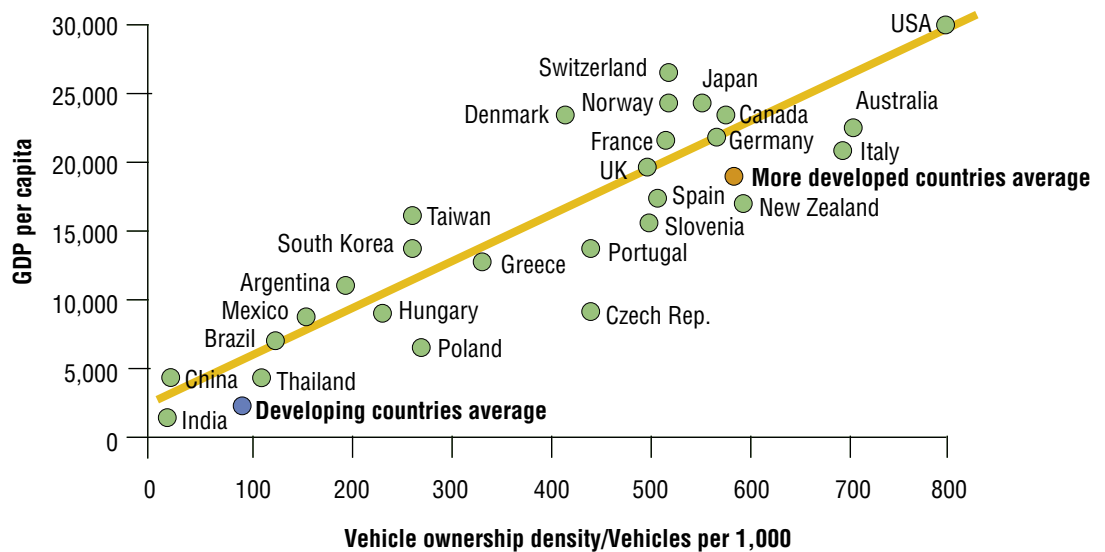
Source: World bank, IBM Business Consulting Services research.

All major OEMs have plans for significant expansion in China. However, the fear of overcapacity is growing, and government regulations could restrict the market. Despite the obvious growth potential, such regulations, coupled with the unpredictability of the Chinese government, can make any kind of engagement in China a

veritable leap in the dark. Expansion to China, though, turns an OEM's *focus* to a future key global market. Apart from legal exigencies, the sheer size of China begs for *responsive* car makers reacting to local customers' wishes.

Management of expansion into new geographies and cultures requires that companies are *focused* on the requirements in these new markets and *responsive* to changing market conditions and requirements. Consequently, sound knowledge about the target market is compulsory for successful expansion. Once in the market, reliable local partners have to be won – an existing and potential problem in China. Comprehensive logistics steer both just-in-time (JIT) procurement and unobstructed delivery. Just-in-sequence (JIS) and JIT require efficient supplier networks. Finally, for smooth delivery, dealer networks have to be built up and enlarged.

Strategic steps toward the on demand business

Based on experience with the seven areas of strategic action discussed, IBM has drawn several conclusions and defined recommendations for further action.

The automotive industry has developed into a complex network of interrelations across the entire value system, where decisions at any level often impact various other levels. Integration with customers, for example, affects not only sales but also product development or expansion into new markets. Therefore, increased business and cost efficiency can result from focusing on one's own core competencies and strengths.

Vehicle manufacturers must define and focus on those features and characteristics that differentiate them from competitors and outsource those non-core design, manufacturing, supply, marketing and administration tasks that can be better handled by suppliers. The integration of strategic partners with more responsibility into the OEM's value chain should be intensified. By doing so, the OEM/supplier interaction, organisation, process and IT are addressed. SRM has to be supported by collaborative engineering, pay-on-supply, risk-sharing models and alignment of the suppliers' QM.

On demand CRM requires a seamless, single view of the customer with consistent cross-channel interaction models. Therefore, we recommend that OEMs bundle all internal CRM strategies into one comprehensive multichannel strategy. On this basis, customer data can be systematically gathered and evaluated for later use at multichannel customer touchpoints from dealership to profitable value-add activities,
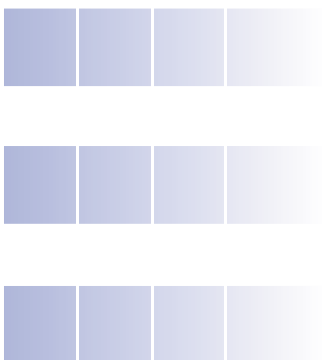
such as financial services. The selective use of comprehensive customer data will drive more personalised communication and thus help increase both customer loyalty and customer sales.

To increase loyalty even further, OEMs should create customer awareness and build or defend a strong brand image that rightly balances the brand's cognitive and emotional aspects. If OEMs integrate CRM with SCM, then product design and production planning can be aligned with the customer information available. Dealers will remain the most important customer touchpoint. To enhance dealers' efficiency and service, OEMs can streamline channel orders' processes and warranty claims through coherent dealer management systems and simplify dealer access to content, applications, people and processes.

Without sound knowledge about new markets for expansion, OEMs cannot make accurate and timely decisions. Therefore, opportunities must be identified on demand with improved data analysis and insights. And, once in the market, supplier and dealer networks have to be developed with reliable local partners. For their integration, vehicle manufacturers have to install virtualised learning solutions and increase communication solutions. This requires technologically consolidated, virtual and local applications and infrastructure management consistent with the internal standards.

Where development cycles and the final product do not conform to increasingly complex market requirements, product development parameters for cost, quality, time-to-market and processes have to be optimised. A set of coordinated actions will help improve efficiency, quality and cost. OEMs' design departments should become on demand by using collaborative tools that define and control standardised processes and distribute knowledge. These tools should also feed lessons learned from manufacturing and service into reliability, design failure and diagnostic models. Web-based design, simulation, tooling, virtualised testing and product lifecycle management capabilities all need to be built on a common infrastructure. Where design centres are globally distributed and collaborative engineering works across company borders, OEMs will need a realtime system for tracking, managing and communicating engineering changes and defects.
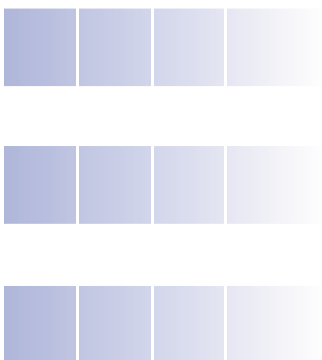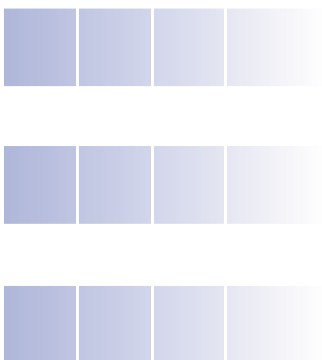
Since automotive electronics and software are influencing product development, quality, core competency and brand management alike, the respective actions recommended above also pertain to automotive E/E and software. Successful software management is the entry gate to innovation, one of the main market differentiators. Open standards contribute to more reliable functions, allowing OEMs and suppliers to develop their applications based on a standard architecture and platform. Thus OEMs should acquire and set up architecture and integration competencies in embedded systems lifecycle management. This help enables definition, organisation and implementation of a standardised software development and tracking process. This enlargement of internal capacities will allow the specification of requirements, effective outsourcing and surveillance of partners' design processes, and exertion of integration competency. In addition, manufacturers should separate software from hardware to develop a software release policy that helps them control both product quality and innovation flow. With all these activities, an OEM can use the extensive opportunities of automotive digitalisation for innovation and quality enhancement.

Vehicle manufacturers have realised that the interconnectedness of business design and technology capabilities is making businesses more *focused, responsive, variable* and *resilient*. It is anticipated that managing the seven areas of strategic action depicted here (see Figure 6), they will successfully move forward to strategic excellence.

Figure 6. Seven areas of strategic action.
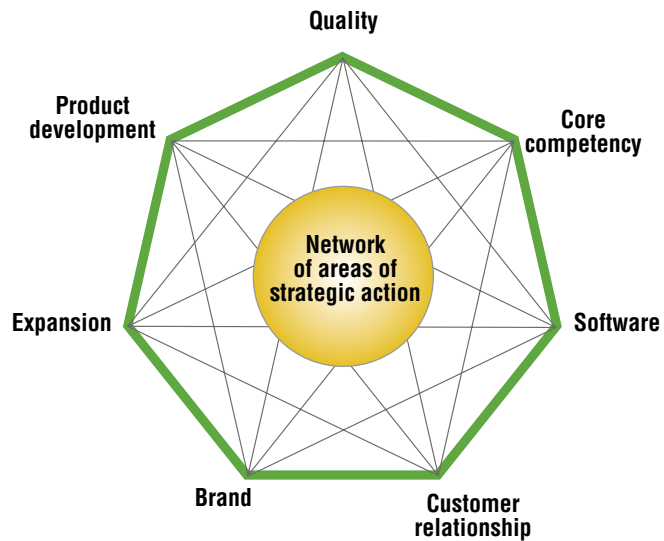
Source: IBM Business Consulting Analysis, 2004.

By focusing on these seven strategic levers, automobile manufacturers will increase their potential to successfully cope with the challenges of globalisation, individualisation, digitalisation and increasing competition.

Conclusion

Today's tough challenges in the automotive industry require OEMs to find new ways to create value if they are to prosper. To successfully adapt, OEMs need to be able to respond to changes with *focus, responsiveness, variability* and *resilience*. OEMs can accomplish this by leveraging seven strategic areas to transform to an on demand environment. To discuss how IBM Business Consulting Services consultants can help you plan and prepare for an on demand future, e-mail the authors below or visit our Web site:

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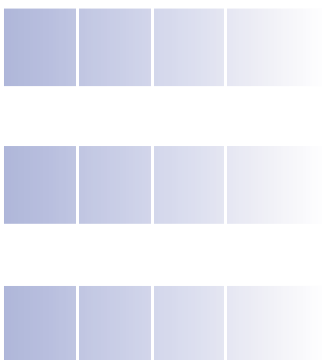
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