

Chapter 2

The Evolution of Competition in the Automotive Industry¹

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Abstract. At the dawn of the second automotive century it is apparent that the competitive realm of the automotive industry is shifting away from traditional classifications based on firms' production systems or geographical homes. Companies across the regional and volume spectrum have adopted a portfolio of manufacturing concepts derived from both mass and lean production paradigms, and the recent wave of consolidation means that regional comparisons can no longer be made without considering the complexities induced by the diverse ownership structure and plethora of international collaborations. In this chapter we review these dynamics and propose a double helix model illustrating how the basis of competition has shifted from cost-leadership during the heyday of Ford's original mass production, to variety and choice following Sloan's portfolio strategy, to diversification through leadership in design, technology or manufacturing excellence, as in the case of Toyota, and to mass customisation, which marks the current competitive frontier. We will explore how the production paradigms that have determined much of the competition in the first automotive century have evolved, what trends shape the industry today, and what it will take to succeed in the automotive industry of the future.

¹ This chapter provides a summary of research conducted as part of the ILIPT Integrated Project and the MIT International Motor Vehicle Program (IMVP), and expands on earlier works, including the book *The second century: reconnecting customer and value chain through build-to-order* (Holweg and Pil 2004) and the paper *Beyond mass and lean production: on the dynamics of competition in the automotive industry* (Économies et Sociétés: Série K: Économie de l'Entreprise, 2005, 15:245–270).

2.1 All Competitive Advantage is Temporary

The roots of today's motor industry can be traced back to Henry Ford, who, based on the inter-changeability of components and the use of the moving assembly line, laid the foundations for modern-day mass production techniques. Even the basic features of a car have not changed much since Ford's days: a car still has four wheels, is propelled by a gasoline engine and its body is still welded together from pressed metal parts. Despite the profound impact that Ford has had on the "industry of industries"², its competitive advantage was short-lived and Ford was soon overtaken by GM, which, based on the visions of Alfred P. Sloan, introduced a more decentralised organisational structure and offered customers the choice they wanted through a much broader product portfolio. While civilian production significantly shrunk during the years of the Second World War, the mass production of cars in the US leveraged the growth of the post-war period until the 1970s saw increasing competition from Japan, where companies like Toyota seemed to be able to offer better deals – in terms of quality and cost – to customers in the US and Europe.

The success story of lean production, leading to the difficult situation faced by the US and European manufacturers in the three decades since 1970, is well known and all major players in the industry have adopted the set of techniques that were first introduced at Toyota in Japan, the Toyota Production System (TPS), or "lean production" as it is more widely known. However, competitive forces are far from being static, and hence vehicle manufacturers can no longer rely on excellence in production only, especially since the performance gap between them has been closing (Holweg and Pil 2004). The automotive industry in the new millennium has seen the advent of three key challenges: regionalisation, saturation and fragmentation of markets, challenges that few manufacturers have addressed successfully to date. New capabilities are required to deal with this competitive situation and return to profitability. There is an increasing number of countries in the world today that have mastered the skills of producing cars with acceptable levels of quality, and often at a much lower cost compared with the US, Europe or Japan.

At the turn of the second automotive century the news from the automotive industry in the established regions is anything but encouraging: record losses are being reported in Detroit, and in Europe household names are, for the first time, being squeezed out of the market. Britain alone has seen the closure of five major car plants over as many years, and one might get the impression that for every factory that closes in the West, (at least) one is opening in Eastern Europe, India or China – suggesting that the days of the motor industry in the western world are numbered. In Japan, several corporate crises and even threats of bankruptcies have been averted, most prominently in the case of Nissan.

But painting a picture of gloom misses the point: the industry is mature, the barriers to entry are high and demand is growing – on average, global car production

² A term coined by Peter Drucker in 1946.

has increased by just below 2% annually since 1975, and major new markets in Asia and previously in Latin America have opened opportunities. The real conundrum is why successful strategies in this industry are so short-lived? Amidst a wealth of explanations pointing to legacy health care costs, to China's rise and to a perennial overcapacity, the real root cause is commonly overlooked: manufacturers have relied heavily on static business models, and have simply failed to adapt to a changing environment.

Revisiting the history of the industry soon shows to what extent fortunes have changed over the last century as companies failed to align their strategies to structural shifts in the marketplace. It was Henry Ford who built his empire based on his ability to mass produce vehicles at an unrivalled cost, albeit in "any colour as long as it is black". Ford's superiority was successfully challenged by Alfred P. Sloan at GM, who sensed the customers in maturing markets desired more variety than Ford was providing. Sloan offered "a car for every purse and purpose", and Ford soon lost its market leadership in 1927 – never to regain that position.

After the war all manufacturers soared on the seemingly insatiable demand that happily took every vehicle produced. Fortunes only changed when the oil crises increased demand for economical cars, which was met by increasing imports from Japan that threatened the heartland of the US and European manufacturers. Trade barriers were soon called for, but as Japanese transplant operations sprung up, this "invasion" could not be halted. This pattern of import competition entering the low segments of the market has replicated itself several times over since: in the 1970s Japanese imports threatened the US and European manufacturers, in the 1980s it was the growing South Korean motor industry that happily filled the space the Japanese vehicle manufacturers left as they moved upmarket, and there is little doubt that the Chinese manufacturers will lead the next wave of import competition by the end of the decade.

Initially, this success was achieved through leveraging their cost advantage, but today the Japanese and Koreans are competing on a level playing field – and thanks to superior manufacturing methods, have captured a 17% market share in Western Europe, and even 37% of the US car market. The real issue that drove this expansion was not labour cost, but the Western manufacturers' inability to adopt leaner manufacturing methods to meet the Eastern productivity and quality standards.

Instead, Western manufacturers sought salvation in size. The mantra of the 1990s was that an annual production of one million units and global market coverage ensured survival, and we are now seeing the fall-out from this single-minded pursuit of volume. Daimler-Benz was not the only one to get caught out: BMW equally failed in its venture with Rover, as did GM in its alliance with Fiat. The wider lesson here is that scale alone does not ensure survival. Those alliances, which do indeed provide economies of scale, crucially also feature a strong complementarity in terms of capabilities. Take Renault-Nissan for example: leveraging compatible product architectures, Nissan's manufacturing strongly complements Renault's design capabilities. This also applies to market coverage: Nissan is well represented in Asia and North America, where Renault has hardly any presence.

Renault is considerably stronger in Europe and South America, where Nissan plays a minor role. And for some, not allying with other firms makes perfect sense – of which Toyota and Honda are living proof – and even BMW does much better without a volume car division.

At present, all attention is on the growth in China and India, where combined vehicle production has grown to an equivalent of 44% of Western European output. Suppliers and manufacturers alike tremble at the thought of low-cost imports from this region, and the “China price” is an often-used menace in price negotiations. Frequently omitted though is that manufacturers and suppliers alike have benefited handsomely from the growth of the Chinese domestic market. Nonetheless, Western manufacturers have been responding with a steady migration into low-cost regions such as Eastern Europe – initially Poland, the Czech Republic and Hungary, and soon into Slovakia and Romania; yet, this strategy is short-lived at best: competing on cost alone is not only futile, it also misses the point.

Success in this mature industry neither has been, nor will it ever be decided on the basis of unit cost or scale alone. It is the ability of the manufacturer to sense trends in the market, and align its product range that determines success. And it is this stubborn refusal to accept these changes that poses the greatest threat to the Western motor industry: relying on high volumes of gas-guzzling SUVs in times of rising fuel prices and growing environmental concerns is as short-sighted as the European manufacturers’ perennial love affair with luxury vehicles.

China and legacy costs are often portrayed as the main threats to the industry, but they are not the root cause of the woes we are feeling. In the long run, wages will rise even in China, as they have already done in Japan and Korea. And as one low-cost region develops, soon there will be another emerging. These mantras of scale and low unit cost might have worked in the past, but no longer suffice in today’s dynamic world. Those who are able to adapt to shifts in market demand and to respond to customers’ wishes will thrive, and rightfully so – if history teaches us one thing, it is that all competitive advantage is temporary.

In this chapter, we will explore in detail the past, present and future of competition in the automotive industry. How did production systems evolve that determined competition in the past, what are the present trends that shape this global industry, and what will it take to succeed in the future?

2.2 The Past: The Evolution of Production Systems

The motor industry has made a dramatic transition over the last century. From small workshops that had crafted customised vehicles for the affluent few, to Ford’s mass-produced Model T, which made motoring available to the public at large, and to the Toyota Production System, which proved to the world that high productivity and high quality can be achieved at the same time. Many researchers have studied these drastic transitions in the motor industry, trying to understand how this drastic change could happen in such a short time. Historians such as

David Hounshell, Allan Nevins and Lawrence White, for example, debate the drivers and enablers of the change from the craft production of the late 19th century, which was prevalent at the time (Nevins 1954; Nevins and Hill 1957; White 1971; Hounshell 1984), and Womack et al. and Takahiro Fujimoto give a detailed account of the lean production paradigm as a contrast to the mass production approach (Womack et al. 1990; Fujimoto 1999).

At the start of the automotive industry were the craft producers of the likes of Panhard et Levassor, Duesenberg, and Hispano Suiza, which employed a skilled workforce to hand-craft single vehicles customised to the wishes of the few customers who could afford them. The core of the mass production logic, or the Fordist system, which was to turn the economies of the motor industry upside down from 1908 onwards, was not the moving assembly line, as many suspect, but in fact the inter-changeability of parts, and Ford's vision to maximise profit by maximising production and minimising cost. This notion was very different from the existing economies of the craft producers, where the cost of building one vehicle differed little if only a single car was made, or a thousand identical ones: since all parts were hand-made, and subsequently amended by the so-called "fitters", the amount of labour required per vehicle differed little, if at all. Furthermore, most vehicles at the time were customised to individual requirements, so standardising parts was not a priority.

It was this notion of the inter-changeability of parts that would become the critical enabler of Ford's mass production system, a concept that originally stems from the arms-making sector (Hounshell 1984). Initially proposed by Eli Whitney and later implemented by Samuel Colt, the ability to standardise parts meant that the assembly operation could be streamlined, and the entire job function of the "skilled fitter" was made redundant. The moving assembly line, however, implemented by Ford in his Highland Park factory in 1913 for the first time, is merely a logical evolution of the production concepts of flow production and standardisation of parts and job functions. As Robert Hall argues, "[...] there is strong historical evidence that any time humans have engaged in any type of mass production, concepts to improve the flow and improve the process occur naturally" (Hall 2004, personal communication). Historians to date disagree who actually invented the moving assembly line, whether it was within Ford or within the McCormick Harvesting Machine Company, and who within Ford made the critical changes (Nevins 1954; Hounshell 1984). In my view this debate is hardly relevant: it was Ford's vision to produce the most vehicles at the lowest possible cost that became the imprint of mass production, and the foundation stone of motor industry economics of the 20th century (White 1971; Rhys 1972). In the same way, it has been argued that Ford was influenced by the Taylorist approach of Scientific Management, which was proposed at a time when Ford's mass production model was still being crafted (Taylor 1911). However, there is no evidence that this influence actually happened, and indeed Ford never referred to Taylor as such in any official documentation (Hounshell 1984). Instead, the concomitant standardisation of work practices and the product itself, the inter-changeability of components, flow production, and the moving assembly line should be seen as tools that allowed Henry Ford to turn his

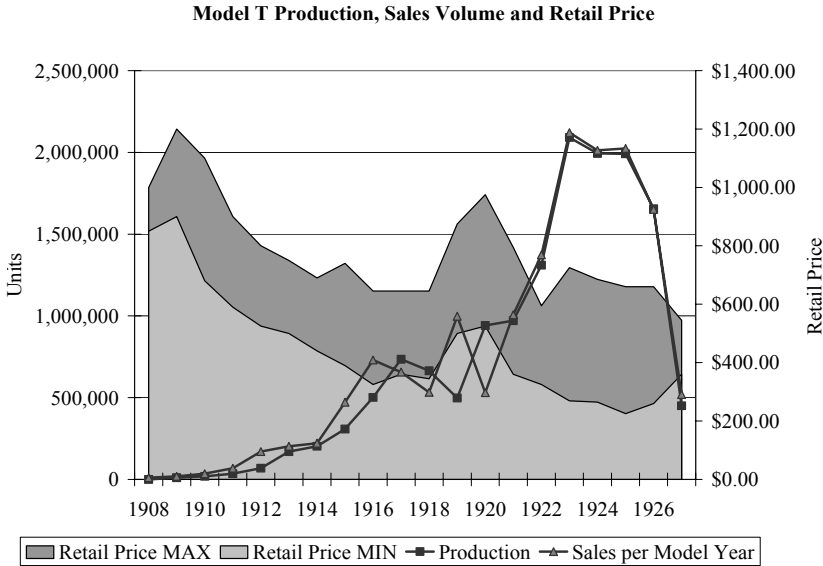


Fig. 2.1 Model T production, sales and retail price band 1908–1927. Source of data: Benson Ford Research Center. Nominal monetary values by year

vision into reality, rather than as the essence of mass production. As Peter Drucker puts it: “[...] The essence of the mass production process is the reversal of conditions from which the theory of monopoly was deduced. The new assumptions constitute a veritable economic revolution” (Drucker 1946).

Henry Ford had the vision that literally changed the face of the planet – to produce large volumes of cars in order to reduce the cost per unit, and make the cars available to the masses. And his new “mass production”, first called as such in an article in the 1925 edition of the *Encyclopaedia Britannica*, worked well for almost two decades. Ford was able to reduce the labour hours for assembly of the vehicle from 750 h in 1913 to 93 h in 1914, and the entry-level sales price for a Model T could be reduced from \$1,200 in 1909 to \$690 in 1914 (see Fig. 2.1). With the introduction of the moving assembly line came labour challenges. The new type of work was not well received by the work force, and staff turnover soared to unsustainable levels (Hounshell, 1984). And although sometimes misinterpreted as a philanthropic move by Henry Ford, the famous “five-dollar-day” was primarily geared at making the workplace attractive for workers to stay, and as a secondary effect also meant that his own workers soon became able to buy these cars, so demand was stimulated.

The demise of the pure mass production logic came suddenly, and as a surprise to Henry Ford: when for the first time in 1927 more customers bought their second cars than bought their first, it soon became clear that the outdated Model T (which from 1914 to 1926 was indeed only available in one colour, black) could not offer the level of specifications expected by the customers. It was at this time that Alfred P. Sloan at General Motors could finally compete against Ford. By offering

“a car for every purse and purpose”, GM was able to offer customers the choice they desired, and the possibility to move up from the mass brands such as Chevrolet, to prestige brands, such as Cadillac – all within the realms of the GM brand portfolio. Ford’s market share dwindled from 55% in 1921 to 30% in 1926, and it took Ford a long time to develop the replacement model for the Model T, the Model A, in order to be able to compete against GM. In the view of many historians, Sloan complemented Ford’s mass production model by marrying the mass production logic with the need to offer choice and a brand portfolio to the customer. As a key element of constant innovation, or the “search for novelty”, Sloan also introduced the “model year” in the 1930s, which involved cosmetic updates to each vehicle each year – a practice that persists today.

Hounshell (1984) refers to this stage as “flexible mass production”, although one should be clear that the increasing levels of product variety led to just the opposite – factories found it difficult to cope with the product and part variety, so components and vehicles were made in large batches to make the economies of scale so critical to mass production. Consequently, lead times and inventory levels soon rose in those factories that Womack et al. describe as typical mass producers in their seminal work *The machine that changed the world*, which marked the second major turning point for the auto industry of the 20th century (Womack et al. 1990; for a comprehensive review see also Holweg 2007).

Womack et al. described the Toyota Production System (TPS), which had been developed at Toyota in Japan as an alternative way of manufacturing cars. Taiichi Ohno and Saiichi Toyoda, the intellectual fathers of the approach, had borrowed many ideas from Ford’s original flow production system at Highland Park: tightly synchronised processes, short changeovers that allowed for small-batch production, machines that stopped in the event of a defect, and a social system designed around workforce empowerment and continuous improvement (Pil and MacDuffie 1996). For a detailed discussion of the evolution of the Toyota Production System see Cusumano 1985, and Fujimoto 1999. Further inspired by quality gurus such as Deming, this lean production system, a term coined by MIT researcher John Krafcik (Krafcik 1988), soon proved to the world that the notion of trading quality against productivity was invalid. Prior to this, the assumption was that high quality levels could be achieved only if more labour was used to correct the quality problems, and vice versa, so that higher productivity would invariably compromise product quality.

This “Japanese manufacturing model” had been known as “just-in-time” in the Western world since the early 1980s, but surprisingly little notice was taken (Schonberger 1982; Hall 1983; Monden 1983; Ohno 1988). It was only in the late 1980s, when Japanese imports captured an increasing portion of the US auto market, that the Western auto industry became concerned. Henry Ford II even called the Japanese imports an “economic Pearl Harbour”. Initially, attempts were made to restrict imports through voluntary trade agreements (Altshuler et al., 1984), but it soon transpired that the Japanese possessed a unique advantage. And it was not until researchers of the MIT International Motor Vehicle Program showed that – taking the differences in vehicle size into account – the best Japanese were almost

twice as productive as their American counterparts. The Japanese took an average 16.8 h to build a car, the US makers 24.9, and the European 35.5 h (Womack et al. 1990). At the same time, Japanese vehicles showed much higher levels of product quality, and thus could disprove the common belief of a general trade-off between productivity and quality in manufacturing. Although known for almost a decade in the West, the *Machine* book brought the lean production paradigm into the Western world by showing its superiority in the global comparison – and all at a time, when the Japanese exports posed the greatest threat to their Western counterparts.

Since then, most manufacturers have adopted lean manufacturing techniques in their operations. Although for political reasons often not called “just-in-time” or “lean”, initiatives like the “Ford Production System” and its counterparts at the other Western manufacturers are clear evidence that key features of the lean production paradigm have been implemented (to a varying extent) by most manufacturers in the US and Europe. Also, starting with the opening of Honda’s factory in Marysville, Ohio in 1984, the Japanese carmakers established a strong local manufacturing presence in the US, Europe, and emerging markets through their transplant operations, further aiding the diffusion of lean manufacturing techniques into the component manufacturing bases in the Western world. These operations, in particular in the US, were established to circumvent import tariffs, but played a key role in disseminating the knowledge of lean production (Krafcik 1986; MacDuffie and Pil 1994; Pil and MacDuffie 1999).

2.3 The Present: Shifts in the Competitive Landscape

At the start of its second century, the automotive industry is undergoing a period of drastic change: we have seen both record profits and bankruptcy of global suppliers and manufacturers, some of the largest industry mergers and de-mergers, and – largely thanks to emerging new markets – an ever increasing global demand for automobiles. If one looked at the present news coverage of the automotive industry across the globe, the obvious conclusion would be that this is an industry in deep trouble. In its last year of being the largest vehicle manufacturer on the planet, GM posted a loss of \$8.6bn dollars, and the combined job cuts announced in early 2006 by GM and Ford totalled 60,000, with no less than 26 plants to be closed in North America by 2008. Unsurprisingly, US employment in automotive manufacturing has steadily fallen from 1.3 million in 2000, to 1.1 million in 2005.

In Europe, the situation is hardly more comforting. In January 2006, Volkswagen tuned in with a further 20,000 job cuts, and Mercedes and parent company Daimler-Chrysler announced a combined 14,500 – in addition to the 40,000 Chrysler jobs lost after the 1988 merger. And while Fiat posted profits in 2005, this came after 17 consecutive quarters of operational losses and after employing almost as many CEOs over that period. And, last but not least, in April of 2005, MG Rover ceased operation, ending a century of the British volume car industry. To put this into perspective, British Leyland (the former name of Rover) was nothing less than the

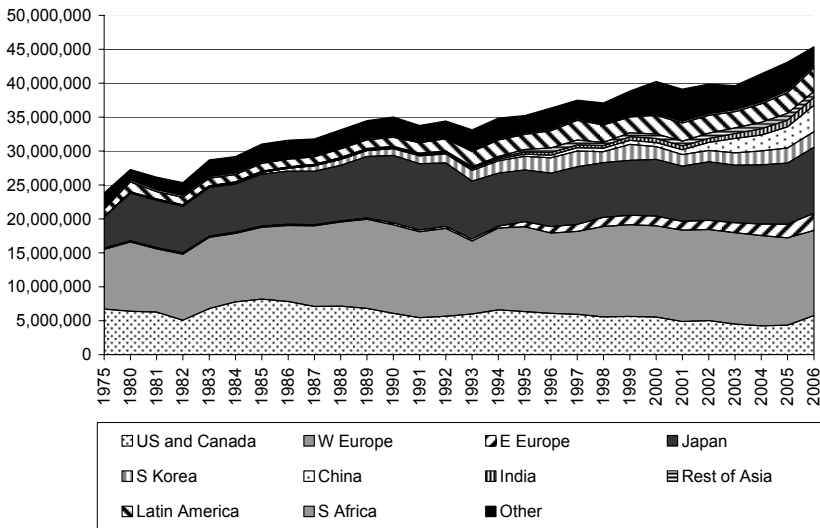


Fig. 2.2 World passenger car production by region, 1975–2006. Source: Ward's Yearbooks

fourth-largest vehicle manufacturer in the world in 1970, with a production volume of close to 1 million units per annum.

In Asia, where the perception is generally that the management techniques of manufacturing companies are superior, a similar picture emerges. With the possible exception of Toyota, we have seen the near bankruptcy and foreign takeover of Nissan, and major crises at Mitsubishi, Daewoo and Proton.

Overall, the automotive industry is not a happy place at the start of its second century. However, there is a paradox to this malaise: despite the depressing news, we are building more motor vehicles than ever. In 2004, global production of passenger cars totalled 42.5 million units, to be complemented by 21.2 million commercial vehicles, which added to the global total of 837 million vehicles in operation that need to be maintained and serviced. On average, the production of automobiles has been growing by 2.2% (1.8% for passenger cars) every year since 1975 (see Fig. 2.2). So why is it that this mature industry, with its high barriers of entry, that clearly finds customers for its products, finds it so hard to create a profitable and sustainable business proposition?

The answer is not as straightforward as some of the simplistic answers that have been suggested: legacy healthcare costs, overcapacity, and of course, the cheap imports from China. There is an element of truth in each, but none can explain what is fundamentally going on in the industry. Indeed, the legacy costs for some manufacturers like GM are calculated at \$1,525 for each vehicle sold, but if a UAW worker earns \$60,000 plus benefits, this cannot come as a surprise. This adjustment in labour cost should have come much earlier on, as GM was essentially still living in the good times of the past. Overcapacity, in 2004 estimated at approximately 20 million annual units globally, is a similar issue: the developments

that have led to the present situation have been on the cards for a long time, and there is no need for this drastic problem, as we will discuss below. And finally, China constitutes both the threat of cheap imports, but largely also a huge opportunity due to the domestic demand. Nonetheless, the underlying shift in the manufacturing footprint, together with the persisting overcapacity created, competition in the automotive industry is fierce. Plagued by legacy costs and increasing product variety, vehicle manufacturers are constantly seeking ways to compete in a world that features increasingly demanding and impatient customers on the one hand, and the threat of cheap Chinese imports on the other. Let us examine the key trends that have, and still are shaping the competitive arena of the motor industry: regionalisation, fragmentation and saturation, as well as the resulting structural changes in the supply chain that these have invoked.

2.3.1 Regionalisation

Over the past few decades, we have observed several distinct shifts in the manufacturing footprint that has shaped the industry's structure as it is today. As demand in the established regions has been stagnating, we have seen several major waves of investment in emerging markets. In 1970, the vehicle production of the US, Western Europe and Japan combined accounted for 91% of the world's 22.5 million car production. Back then, the US and Western Europe in particular were large net exporters, while Japan was still on a steep curve of increasing both production and export volumes. By 2004, the picture had changed considerably. Of the 42.8 million units that were built, only 70% came from the three established regions, USA, Europe and Japan. The number of assembly plants had grown from 197 to 460, of which only 44% were located in North America, Western Europe and Japan. What had happened was that the industry had distributed its manufacturing base: whereas previously largely knock-down operations (CKD or SKD) were used in emerging markets, the growth of their respective domestic demand now justified full-scale assembly plants. The increase in demand in Latin America in the 1990s, for example, sparked a wave of investment in the motor industry in those countries. From 1980 to 2000, the combined vehicle production in Argentina, Brazil and Mexico nearly doubled to just under 4 million units. Yet, the experience obtained in Latin America also serves as a warning signal, as the demand in Brazil and Argentina collapsed sharply after currency devaluation. Exchange rate uncertainty remains an issue, today more than ever, with respect to the most recent wave of expansion in China, and the artificially pegged Yuan.

The opening of the Chinese domestic market, in conjunction with a strict growth policy, has seen the dramatic rise of the Chinese automotive industry. With virtually no passenger car production before 1980, China produced 2.32 million cars (total vehicles: 5.1 million) in 2004. Of these, 90% were made by the joint venture companies of the large foreign manufacturers, and virtually all have been (so far) sold domestically. Even by the later parts of this decade more than 90% of China's

Table 2.1 Share of world car production by region, 1971–2003. Source: Centre for Competitiveness and Innovation, University of Cambridge

		1971	1980	1990	1995	1997	2000	2001	2002	2003
World car production	(in million units)	26.45	28.61	36.27	36.07	38.45	41.23	39.97	41.22	41.78
Industrialised countries	Percentage of world car production	90.85	89.90	87.84	81.98	73.44	74.85	75.27	72.26	70.12
	Percentage of growth (based on previous period)	–	7.03%	23.87%	–7.19%	–4.5%	9.28%	–4.28%	0.83%	–1.62%
Newly industrialised countries	Percentage of world car production	5.14%	7.65%	8.66%	15.05%	17.31%	17.22%	18.00%	21.36%	23.45%
	Percentage of growth (based on previous period)	–	61.03%	43.38%	72.93%	22.6%	6.19%	–0.08%	24.61%	11.3%

production is used to meet growing domestic demand, and thus does not yet pose an import threat of the kind that Japan and South Korea did, and maybe still do.

What one can observe here is not what is commonly referred to as *globalisation*, but what is much better described as *regionalisation* of the industry. The net export balance that fostered the growth of the automotive industry in the industrialised world over much of the last century is gradually being replaced with an infrastructure that builds vehicles locally, close to the customer. The immediate result for the established regions has been a necessary yet painful capacity adjustment, and the closure of plants like Luton, Dagenham and Longbridge in the UK are likely to be followed by others in Western Europe. In the USA, the overcapacity situation is even more pronounced, and further Big Three plant closures in addition to those already announced are expected.

Lower labour costs are generally stated as the main reason for the increase in decentralising global production into countries with low labour costs, and comparing the nominal hourly remunerations, there are indeed stark differences (see Table 2.2). But how significant are labour costs? First of all, in the overall cost structure, the approximate production cost of a vehicle from the customer's point of view breaks down as follows: 31% of the list price is accounted for by distribution and marketing costs, as well as dealer and manufacturer margins; the 69% ex-factory costs split into 48% for procured parts and materials, 9% overheads, and only 13% is related to the vehicle production operation. Here, labour represents the largest component, alongside capital investment depreciation of the production assets. When one compares the above to the hourly rates a worker earns then it is obvious that labour cost is indeed a significant competitive factor in the lower segments of the market; yet, it does play a decreasing role in the higher market segment, where firms do not compete on cost alone, but on technological innovation, design and brand image.

Table 2.2 Average hourly remuneration for production workers in manufacturing. Data for 2003, Source: Bureau of Labour Statistics 2004 & Economist 2005

Germany	\$29.91	South Korea	\$10.28
USA	\$21.97	Czech Republic	\$4.71
UK	\$20.37	Brazil	\$2.67
Japan	\$20.09	Mexico	\$2.48
Spain	\$14.96	PR China	\$1.30

2.3.2 *Fragmentation of Markets*

The second key trend is one that is relatively easy to observe; namely, the implosion of traditional vehicle segments, in favour of cross-over and niche vehicles. The traditional segments of small cars (B-segment, e.g. Polo or Fiesta), compact cars (C-segment, e.g. Golf and Focus), family cars (D-segment, e.g. Passat and Mondeo), and executive class (E-segment, such as E-class and 5-series) have been joined by SUVs, MPVs, UAVs, and the like. In quantitative terms, this trend can be easily seen: across Europe, in 1990 a total of 187 models were offered, which increased to a total of 315 models in 2003. This increase is not only due to the new segments, such as MPVs and SUVs, but also to model line expansions in existing segments. The B-segment of the Corsa and Fiesta, for example, saw an increase from 16 to 31 models over that time period.

The increase in model range is accompanied by a general shortening of product life cycles. While the average time a product stayed in the market was around 7 years in 1970, this average has been reduced to 5 years – a trend consistent across the US and Western Europe. In Japan, life cycles have traditionally been much shorter, and some companies like Toyota have coped by building two generations on one platform, before changing both design and platform with the third generation.

Together, the increase in model range and the reduction in life cycles have a drastic impact on the economies of scale that can be achieved. The volume sold per model has been significantly reduced over time, which gives the manufacturers less and less opportunity to recover their considerable development cost. As a reaction, manufacturers are trying to increase the component sharing and platform usage across as many models as possible. Table 2.3 illustrates the overall shifts in volume per model, and the use of platforms in Europe.

This development is, and will continue to be, a major challenge for vehicle manufacturers. While the large players are currently working on leveraging their resources across their brands, for smaller companies this is not so easy. One reason why MG Rover failed was the need to cover the growing new market segments, while volumes were shrinking in the traditional segments in which it was offering products. Ultimately, its volumes were too small to finance the required product development programmes, and with an ageing line-up in limited segments, sales continued to fall.

Table 2.3 Platform usage in the European automotive industry. Source: Pil and Holweg (2004)

	1990	1995	1996	1997	1998	1999	2000	2001	2002
Number of platforms in use (Europe)	60	60	57	56	53	51	45	45	48
Number of body types offered (Europe)	88	137	139	148	157	162	170	178	182
Average number of body types per platform	1.5	2.3	2.4	2.6	3.0	3.2	3.8	4.0	3.8
Average production volume by platform (in 1,000s)	190	171	185	194	199	215	249	272	258
Average production volume by body type (in 1,000s)	129	75	76	73	67	68	66	69	68

2.3.3 *Saturation and Overcapacity*

The third key trend is a malaise that is entirely self-inflicted: as a result of the failure to adjust capacity to demand, the auto industry suffers from a global overcapacity that at this point is estimated at 20 million units – equivalent to the combined installed capacity in Western Europe! The basic reason for the overcapacity is an asymmetry: it is much easier to add capacity than it is to reduce it. With an average level of employment of 5,000 workers per assembly plant and an additional job multiplier of up to four jobs in the supply chain, governments encourage, and most often also subsidise, the building of new vehicle assembly plants. For the same reason, closing a plant when demand drops is difficult and quickly becomes a political issue.

The main consequence of the overcapacity is that manufacturers – in their quest to keep capacity utilisation high – produce into the growing inventories of unsold cars (around 1.5–2 months in most markets), and then employ sales incentives, such as discounts, high trade-in prices, free upgrades, and the like, to maintain their market share. Initially, the problem was confined to the North American market, which after the recession of 2001 has seen an increasing “war of attrition” between the manufacturers. Average incentives then and to-day range between \$2,000 and \$6,000 per vehicle. That way, the Big Three have indeed managed to maintain their market share, yet their position is not sustainable, as the respective 2005 losses of Ford’s and GM’s automotive businesses graphically illustrate.

The root cause here is a chronic inability to adjust output to demand and link the production schedule to actual customer orders. While Henry Ford founded the industry on the premise of making vehicles as efficiently and inexpensively as possible, this mass production “volume-push” approach is no longer viable in current settings of saturated markets, where one has to deal with increasingly demanding customers. At times when Dell illustrates that one can order a customised product that is built to order within only a few days, the established automotive

business model seems obsolete. Several manufacturers have understood the need to link production to customer demand and have successfully initiated “build-to-order” (BTO) programmes, such as Renault, Nissan, BMW and Volvo. Their success has illustrated that one can indeed build a car to customer order within 3 weeks or less, and operate without the costly finished vehicle inventories and the incentives needed to clear the overproduced cars from dealer stock. Most other manufacturers recognise the need to get closer to their customers, but implementation often lags behind what the press releases state. One could argue that while there is widespread intellectual acceptance, there is an equally widespread institutional apathy.

2.3.4 *Structural Changes in the Supply Chain*

The pressures outlined above faced by the manufacturers have led to internal changes (such as increased platform usage across models), but the wakes are equally felt in the supply chain – most prominently at the interface with the first-tier suppliers. The main changes here are a general reduction of supplier numbers per vehicle assembly plant, the re-distribution (i.e. outsourcing) of value-added activities, and the increase in globally sourced components and materials.

The reduction in supplier numbers, shown in Table 2.4, is driven by two strategies: first, in order to develop longer term, collaborative (Japanese-style) relationships, vehicle manufacturers focus on a few key partners, rather than change suppliers opportunistically based on unit price only. Second, the increasing product variety means that vehicle manufacturers have to rely more and more on their suppliers to provide the design and assembly of key vehicle systems and modules. This drive towards outsourcing required a re-tiering of the supply chain, whereby several previous first-tier suppliers became “0.5-tier” module or systems suppliers, now sourcing components from their previous first-tier peers. For the vehicle manufacturer, outsourcing was also a means of harnessing the lower labour costs at suppliers (\$17 versus \$23/h in the USA) and to reduce transaction costs by dealing with fewer suppliers at the same time.

Unlike the components we see in the computer sector that feature standardised interfaces, a motor vehicle features a largely integral product architecture that

Table 2.4 Number of suppliers across Japan, Europe, the USA and new entrant countries. Source: Holweg and Pil (2004)

Region	1990	1994	2000
Japanese OEMs in Japan	170	173	206
European OEMs in Europe	494	357	341
US OEMs in North America	534	457	376
New entrant countries	409	615	201

renders the outsourcing of modules difficult. The drive towards modularity also called for a geographical change in the supply chain. With the need to provide sequenced parts deliveries at short notice, “supplier parks” were created in the 1990s that housed primarily module and systems suppliers in the immediate vicinity of the car assembly plant. And within these parks, logistics companies often took on tasks such as component sequencing and minor assembly tasks. In a general sense, considerable value added by the manufacturer was outsourced to component suppliers, and to a lesser extent, logistics service providers.

Interestingly, the structural changes in the auto supply chain do show a stark dichotomy. On the one hand, increasing outsourcing requires physical proximity to enable a fast response time to manufacturers’ call-off signals. On the other hand, manufacturers are increasingly sourcing components from distant regions with low labour costs, such as Eastern Europe, Mexico or China, which induces long logistics lead times. Despite the hype, China was still a net importer of components in 2004, but it is widely estimated that this balance will shift towards increased component export in 2008. Sourcing from China, however, creates operational tensions, in particular where customised or configured components are sourced from abroad. For example, the wiring harness is generally specific to a particular vehicle, yet very labour intensive, which poses a constant temptation to source it from low-cost regions. With a logistics lead time of as many as 6 weeks, this means that the build schedule has to be set for these 6 weeks in advance, which severely limits manufacturing flexibility and makes a rapid response to an impatient customer almost impossible.

The auto industry is undergoing considerable change, and it is in particular the structure of the supply chain that is changing. Caught between a rock and a hard place, manufacturers are trying to become more responsive to customer needs and avoid the costly inventories and sales incentives that cut into their profitability at present. At the same time, they are trying to reduce cost by outsourcing tasks, and by sourcing components from low-cost regions, and in some cases, even relocating their vehicle assembly operations to these regions. While the current competitive pressures in the motor industry are not likely to subside for the time being, logistics companies on both the inbound and the outbound side can harness these for their growth. Bridging the gap between distant component suppliers, and coordinating a supply chain that increasingly is not only measured on cost alone, but also on how fast it can deliver the product to the customer, is a task that neither vehicle manufacturers nor suppliers are particularly well set up to do. Here, logistics companies have the unique ability to integrate their core transportation business with additional value-added services that can include anything from component sequencing and the management of supplier parks, to the late configuration of entire vehicles (Reichhart and Holweg 2008). In an industry that features intense competition and a global stage at the same time, logistics companies are the connecting element in the system, and now have the chance to advance as an enabler of a supply chain that is both cost-efficient and responsive to customer needs.

2.4 The Future: Competing in the Second Automotive Century

At the turn into the second automotive century, the automotive industry finds itself in a complex competitive situation, and one that is hard to explain with the current notions of “craft, mass and lean producers” The reason is that the competitive landscape is much less clearly divided than it had been for most of the first automotive century. Boyer et al. (1998) illustrate this fact well by showing that – instead of a universal best practice – auto companies have developed individual forms of work organisations and production systems that are shaped by their respective national environments and business histories.

First, the persistent overcapacity in the industry has resulted in an unprecedented wave of mergers and acquisitions in the industry. Coupled with the financial crises in Asia and considerable mismanagement in many Japanese industrial conglomerates, the keiretsus, this has led to the situation that – apart from Toyota and Honda – all Japanese carmakers were at least partially owned by a Western vehicle manufacturer at the end of the 20th century. Also, most Western manufacturers have joined forces with others in order to achieve higher economies of scale in purchasing and product development, to develop a global brand portfolio, and to gain access to emerging markets. Many of these mergers have a rather troubled history, such as DaimlerChrysler and Mitsubishi, are far from delivering the financial returns that were hoped for, and have not led to the reduction in global overcapacity that had been hoped for (Holweg and Pil 2004).

Second, since almost all vehicle manufacturers across global regions have adopted lean manufacturing techniques, the competitive advantage of the Japanese has been considerably reduced. The results from the global assembly plant survey of the MIT International Motor Vehicle Program show that the gap between the US and Japan has been reduced to duration of build. As shown in Fig. 2.3, the average vehicle build takes 16.6 h in the US, compared with 12.3 h in Japan and 21.3 h in Europe (Holweg and Pil 2004). Equally, product quality has improved considerably since 1990. In fact, the quality has improved so much that JD Power

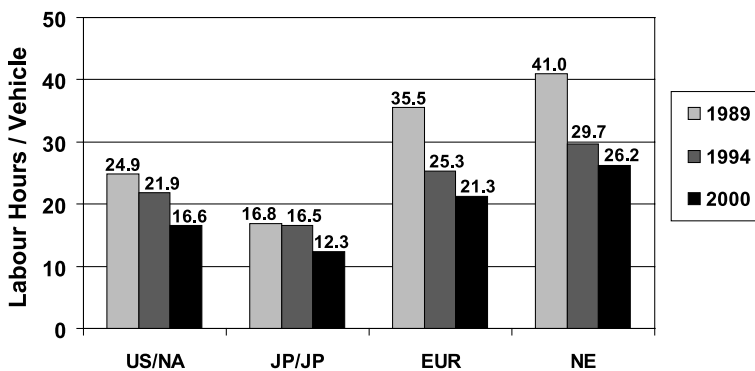


Fig. 2.3 Labour productivity across US, Europe, Japan and new entrant countries. Source: Holweg and Pil (2004)

(the institution that collects the customer quality data) had to tighten up their measurements in 1997, as most vehicles simply scored “zero defects”. Overall, our current benchmarking studies found strong evidence that the “message of lean” had indeed been heard in the Western world, and although Japan is still in the lead, the competitive situation is far less drastic than it was in 1990.

Third, the globalisation and wave of mergers in the 1990s also meant that a global identity is far less obvious to establish. The same applies to the brand image. Is Volvo still Swedish, or is Saab now American? Not only has the ownership of many “national” producers changed, some of their vehicles may also not even be produced in their “home countries” any longer in the future. This raises further questions as to whether any regional comparisons (the “Japanese” model against the “Western” model, for example), still make any sense. This is furthermore problematic as a strong local manufacturing presence dilutes the incentives for policy-makers. In fact, the Big Three have continuously been losing their market share in the US, and in 2002 even lost their majority in the US passenger car market, down from a market share of more than 90% in the 1950s. Accordingly, the assembly capacity that is being added to the US market is almost exclusively thanks to new Japanese, Korean and European transplants, whereas the Big Three show a consistent net loss of capacity and employment. Thus, the transplants make an attractive proposition to policy makers, and are generally being subsidised by the respective local governments. Building automobiles remains the world’s largest manufacturing activity, and the industry directly or indirectly employs one in every seven people (Sako 2002).

While the fortunes in the industry have changed drastically over the last century, the way we sell and distribute cars has not. In fact, Henry Ford’s legacy equally lies in the way we run factories, and sell the vehicles that have been made by our mass production factories. Craft producers used to build all vehicles to customer order in the 1900s. Henry Ford made his Model T entirely to forecast and sold the cars from dealer stock, which allowed him to run the factories as efficiently as possible. His reasoning was that running higher volumes at the factory would reduce unit cost, and thus the sales price. Lower sales prices in turn would increase demand, and therefore sales. This logic was fine when demand exceeded supply, but in today’s market, where increasingly demanding customers require customised vehicles at short lead times, this forecast-driven model is flawed (Holweg and Pil 2004). Yet, to date, most manufacturers drive their production by long-term sales forecasts, and then hope to sell their vehicles from dealer stock thereafter. As can be seen in Table 2.5, the majority of vehicles are still built to forecast across regions. The basic underlying problem of increasing the content of vehicles built to order (thus avoiding the costly inventory and sales incentives) are the long lead time it takes to build and deliver a vehicle to order. In Europe, the average order-to-delivery (OTD) lead time is 41 days, yet customers are generally only willing to wait 2–3 weeks (with the exception of few very patient customers, and the German market, where build-to-order has a long tradition). Thus, in order not to lose any sales to competitors with better availability, manufacturers produce vehicles against a sales forecast, and sell vehicles from stock, where they are

Table 2.5 Sales sourcing in major volume markets. Source: Shioji (2000), Williams (2000)

Sales source	Europe	United Kingdom	Germany	United States	Japan (Toyota)
Cars built to customer order (BTO) (%)	48	32	62	6	60
Sales from central stock (distribution centres) or transfer between dealers (BTF) (%)	14	51	8	5	6
Sales from dealer stock (BTF) (%)	38	17	30	89	34

instantly available to the customers. Supply is driven by the production forecast, and demand is adjusted by using sales incentives.

In a world of global overcapacity and fashion-conscious consumers, the results of this mass production logic are disastrous: vehicle manufacturers use increasing amounts of sales incentives to sell off their overproduction, and thereby not only erode their brand image, but also put serious strain on the residual values of their brands and models. This in turn hurts the (currently still) very profitable leasing operations of the vehicle manufacturers (Holweg and Pil 2001). In fact, manufacturers such as GM or Ford currently derive considerably more profits from their leasing and finance arms than from manufacturing cars in the first place. If the current make-to-forecast practice and the current levels of incentives persist, that situation may well change in the future. Since the start of the new millennium, the Big Three in particular have been fighting a war of attrition on the levels of incentives, and by 2004 levels of \$3,000 per vehicle were consistently observed as average across the US market, and exceeded \$5,000 for individual models. More recently, these incentives have also affected markets such as Europe, and surprisingly, the new entrant market, China, where the developing overcapacity is taking its toll.

2.5 What Next?

The question arises: what is to come next? What new concept might follow the implementation of lean production, increasing scale through platform-sharing, global mergers and collaborations, and build-to-order strategies? Where is the competitive realm going to shift after mass customising products? As could be observed in other sectors, the offer of services around the product could provide further differentiation. For example, one could think of providing a complete “mobility service” to the customer, rather than simply selling a vehicle. Yet, even if such advanced service offerings were to become mainstream in the near future, in terms of manufacturing strategy, however, such a shift would have little impact. Manufacturers would still build vehicles to customer specification, even if the customer does not own the vehicle any more, but simply remunerates a service subsidiary of the manufacturer for using the vehicle. Others argue that the internet will drastically

alter the way we market and sell cars, in the same way as telematics offers radically new ways of redefining vehicles as communication platforms (Sako 2002; Fine 2003). The largely unfulfilled promises of the e-commerce and internet applications, as well as the slow establishment of telematics applications in vehicles, however, cast serious doubts over their potential to radically alter competition in the automotive industry.

In my view, the next major change in the competitive realm is going to be triggered by a major shift in technology, i.e. the advent of a “disruptive technology” (Christensen 1997). Such radically new technology would then reset the competitive dynamics back to the days of Henry Ford – completely new technology will require considerable changes to current practices and change existing economies, as did mass production to the automotive industry at the time. Initially, manufacturers will seek to boost production volumes to achieve better economies of scale. The speed of adoption is critical, as the “chicken-and-egg” dilemma (high product price due to low production volume on the one hand, and low sales due to the high price of the product on the other) needs to be overcome quickly in order to reach market acceptance. Thus, as in the case of Henry Ford in 1908, the focus will be on minimising production costs and increasing the market share in order to establish new technology. Only once the market matures will the competition shift away from mere cost-driven strategies, towards variety, diversification, and customisation. The double helix dynamic that establishes itself, as shown in Fig. 2.4, is one that mirrors the developments in many other markets and industries, and one that has been used to describe the evolution of product architecture and other management processes (Fine and Whitney 1996; Fine 1998). Although we have seen these dynamics in many sectors, such as electronics and communication, many times over, the striking fact is that technology in the motor industry has not yet changed radically, and that we are on the verge of seeing the double helix complete with in the next few decades. And this change might, for example, be catalysed by alternative propulsion technologies entering the mass market.

It is not within the remit of this chapter to speculate about the adoption of advanced powertrains in the automotive industry. What is clear, though, is that environmental needs and the price of fossil fuels will require changes to the current

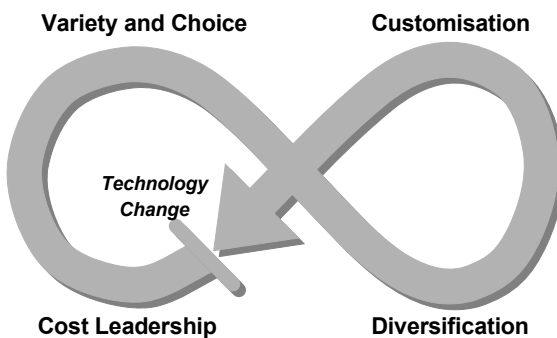


Fig. 2.4 Helix dynamics of competition in the automotive industry

powertrain technology. None of the options at hand has established itself as the dominant design or technology as yet – once this has happened, however, the dynamics of competition would run through the second cycle, with an initial focus on scale and cost leadership, moving towards greater variety and choice, and on to diversification, and ultimately, product customisation.

2.6 Conclusion

The competitive realm of the auto industry is dynamic, and has been throughout the past century. However, contrary to the past, the strategies adopted by firms are far less distinctly defined than they used to be. Over the last century we have witnessed the evolution from craft production to mass production under Henry Ford, to Sloan's policy of brand and product variety, to lean production, and more recently, to build-to-order initiatives at both volume and luxury vehicle manufacturers. Along the way, most manufacturers have adopted a wide range of mass and lean production tools and techniques, as well as Sloan's concept of a brand portfolio. Thus, today we see elements of all these approaches across manufacturers: the moving assembly line, the product and brand portfolio, model years, and lean production techniques are common at most manufacturers, even at those luxury makers that traditionally were seen to be "craft producers". In the process, the competitive realm has shifted considerably, and the main basis on which companies are competing has changed.

In this chapter, the dynamics of the competitive realm in the motor industry have been laid out over time, and four generic phases could be identified: cost leadership, variety and choice, diversification, and customisation. At present, most companies are at the diversification and customisation stages of this model, although it could be argued that Ford and GM in North America have remained at the "variety and choice" stage, competing on both cost and model variety, whereas others, such as BMW, Volkswagen, Toyota, Audi, and Renault, have found their diversifying feature: brand image, innovative design, leading product technology or manufacturing excellence provide the basis on which these companies have established individual competitive profiles. The next step, to provide individually customised vehicles, is well underway at most manufacturers, although some have chosen to opt out of this challenge. Honda, for example, has decided to compete on the basis of low cost through efficient production (enabled by forecast-driven strategies and low variety), rather than aiming at customising individual vehicles. Similar low-cost strategies can be expected from entry-level, low-cost producers such as Hyundai, Daihatsu, Proton, Kia and Daewoo, which are severely constrained by their import logistics lead times.

What is clear, though, is that all manufacturers have adopted the key elements of Ford's mass production system (consider the standardised work processes, the moving assembly lines etc. that are standard in assembly plants across the world), the need to provide variety and choice so drastically demonstrated by Sloan's

success at GM, and the lean production paradigm that laid the foundation for Toyota's persisting success. Thanks to the implementation of lean production techniques, the way we manufacture vehicles has changed considerably – the way we sell vehicles, however, has changed little since the days of Henry Ford. Large vehicle stocks and sales incentives are the inevitable by-products of the forecast-driven production and sales strategies still pursued by most manufacturers. Few companies have realised that the new competitive battle, in a setting of global overcapacity, increasing dynamic variety and customers demanding customised products, is how to overcome this second legacy of the mass production system: forecast-driven production planning and vehicle supply. Early adopters of BTO strategies such as Volvo (Hertz et al. 2001) and Renault ("Project Nouvelle Distribution") have the objective of linking the mass production facility to customer demand. Early adopters will undoubtedly face challenges; yet, most will likely also benefit the most from adopting BTO, whereas the remaining companies are likely to be forced to follow suit, or to continue on their mass production path and become the providers of low-cost, entry-level cars in a segment that will continually be challenged by low-cost import competition. Truly sustainable competitiveness in tomorrow's automotive industry can only be found in developing customer-responsive supply systems that respond to both demanding customer needs, as well as an increasing product and model variety that has invoked considerable changes in the economic foundations of the global automotive industry.

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Build To Order

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