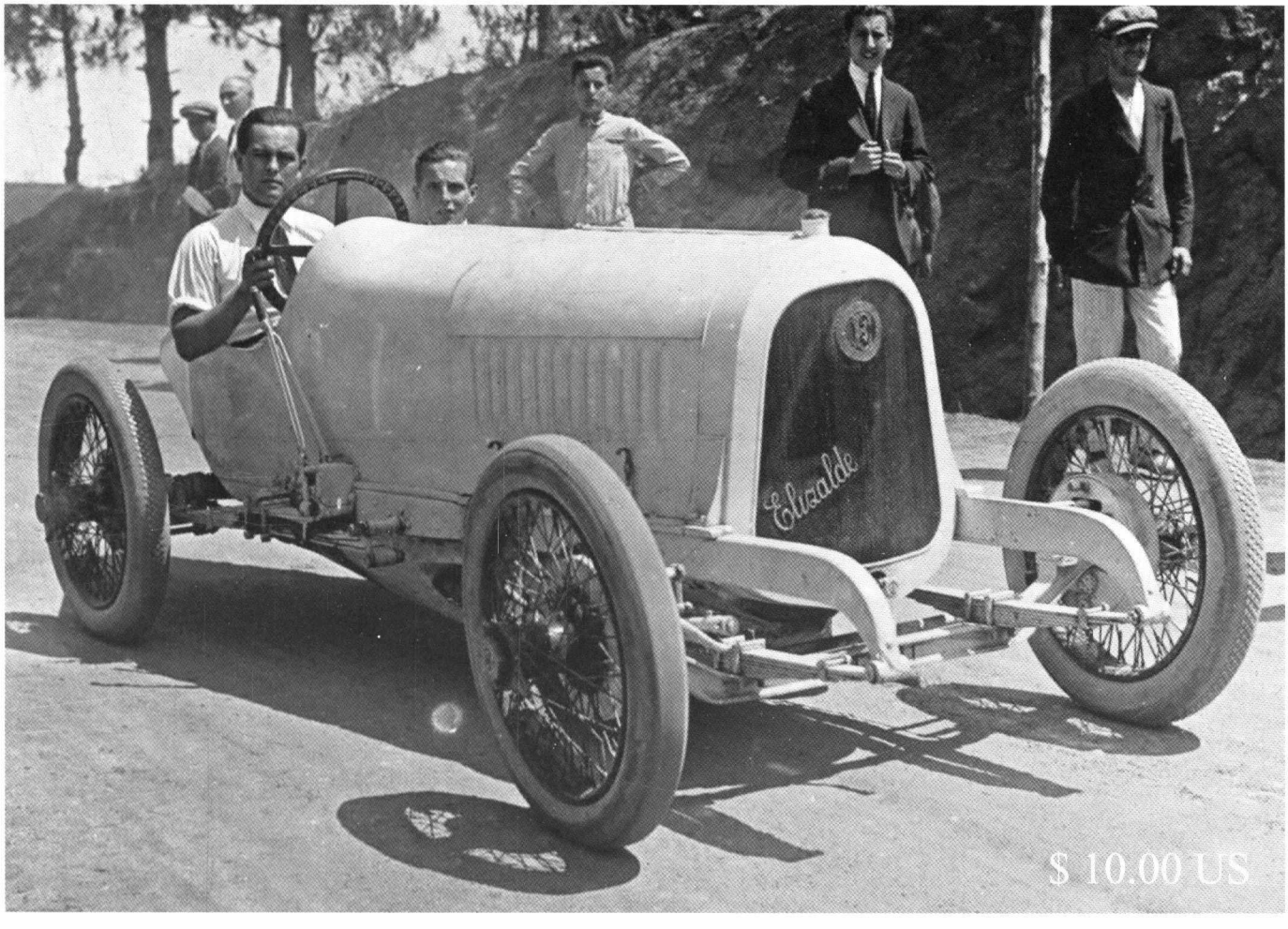
AUTOMOTIVE HISTORY REVIEW

AUTUMN 2013 ISSUE NUMBER 55



Proceedings of the Ninth Biennial Automotive History Conference
Philadelphia, Pennsylvania, April 12-14, 2012

THE SOCIETY OF AUTOMOTIVE HISTORIANS, INC.

An Affiliate of the American Historical Association

Chairman's Notes

This issue of *Automotive History Review* is devoted to the publications of papers and abstracts of papers presented at the Society's Ninth Biennial Automotive History Conference held at Philadelphia, Pennsylvania, on April 12-14, 2012. This was the initial effort in the new program whereby the Society has assumed full responsibility for the conference which was in the past hosted by a member museum under the umbrella of the National Association of Automotive Museums. The positive reception given by presenters and attendees is evidence that the Society is up to its new responsibilities and can move forward with confidence to reinforce its credentials in the world of historic studies.

The conference theme, "A World of Cars: Manufacturers, Drivers and the Impact of Globalization" was selected because the international character of the automotive industry was established in its earliest days when production was dominated by European and North American firms. In recent years it has expanded to follow growing world markets in ways not previously thought possible. Several presenters focused on the beginnings of the motor vehicle while others discussed the turbulent period through which the industry is now passing, all of it demonstrating that automotive history is a story that is far from reaching a final conclusion. Six of our sixteen presenters joined us from abroad giving further evidence of the global significance of the issues that confronted the industry in the past and continue to do so today.

The conference continued with a visit to the Hagley Museum and Library in Wilmington, Delaware, the birthsite of the DuPont Company where its historic gunpowder and blasting powder works have been preserved. As we know, DuPont played a pivotal role in supporting a struggling company that soon became the most successful American automobile manufacturer. We concluded the tour with a visit to the Simeone Foundation Automotive Museum where our host, *Dr. Frederick Simeone*, introduced us to his iconic collection. At the closing dinner, surrounded by historic competition cars, keynote speaker, Dr. Mira Wilkins, spoke on "Foreign Investment in the U.S. Automobile Industry – An Historical Perspective." Many of us were familiar with Dr. Wilkins' much acclaimed work on Ford Motor Company's international business activities, *American Business Abroad: Ford on Six Continents*, published in 1964, but had not had the privilege of hearing and interacting with this path-breaking scholar. The opportunity was a high point of the conference.

The Tenth Biennial Automotive History Conference will be held in Palo Alto, California, from April 10-12, 2014. We are grateful for the support of the Revs Program at Stanford University, which has made it possible for sessions to be held at the Vail Automotive Innovation Facility on the Stanford campus. The conference theme will be "The Evolution of Automotive Technology" and will focus on the continuing development of the motor vehicle and its process of manufacture over a 120-year history. The development of future transportation technologies by electronics companies in the Bay Area as well as the Revs Program's focus on the historical automobile as a technical, industrial and aesthetic achievement underlie the choice of the conference theme. We encourage all to plan to attend this exciting event.

Arthur W. Jones

From the Editor

The papers chosen for publication in full in this issue indeed follow the global theme of the conference: "A World of Cars." Hans Heese treats us to a tale of automaking in South Africa, whose auto industry flies beneath the radar of most historians. It is not a simple story, for it involves the cultural and ethnic implications of Asian investment and immigration in what was then a segregated country.

When we think of Spanish automaking it is usually Hispano-Suiza that first comes to mind, followed perhaps by Pegaso and SEAT. What we don't realize is that Spain has its own "Detroit" in the Barcelona district, where automobile manufacturing is concentrated. Jordi Catalan Vidal tells the story in detail, from 1889 to the present day.

Today the German automobile industry is considered almost invincible, but it was not always so. Between the two world wars, the "American threat" was considered very real and steps were taken to protect against the inexpensive, yet reliable cars from the United States. Christiane Katz describes the measures taken by industry and government to improve their own production methods and keep out foreign competition.

Finally, Michael Wynn-Williams explores how economies of scale affect automobile manufacture, and comes up with some surprising conclusions. Bigger is not always better, and there are limits to the advantage of growth. Changing legal requirements and consumer demand affect the optimum size of an automobile company, as does changing technology, and these effects cannot be easily predicted for the future. His article also discusses the role of joint ventures, in particular multinational ones.

Abstracts of the other papers presented at the conference begin on page 40. In the last conference issue, Number 53, I said we were living in "interesting times." If anything, the present is even more so.

Kit Foster

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Back cover: MG lives: The MG 6 is built by MG Motor in China, and since 2011 from PKD kits at Longbridge, UK. Wikimedia.

Politics and Profitability in South Africa

A case study of Toyota and Lexus, 1961-2011

By Hans Heese

Department of History, University of Stellenbosch, South Africa

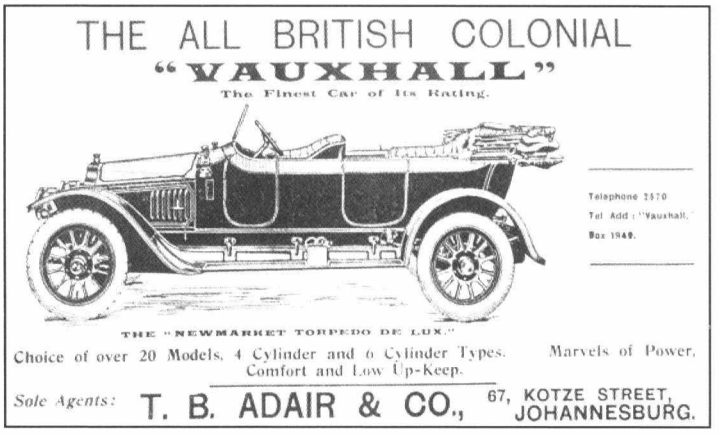
Introduction

The first car to have been imported to Southern Africa, a Benz Velo, was displayed to the public in Johannesburg in 1896. The president of the Transvaal Republic, Paul Kruger, was present at the occasion; but when offered a ride, he declined, thereby missing the chance to be perhaps the first head of state to be driven in a horseless carriage. However, in South Africa cars only became popular after the end of the Anglo-Boer War and the onset of British colonial rule in the whole of southern Africa. As a result, the vast majority of cars were imported from Great Britain. During the mid 1920s, Ford and General Motors both established assembly plants in Port Elizabeth. South Africa, as a member of the British Commonwealth, eventually received most of the completely knocked-down (CKD) units from Canada at lower import taxes. At the time of the Empire Exhibition in Johannesburg in 1936, the following full-page advertisement appeared in the *Cape Times* of September 18, 1936: "Buy Empire Products - Canada buys South African products. When you buy a Ford Car or Truck you buy a Canadian product made by Canadian labour assembled in Port Elizabeth with exclusively South African White labour." At the time General Motors also placed advertisements stating that the assembly of General Motors vehicles in Port Elizabeth was done by *White* workers (author's emphasis).

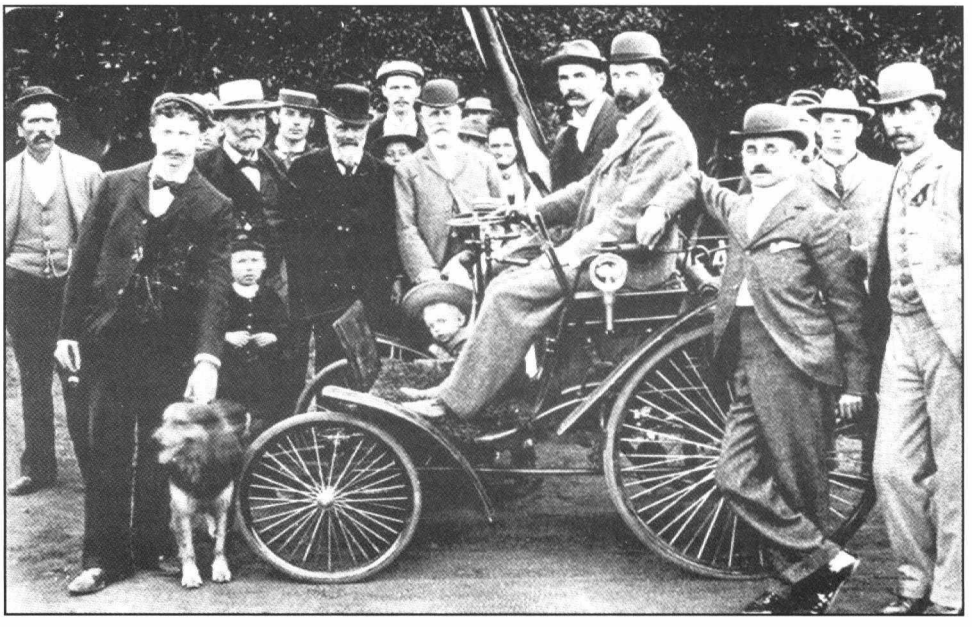
Roads in South Africa, even main routes, were often just rough ox wagon trails, slightly upgraded as motor vehicles gradually become more popular. As a result, the sturdier and heavier American Chevrolets and Fords soon dominated the market, since the English and Continental cars were too small and light for the harsh African roads and the huge distances between towns and the few cities. In this way, the development of the car industry and the choice of type of vehicles were similar to Australian conditions: a small population spread out over the huge outback, connected mostly by rough dirt and gravel roads. Only when tarred roads appeared in the 1930s did British cars grow in popularity. In 1950, with a war economy still in place, 55 percent of cars imported to South Africa came from the United Kingdom; for Australia, this figure was as high as 85 percent (*The Motor*, May 9, 1951, pp. 406-408). At that stage, South Africans preferred to buy cheaper Vauxhalls from England rather than more expensive General Motors products built in North America, and they preferred British Ford Zephyrs to American V8 Fords and Mercurys. The reason was simple: the UK sold cars for British pounds while American dollars were few and far between and their flow was strictly controlled by the South African government.

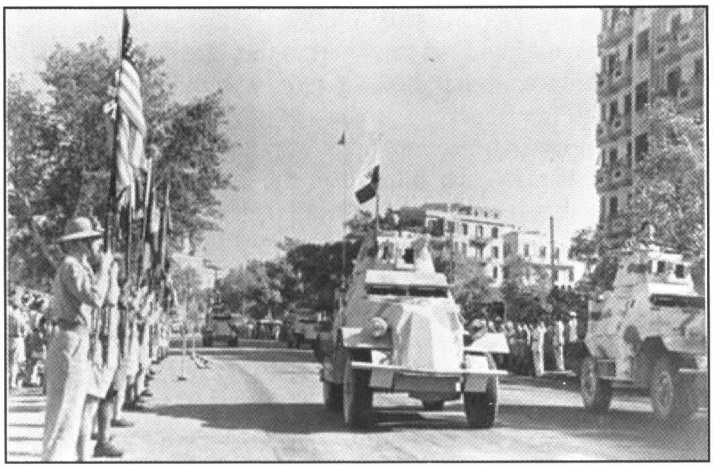
World War II

It was only during World War II that the Ford plant in Port Elizabeth started manufacturing, not merely assembling, Ford army trucks for use by the South African Defence Force in East and North Africa. However, the most important event was the planning and development of a South African armored car, begun in 1938 as dark war clouds rolled over Europe.



Above, General Motors stressed the Colonial roots of Vauxhalls sold in South Africa. Below, Willem Leyds, State Secretary of the South African Republic, in a Benz Velo, the first car imported into South Africa, in 1896.



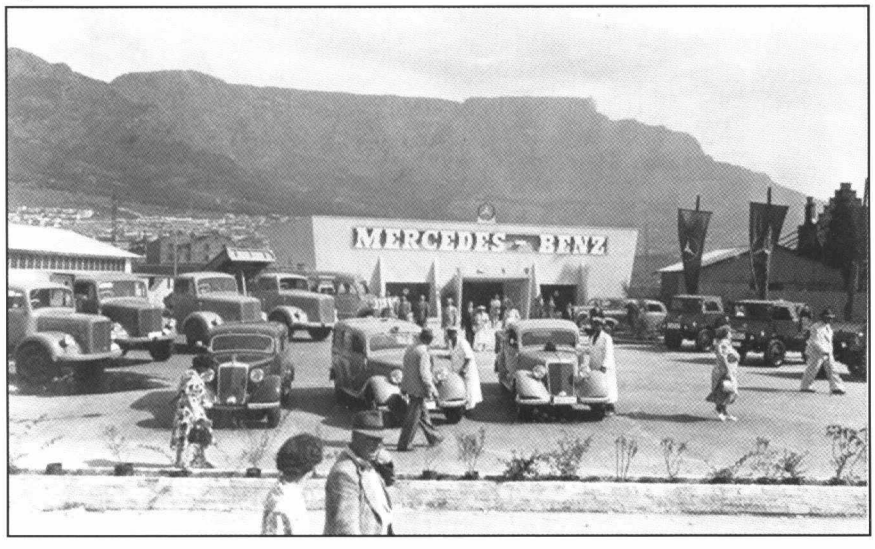


Ford-based Marmon-Herrington armored cars developed in South Africa were widely used in World War II.

The armored car was based on a three-ton Ford V8 truck fitted with armored steel supplied by the Iscor steel works at Van der Byl Park near Johannesburg. The vehicles were assembled at the Dorman Long factory that also built rolling stock for the railways. The first models were two-wheel drive, but when the next series came off the line four-wheel drive was introduced, utilizing the American Marmon-Herrington 4x4 conversion kits. This series subsequently became known as Marmon-Herrington armored cars. When supplies from America had been exhausted, the running-gear of Canadian Ford 4x4 trucks was employed until the end of the war.

Many of the South African-built Marmon-Herrington armored cars did not return home after the war; the British forces used at least a thousand or more in other operational areas in the Mediterranean. There are still examples on display in military museums in Israel and Greece. The international success of the Marmon-Herrington armored cars opened the door for the future manufacturing of motor vehicles, not only their assembly, in South Africa.

Already in the early 1950s, the government encouraged manufacturers to use local materials in automotive production. This started off in a small way: first batteries and tires, then the spray-painting of vehicles and the addition of wing (fender) mirrors, followed by local body pressings and electrical equipment. This period also witnessed the increase of local assembly plants for British and Continental manufacturers like BMC (Austin and Morris), Volkswagen and Mercedes-Benz. Further, it saw the arrival of the first Japanese imports to the country when a small number of tiny Datsun cars and mini-trucks landed on the South African shores in 1958.



Among the foreign manufacturers assembling vehicles in South Africa by the 1950s was Mercedes-Benz. This photo was taken during the Jan Van Riebeeck tercentenary festival at Cape Town in 1952.

The Year of Africa

The year 1960, the official "Year of Africa," was a crucial one for South Africa. The British Prime Minister, Harold Macmillan, visited several British colonies in Africa in January 1960 and conveyed the message that these territories were due to receive their political independence from Britain and become equal members of the British Commonwealth. On January 3, 1960, he addressed the Houses of Parliament in Cape Town and repeated a speech he had earlier given in Ghana. The speech, starting with the words: "A wind of change is blowing over Africa," signaled the beginning of the end of minority and settler rule on the continent. From the side of the South African government, which had introduced apartheid in 1948, the response was one of firm rejection. Under apartheid, official race classification was introduced that classified the population as White, Cape Coloured, African (Black) and Asian (Indians). Political rights for individuals not classified as White differed from province to province. In the more liberal South, Cape Coloureds could vote in parliamentary elections but had to vote for White candidates; Cape Coloureds also had to live in designated areas, separately from Whites. Under no circumstances would the government allow a one-man, one-vote system in a racially undivided country where Whites were outnumbered nearly ten to one. This they made quite clear to the international community. At home, Black (African) people, who had to carry identity documents (or pass books) with them at all times, protested against this discriminatory measure and marched on the police station of Sharpeville in March 1960 to turn in, or burn, their pass books. The police panicked and fired into the crowd, leaving 69 dead. Within hours the world took notice of the harsh side of the South African political system of apartheid and reacted with threats of economic boycotts and even military intervention.

The United Nations debated the introduction of economic sanctions against South Africa at great length. The events of March 1960 caused concern for foreign investors and a number of international companies withdrew from the country as the profitability of a long term investment seemed unwise. Yet, this negative view of the South African economy proved to be wrong as it eventually experienced an unexpectedly high growth rate and profitability after political stability had returned. At the same time, the white population, alarmed at events

in the newly independent Congo, marked by chaos, murder, rape and executions which had become daily occurrences, took a tough stand and prepared for armed resistance.

The year 1961 also proved to be crucial in the South African political calendar, when the Republic of South Africa was established. Knowing that the country was not welcome in the newly-enlarged British Commonwealth, where Asian and African countries would be in the majority, they withdrew their membership. The South African government suddenly realized that it had few friends left. It was exactly at this stage that a second Japanese brand, Toyota, entered the local market, an event that would eventually change the economic, social and political conditions over the next few decades.

"Beach apartheid" was a fact of life in pre-1960 South Africa. In order to attract Japanese investment, the Japanese people were designated "honorary whites."

With the arrival of Japanese companies in the late 1950s, the apartheid government found itself in a dilemma. According to the apartheid laws, the Japanese were considered "Non-Whites" or "Non Europeans" and Japanese officials would have to, according to the apartheid doctrine, live in designated and inferior "Coloured" areas. If they travelled in the country, they could not stay over in any hotels or have a meal in any normal restaurants or diners. At filling stations they would have to use the inferior toilet facilities designated for "Non Europeans" and not those for "Europeans." (American visitors to South Africa during the fifties also found the "Europeans Only" signs most confusing.)

Japanese: From "Coloureds" to "Honorary Whites"

Contact between Japan and South Africa dates back to the 17th Century. The first two commanders at the Dutch settlement at the Cape, Jan van Riebeeck and Zacharias Wagner, both served the Dutch East India Company at the trading post at Nagasaki before they took up their positions at the Cape. Also, among the very first slaves at the Cape of Good Hope was a certain Anthony from Japan (Osada 2002, pp. 27-29).

During the 19th and early 20th centuries, a number of Japanese, mostly businessmen, settled in South Africa. The Anglo-Boer War drew the attention of the Japanese Government who wanted to learn more about the British art of warfare, although popular support in Japan was on the side of the Boers. This situation was similar to the attitude of the Germans and French governments that did not want to alienate Britain, although the general sympathy of the people lay with the Boers.

The visit of a Japanese warship to Cape Town in 1910 was of particular interest to the Cape Coloured community. In the newspaper of the African Peoples' Organisation, *APO*, the editor wrote that the ship *Ikoma* and its crew showed the technical progress that "coloureds" could make and that it should serve as an example to and inspiration for the Cape Coloured people of South Africa. He referred to Japan as "the mighty continent of Asia" (*APO* May 7, 1910, p. 11; also mentioned in Osada 2002, pp. 33-4). The next year, the Cape Coloureds did not show the same enthusiasm for the cadets on the Japanese training vessel when they again visited Cape Town, as they were now allowed to sit on the pavilion for white South Africans at the Newlands sports stadium—something which had been forbidden to the Cape Coloured people. Yet the APO again referred to the mighty power of "coloured" Asians who had their own warships, something the (White-controlled) Union of South Africa still lacked at that stage (*APO* May 6, 1911, p. 4).

Faced with the dilemma that started from 1960 onward, with increased calls for economic sanctions from the international community, the government encouraged an indigenous car industry to make it less dependent on imports. The further development of the automotive industry, as well as the armaments industry, would be the first priority of the apartheid government. The first step was to encourage local manufacturing instead of simply assembling vehicles. But how does a government attract Japanese investment while treating its subjects as second class citizens? The answer that the apartheid thought up was quite simple; make the Japanese "honorary whites." Mr Jan de Klerk, Minister of the Interior and father of the later State President F.W. de Klerk, stated in Parliament in April 1961 that "for the purpose of the Group Areas Act members of the Japanese group are regarded and treated as members of the White group" (Osada 2002, p. 55).

This was, however, not so simple. Cape Coloureds were angry that they, who shared the same language and culture as white South Africans, but who were often only of a slightly darker complexion, could not share in the privileges of the Japanese. Also, many Whites did not and could not distinguish between Japanese and Chinese and other Asian people. A number of incidents with international repercussions were reported in the press. Of particular interest was the decision of the Pretoria City Council to prohibit a Japanese swimming team from practicing in a swimming pool in a White residential area in the city early in 1962 (*Die Burger*, Feb. 1, 1962). This incident might have partly influenced the decision to bar an all-white South African team from the Olympics in Tokyo in 1964. In later years a Japanese jockey was also not allowed to take part in a South African horse race, an incident that also had international repercussions. The decision of the local council was reversed when it came under fire from the central government for taking a decision that harmed the image of the country internationally. The entry of Datsun/Nissan to the South African market in 1958, and especially Toyota in 1961, probably influenced the liber-

alization of the strict racial policy and structures of the day, as the country could not afford to lose any more friends and allies at this stage of the history of the country.

Toyota Arrives

Johannesburg Afrikaner entrepreneur Albert Wessels started off as a bank clerk but eventually progressed to a clothing company before he entered the automotive industry. His involvement with the importation of French Panhards and Czechoslovakian Škodas did not prove successful. It was only after a visit to Japan to acquire special cloth and material for his clothing business that his path crossed that of the Toyota Motor Company. This was the beginning of his personal success story, and that of Toyota in South Africa.

Albert Wessels (1908-1991) eventually became the managing director of Toyota South Africa. After his death, his son Bert (1944-2002) succeeded him as Executive Chairman. After Bert's death, his sister, Elizabeth, joined the Board as Vice-Chairman until the Toyota Motor Company of Japan took final control of its South African operations. This success story of an Afrikaner who entered the English-controlled business world runs parallel with that of Anton Rupert, who started off in the cigarette business and built a world empire based on tobacco. He eventually progressed to the international luxury goods and investment sector. Both men were members of the small Afrikaner elite who subscribed to the basic philosophy of separate development but were critical of the application of so-called petty apartheid. In 1962 the Japanese External Trade Organisation (JETRO) advised "Japanese firms should use 'politically powerful Boers' [Afrikaners] as their agents, not English-speaking South Africans who were under the control of European companies" (Osada 2002, p. 56).

Until 1959-1960, South Africans still believed that any products made in Japan were of inferior quality and cheap copies of existing products and that only cameras and radios from the Land of the Rising Sun were worth buying. The successful introduction of the small Datsun Bluebird cars and tiny bakkies (pickups or small trucks) to the South African market in 1958 proved that perceptions were beginning to change. From January to June 1959, 36 Datsuns were sold; from January to June 1960, sales more than doubled to 82 and the number of dealerships, also those in rural areas, increased steadily (*Motorgids* May 1961, p. 4). This occurred despite the fact that South African farmers were used to big American trucks and cars.

Wessels learned something from the importers of Datsuns. The first batch of Toyotas, which arrived in 1961, comprised 10 Stout pickups, much bigger than the Datsuns. Although smaller than the typical American bakkie, it could carry a much higher payload and the cabin was much bigger. To emphasize the space of the cabin to its South African audience, a Toyota advertisement for the Stout pictured three well-known, huge Springbok lock-forward rugby players in the cabin and 1½ tons of cargo in the back. To compensate for the lack of cubic inches in the engines, Toyota installed very low gear ratios. They proved to be so popular that in 1962 the 30 Toyota dealers sold 384 vehicles. In 1963 Wessels offered shares to the public and the sales of imported units that year topped 2,332 (Thomas 1993, p. 2).

But Wessels also gained from the initiatives of Nissan, who actively and successfully competed in tough South African car rallies. Time and again, works driver Ewold van Bergen, driving Datsun Bluebirds from 1963 to 1971, showed that Japanese cars ought to be taken seriously when factors like performance, durability and reliability came into play. When the Corona was launched as a locally-manufactured sedan in Durban in 1966, Toyota also took the rally route to establish the same solid reputation that Datsun had built up in the span of a few years. Toyota managed to get Jan Hettema, a former Springbok cyclist and Alfa Romeo and Volvo rally driver, to drive the Corona to victory. In 1968, Toyota scored first places in three rallies, followed by one Datsun victory. Altogether the Japanese entries won half of all the national rallies. In 1969 the Japanese entries won seven of the nine national events (Houghton n.d., pp. 17-20). As a result of these successes no one doubted the quality of Japanese cars any longer and dealers had problems supplying an eager motoring public with new vehicles in the showroom.

South African assembly of the Toyota Corona, above, began in 1966. Below, Bert Wessels greets "Madiba," Nelson Mandela, before a new Lexus.

It was the success of Toyota's light trucks that made it the number-one seller of light commercial vehicles in the country. Toyota was honored as Company of the Year by the local financial press in 1968. The best seller in the Toyota range was the Corona bakkie that was built from 1963-1970, when it made way for the record-breaking Hilux bakkies. In South Africa, like Australia, sedans with truck-like loading bays were very popular. In Australia they are called "utes" (for "coupe utility"); the corresponding South African term is "bakkie." General Motors produced locally-developed Opel bakkies, which had been exported to East Africa since 1958. Ford later followed suit. The model that gave Toyota the reputation of building tough, reliable and economical vehicles during the early 1960s was the Stout bakkie.

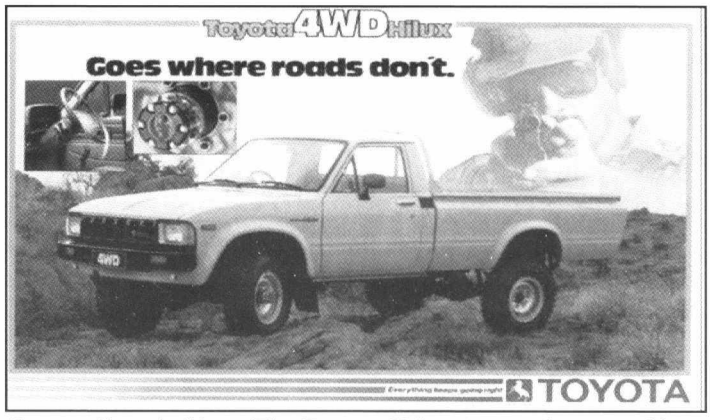
Despite the Sharpeville massacre in 1960, the renowned South African motoring historian Fred Schnetler described the Sixties as the golden age of motoring in South Africa. Despite political problems surrounding the policy of apartheid, all the manufacturers from Europe and North America had a presence in South Africa, mostly because of the protection the motor industry received from government. An extremely wide range of vehicles had been produced. This Schnetler saw as a sign that making cars in South Africa was at that stage a profitable undertaking. He also very aptly stated "For South Africans, the 1960s and 1970s were the years of the Rising Sun" (Schnetler 1997, pp. 49, 51). This applied to Toyota in particular as one success led to another, especially in the escalating sales and market shares.

In 1972, the company Motor Assemblies, in which Toyota (Wessels) had a major share, was built at a cost of R15m (about $20 million US) to increase the building capacity of both cars and bakkies. In 1979 Toyota took control of the company but used the surplus facilities to build Renault cars until 1984. Many Toyota dealerships also sold Renault 5s during this period of consolidation.

Leon Sullivan and the German Reformers

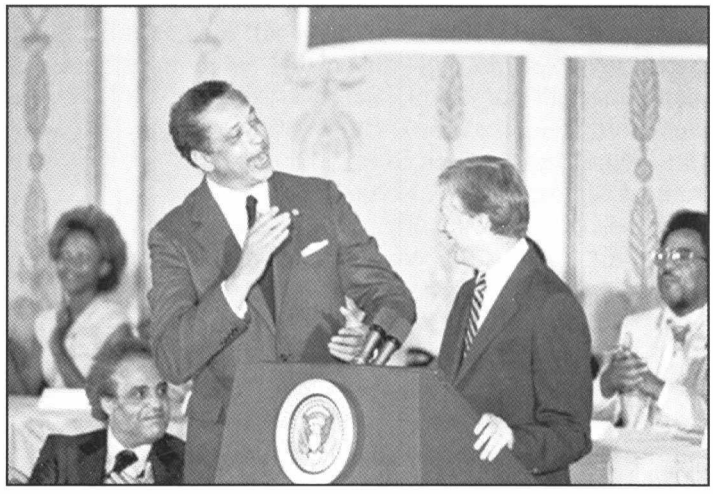
During the 1970s, South Africa again became the focal point of international media after the student revolt in the black township of Soweto in 1976. Until then, the anti-South African government movement had its strongest support in Europe. After Soweto, this movement spread to the United States where the Reverend Leon Sullivan, a civil rights campaigner and a member of the board of GM, had drafted a code of conduct for American companies who did business with South Africa. The code called for the abolition of apartheid on the shop floor and radical improvements in the economic and social conditions for the predominantly Black workers. This led to the disinvestment of a number of American companies in South Africa and included the car makers General Motors, Ford and other companies like IBM and Kodak. The irony is that local conglomerates bought these companies and the production of cars continued, albeit in South African hands.

At the same time, it was not only the international conscience that was troubled about the inequalities in South African society. Following the 1976 tragedy, the apartheid government reviewed labor legislation that discriminated against Black workers. The economist Nic Wiehahn was appointed to investigate the improvement of labor legislation. His report was adopted in 1979 and included in new legislation that gave Africa its most liberal labor laws and legalized Black trade unions. In practice this meant that not only labor problems were brought to the factory for arbitration but also politics, since the most important Black political organization, the ANC, had been banned in the early 1960s and now could act through the trade unions that took orders from the African National Congress leadership-in-exile in Lusaka, Zambia. The German trade union for metal workers, IG Metal, also had regular meetings and consultations with the black trade unions in South Africa, resulting in European norms being applied to South Africa. This was probably the only initiative IG Metal ever undertook in Africa.



Best-selling bakkie: The Toyota Hilux 4x4 pickup quickly became the most popular of its genre.

Many of the elements of Leon Sullivan's code were reflected in the new policies of the government of the day. But pressure to reform did not come only from the USA. Germany, second only to Japan as the most important player in the automotive sector during the 1970s and 1980s, had to conform to European Union guidelines for operating in South Africa. All the German companies had to report annually to a special office in Bonn on progress in breaking down apartheid within the industry, as well as the development of



The Reverend Leon Sullivan, seen here with U.S. President Jimmy Carter, was a civil rights activist and member of the General Motors board. His code of conduct for companies operating in South Africa led to disinvestment by many multinationals, including GM, and opened the door for local backing.

social development schemes. Most of the negotiations between foreign reformers and the South African government took place behind closed doors in Parliament in Cape Town. It was a matter of quid pro quo. The message was clear: reform and the Germans would invest; if not, they might withdraw, like the Americans had done, and leave the country in economic chaos. Unfortunately there is very little documentation of these crucial, informal discussions that took place during the late 1970s and 1980s.

Japanese Actions and Reactions

Despite the official anti-apartheid stance of the Japanese government, trade between South Africa and Japan grew steadily. Also, the Japanese public was largely kept in the dark. Masako Osada (2002, p. 68) quotes an in-depth article in a business newspaper on South Africa in 1981 that mentioned the "Bushmen," "Hottentots" and other European groups in the country but not a word about Blacks or the institution of apartheid.

By 1987, things had changed dramatically. Oliver Tambo, president of the ANC, visited Japan and at a meeting with the Foreign Minister, Mr. Kuranari, the minister stated: "The Japanese are of a coloured race. We have also fought against racism."

The following year a number of Japanese parliamentarians issued a statement calling for the South African Government to stop oppressing its own people; for the Japanese companies in South Africa to improve the treatment of their black employees and to reject the classification as "Honorary Whites." Large donations were also made to anti-apartheid movements and the victims-of-apartheid fund in South Africa (Osada 2002, pp. 75-78).

The announcement by President F.W. de Klerk on February 2, 1990, in Parliament that the ANC, Communist Party and Pan Africanist Congress were unbanned, and that Nelson Mandela would be freed shortly afterwards, was as unexpected as the fall of the Berlin Wall a few months previously. Already, in October 1990, Mandela had paid a visit to Japan and had had the honor of making a speech in the Diet, an unusual event for any person not a head of state. The Japanese government, however, turned down his request for a donation of about U.S. $25 million for the funds of the ANC: they thought it wiser to donate money for the uplift of Black people in general.

In 1994, following the first democratic election and the establishment of the new fully representative government under the leadership of Nelson Mandela, South Africa again became a respected member of the international community. This eased the way for new investment in South Africa and in 1996 Toyota Motor Corporation (TMC) in Japan made headlines when it bought a 27.8 percent share in the ownership of Toyota of South Africa operations. In 2002, TMC again increased its share to reach 74.9 percent with Wesco Investments, stemming from the original Wessels family fortune holding 25.1 percent of the equity (Houghton 2011, pp. 41, 45). In 2008 TSA became totally integrated in TMC, but the South African component still plays a major role in management, with Dr Johan van Zyl as President and Chief Executive of Toyota South Africa Motors.

As the role of TMC in the management of the local Toyota subsidiary increased after 1990, the South African operation for the first time became a global player. The export of vehicles manufactured grew annually. Toyota exported 1,726 vehicles of the local production in 1992; in 2005 it grew to 46,187 and by 2008 it had reached a peak of 127,453. At the same time, as import restrictions lessened, 36,147 fully built-up models were imported in 1994 and this grew to 40,495 in 2010. The export markets not only comprise neighboring states, but include West Africa, Europe and Scandinavia, all supplied with Hilux bakkies and Fortuner SUVs. Imports come from Toyota plants in Japan, Asia, Australia and Turkey.

Although Toyota had one annual financial loss, this was mostly due to the fluctuation of the South African Rand

Above, in 1970, Toyota celebrated the 100,000th sale in South Africa, a tremendous achievement from seven cars in 1962. Below, Toyota South Africa Motors president and CEO Dr. Johan van Zyl, right, with developer Richard Maponya, left, and Nomvula Mokonyane, premier of Gauteng province.

A swarm of Toyota HiAce minibus taxis. Called "Matatu" *in Kenya,* "dala dala" *in Tanzania and* "tro tro" *in Ghana, they form the backbone of shared public transit in all of Africa.*

against the Yen. Even when the company underwent a 49-day strike in 1992, it still managed to make a profit and lead the local market in sales.

Leveling the Playing Field

When the South African "Berlin Wall" gradually disintegrated during the period 1990-1994, Japanese confidence in South Africa grew steadily. This also witnessed the introduction of the premium market Lexus into South Africa in 1993. In 1998 the second generation GS 300 models arrived, followed by the popular RX 300 sports utility models and the RX 400h gasoline-electric hybrid in 2008. The latter vehicle is of course from the technology used in the Prius. As in the USA, the Prius became the most popular hybrid in South Africa and is still regarded as the most environmentally-friendly vehicle on the market. Lexus hybrid models are gaining popularity in the premium car category where an increasing number of wealthy, educated and sophisticated individuals really care about the environment – and Toyota is the only car manufacturer currently offering such models there.

At another level, Toyota was chiefly responsible for the success of the Black Taxi Revolution that gave rise to real and meaningful Black empowerment. This transport revolution, squarely in the hands of Black entrepreneurs, preferred the South African-made Hi-Ace minibus. When the minibus taxi business was firmly established in the country, the new industry was unofficially "exported" to neighboring countries, so too the locally made Hi-Aces. In the commercial vehicle range built in South Africa from 1969 until 2010, the Hilux bakkies accounted for 823,265 units and the Hi-Ace 212,226 units. When the government regulated the taxi industry and introduced new safety standards, the imported Quantum minibuses from Japan replaced the locally manufactured Hi-Ace buses and again became the most popular vehicle in the business. In March 2012, Toyota announced that these vehicles will in the future be assembled in South Africa and also supply the local and neighboring markets. As the largest vehicle manufacturer in the country, this opportunity will again create more jobs for South Africans.

The "positive wind of change" that blew over South Africa in 1994 enabled the country to become a fully-fledged member of the international operations of Toyota Motor Company, also as a manufacturer for the export of vehicles. In 1992, the South African plant exported 1,726 locally-made vehicles to African states. These figures gradually increased to 127,453 vehicles in 2008, including markets as far apart as Scandinavia, Germany, West Africa and Australia and vehicles ranging from Hilux bakkies and Corollas to the Fortuner SUV. With import restrictions virtually something of the past, Toyota in South Africa now exports more vehicles than it imports.

Conclusion

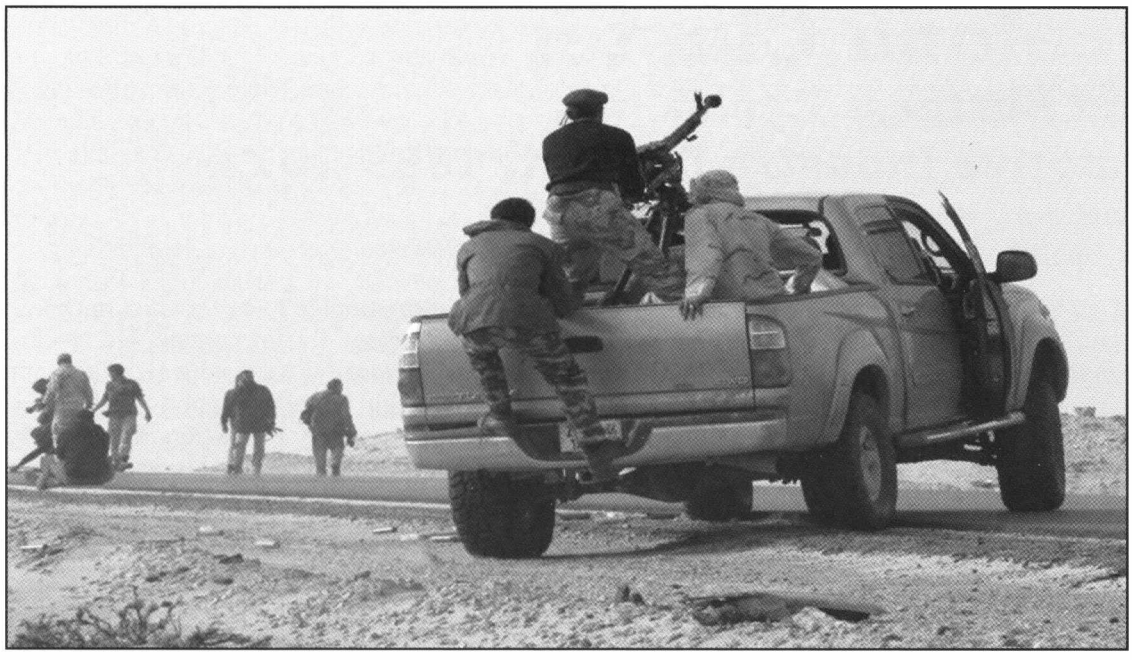
Historians can but should never attempt to predict the future. Economists do, and are often proven wrong. This is especially true in Africa.

The highly-respected study by Altshuler, Anderson, Jones, Roos and Womack, *The Future of the Automobile* (1984, pp. 34-35), had the following to say on vehicle production in South Africa (and Australia):

> Two countries outside the major auto-producing regions have had substantial auto industries for 30 years, fostered by a long history of government efforts to promote local manufacture. However, neither Australia nor South Africa has developed an export industry, and it is difficult to see any competitive superiority developing in these locales, which share the disadvantages of relatively high wage rates, small domestic markets, long shipping distances to domestic markets, and low labour productivity compared to Japan.

In addition, Jones, the European Director of the study, was interviewed by David Duncan in 1992, when he expressed the following thoughts:

> In global terms, the Third World seems set to be a marginal producer of cars, at least into the foreseeable future: The Japanese see Europe, North America and Japan/South East Asia as the major growth poles. The next one will be in Brazil. Africa is 20 years off - we'll look at it when it comes ... In the meantime, South Africa shouldn't dream of surviving on its export market - there are possible niches, but no more. The distances are too huge. Growth will be local. It is unlikely South Africa will be world class in quality—it can't steal a march on the lean producers in Europe and Japan." (Duncan 1997, pp. 185-189)



Left, crew-cab Toyota 4x4 Hilux is the successor to South Africa-built Marmon-Herringtons in North Africa.

The report is correct, but only up to a certain point. South Africa (and Australia) will probably never join the ranks of major role players. But they are now part of the global Toyota Motor Corporation and do at least play a major part in boosting the economies of the two countries. An example is the import and export of economies-of-scale-produced Toyota models between the two countries, e.g. Australia recently supplied Camrys to South Africa in exchange for locally-built Corollas. This is not on a huge, worldwide scale but it has had a very strong impact on the local automotive industry and, more importantly, on the national economies. In this respect, the role of Toyota in establishing factories and stimulating the economy of both countries south of the equator is of significant importance.

Lean production methods, mentioned by Jones, were already introduced by Toyota in South Africa in the 1980s, and this was later followed by the German manufacturers. With regard to quality, the Toyotas produced and exported to Europe and Scandinavia are of the same quality as vehicles produced in Japan. Other manufacturers also export South African-built vehicles on a large scale, *inter alia* to the UK, Japan and the USA.

Historians do not predict, they only tell the story of the past. Suffice it to say; the bleak prediction for the "Black Continent's" automotive industry in 1992 did not prove to be so bleak after all.

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Bibliography

Books and Journals

Altshuler, Alan, and Martin Anderson, Daniel Jones, Daniel Roos and James Womack. 1984. *The Future of the Automobile.* Cambridge, Massachusetts: The MIT Press.

Duncan, David. 1997. *We Are Motor Men: The Making of the South African Motor Industry.* Caithness: Whittles Publishing.

Heese, H.F. 1992 (February). "Die Duitse Motorbedryf"; 1896-1990, *Lantern*, Pretoria,

Houghton, Roger. 2011. *50 Years by Your Side*. Cape Town: Toyota South Africa.

Houghton, Roger. 2008. *South African Rally Championship, 1960-2007*. Johannesburg: Toyota South Africa.

Johnston, R.H. 1987. *Early Motoring in South Africa: A Pictorial History*. Cape Town: C. Struik.

Osada, Masako. 2002. *Sanctions and Honorary Whites: Diplomatic Policies and Economic Realities in Relations between Japan and South Africa*. Westport, Connecticut, USA: Greenwood Press.

Rosenthal, Eric. 1976. *The Rolling Years: Fifty Years of General Motors in South Africa*. Port Elizabeth: General Motors of South Africa.

Schnetler, Fred. 1997. *A Century of Cars*. Cape Town: Tafenberg.

Thomas, Harvey. 1993. *Sê nooit vaarwel. Die verhaal van Toyota Suid-Afrika*. Johannesburg: Toyota South Africa.

Newspapers and Magazines

CAR Magazine; 1958-1970.
Die Burger, 1958-1962.
The Cape Times, 1958-1962.
Motorgids, 1961.
The Motor (UK), 1951.

The Barcelona Cluster

Hub Firms and Business Cycles in Spain's Automotive Industry District, 1889-2012

By Jordi Catalan Vidal
University of Barcelona, Spain

Introduction

This article analyzes the development of the Barcelona automobile industry cluster from its origins at the end of the 19th Century until the present day. The Barcelona district remained at the top of the Spanish automobile districts for a century. In 2000, when Spain had risen to sixth position in the worldwide ranking of automobile producers in terms of volume, Barcelona was still the Spanish province with the greatest output and the most employees in this industry.

Barcelona, located on Spain's northeast Mediterranean coast, is the country's second largest city and the capital of the province bearing its name, as well as of the autonomous community of Catalonia. Founded as a Roman city, it experienced substantial growth during the late Middle Ages into the 19th century. It is considered one of the world's major global cities. In addition to automobile manufacture, it is influential in book publishing, pharmaceuticals, education, science, fashion, sports, and the arts. The province of Barcelona has a current population of 5.5 million.

In the late 19th century, Alfred Marshall, the influential economist, underlined three main advantages of a geographically-concentrated industry. Knowledge and information are, partially, free in the district. Entrepreneurs can benefit from a pool of skilled labor. They also have access to numerous subsidiary industries. More recently, Michael Porter revived Marshall's original interpretation and used the concept of cluster to underpin the basis of the competitive advantage of nations and regions (Porter 1990 & 2000).

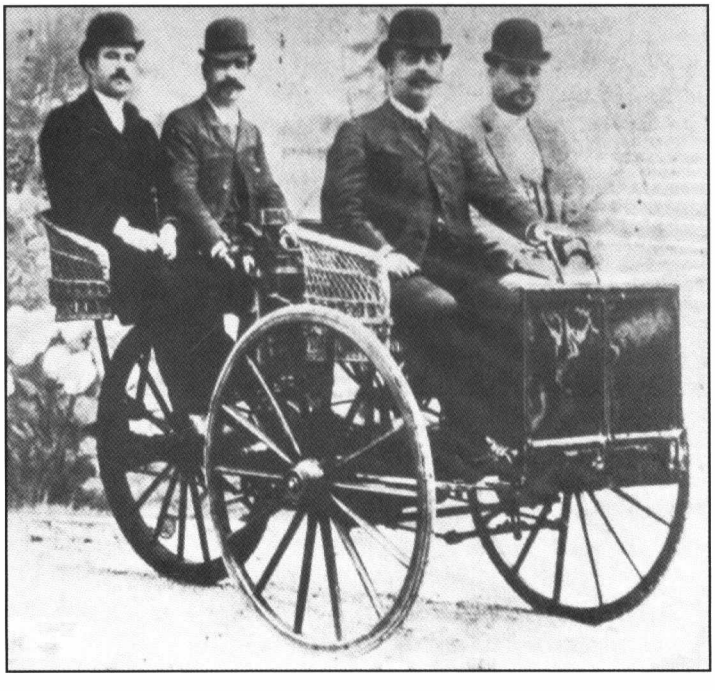
Business historian Alfred Chandler insisted on the efficiency gains derived from company size (Chandler 1964 and 1992). He also stressed the fact that, during the Second Industrial Revolution, the best world performers were those firms that could not only benefit from economies of scale in production, but also develop organizational capabilities in management, research and development, marketing and distribution. Moreover, Chandler accepted that a common feature of all three industrial revolutions was a geographically-concentrated location of large profit-oriented enterprises (Chandler 2005). Similarly, Ann Markusen focused on hub-and-spoke districts, which she considered to be quite common in the United States (Markusen 1996). Such districts hosted a few leading firms of a certain size, which acted as coordinators of the district. Hub-firms, mainly of local origin, could take advantage of both internal and external economies. A more extreme position has been put forward by Steven Klepper, who analyzed the formation of key clusters such as Detroit. According to him, the successful cluster not only hosts outperforming firms that dominate the industry, but is, in fact, the result of abundant spin-offs from the leading firms (Klepper 2010).

Ha-Joon Chang stresses the role of politics in changing the comparative advantage for latecomers. He revived the old arguments put forward by Alexander Hamilton and Friedrich List, in favor of government support for development and extended infant-industry protection. With regard to the automobile industry, he underlined the cases of Japan and South Korea, which benefited from domestic protection during the Golden Age and experienced remarkable success in automobile production in the last quarter of the 20th century (Chang 2002).

The Barcelona automotive cluster was much smaller than those of Detroit, Île de France, Wolfsburg, Nagoya or Ulsan. Its firms were also quite modest in size in comparison with giants such as General Motors, Ford, Renault, Volkswagen, Toyota or Hyundai. However, as the Barcelona cluster developed, classical Marshallian externalities were created and hub firms emerged. The cluster was strengthened by the adoption of infant industry policies in the mid-20th century which favored the take-off of mass production. In 1973 the cluster manufactured about 400,000 vehicles and had 55,000 employees. By 2000 the output reached 600,000 vehicles and total employment in the cluster was around 50,000.

Origins of the Barcelona Automotive Cluster, 1889-1903

In 1889, the textile entrepreneur Francesc Bonet visited the Exposition Universelle in Paris. He was so impressed by the applications of the Daimler engines exhibited by Panhard-Levassor that he decided to bring one back to Barcelona. In December 1889 he patented the first automobile in Spain.



Bonet built a tricycle which incorporated the Daimler engine and drove it with some friends down one of the main avenues of the Catalan capital. As the manufacturer of the first vehicle powered by a combustion engine, the cotton industrialist is usually referred to as the pioneer of the Iberian automotive industry (De Castro 1964; Ciuró, 1970; Gimeno 1993).

Another entrepreneur established in Catalonia was Lieutenant Emili de la Cuadra, who also visited the Paris Exposition. He was working with electric motors, and had opened a plant in Lleida to generate hydroelectricity. He transferred to Barcelona in September 1898. De la Cuadra began by building electric cars, with somewhat disappointing initial results. Later, he contacted a bright young Swiss engineer named Marc Birkigt. Thanks to 21-year-old Birkigt's formidable skills as a designer, de la Cuadra was able to build at least five gasoline-powered automobiles in 1900.

As the new century began, the United States already had more than 200 automotive brands. France and Britain had over 100 brands each. Germany, the industry's pioneer and the country where the early movers were already benefiting from scale economies, had 35 car brands. Italy had eleven car constructors. In sharp contrast to the pattern in most of Western Europe, only four companies attempted to manufacture cars in Spain. Nevertheless, three of them were located in Barcelona: Bonet, La Cuadra and Castro.

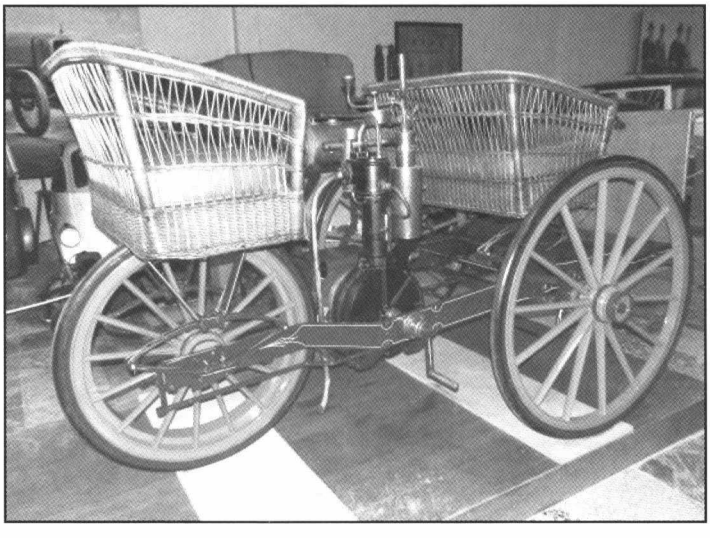
Early Prosperity with Hispano-Suiza and Elizalde, 1904-1922

In 1904 a new group of entrepreneurs led by Damià Mateu and Marc Birkigt founded "La Hispano Suiza" (Ciuró 1970; Nadal & Tafunell 1992; Gimeno 1993; Nadal 2010). Hispano-Suiza can be considered as one of La Cuadra's start-ups but its greater success, supported by key figures in Barcelona's financial elite, qualifies it for Markusen's definition as a hub firm, the leading company in the district (Markusen 1996). In 1908 Hispano-Suiza had already built 200 vehicles with 20- to 40-hp engines. Given the low demand for private transport in a relatively underdeveloped country, the firm supported the creation of coach companies using Hispano vehicles. In order to increase its business, the company created an agency in Paris in 1911 and two years later it began to build a new plant in Bois de Colombes, on the outskirts of the French capital.

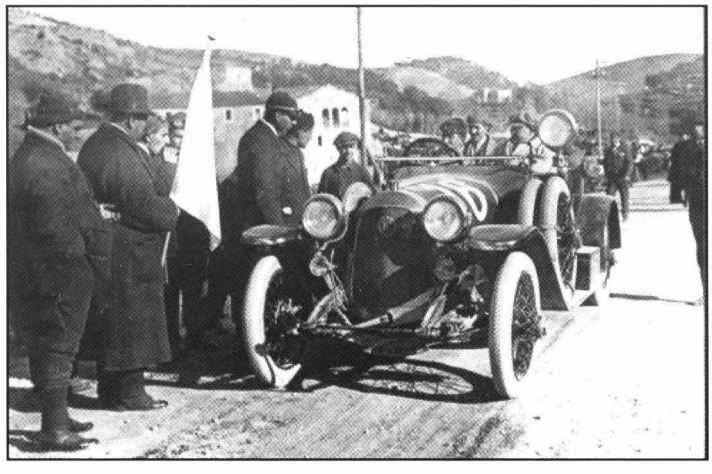
At the outbreak of World War I, Birkigt began to work on the design of an aircraft engine and early in 1915 presented the new vee-shaped engine, which produced more than 150 hp. (Lage 2003; Nadal 2010). The Birkigt engine could run for 50 hours without stopping. During the war, the Hispano-Suiza engine was being manufactured by 15 factories in France, three in the United States, three in Italy, one in Britain and one in Japan. Among these, the companies which manufactured Birkigt's aircraft engine were Peugeot, Wright and Mitsubishi. More than 40,000 Hispano-Suiza aircraft engines were built all over the world, and Hispano-Suiza's profits rocketed (Nadal & Tafunell 1992; Nadal 2010).

The second hub-firm in the Barcelona district in the period before the Spanish Civil War was Elizalde, which was considerably smaller than Hispano-Suiza. Artur Elizalde opened his first automobile workshop in Barcelona in 1909 (Catalan 2006a). He manufactured crankshafts, valves, differentials, gears, bumpers and other parts. In 1913, the firm presented its first car built in Barcelona and the vehicle made the 600-kilometer trip between the Catalan capital and Madrid in 13 hours. In 1917 Elizalde also designed two 220-hp and 150-hp aircraft engines.

Elizalde tried to imitate Hispano-Suiza in its bid for luxury cars and aircraft engines, but had less success. It launched a series of 15-, 20- and 25-hp engines and even one 180-hp model. This last model, an eight-cylinder colossus, was put into the Elizalde 48, which, at a body length of 5.7 meters, was advertised in 1921 as the biggest car in the world. But although its engine featured additional technical innovations, the main drawback of the Elizalde 48 was its price and at 60,000 pesetas (then about $8,100 U.S.) it cost much more than other cars being sold in Spain: Ford models, for instance, could be bought for around 10,000 pesetas (about $1,350).



Opposite, Francesc Bonet and colleagues driving the first automobile patented in Iberia, 1889. (Museu Salvador Claret, Sils). Above, reconstruction of the first automobile built in Iberia by Francesc Bonet (1889). Photo by the author (Museu Salvador Claret, Sils).



Racing in pre-civil war Catalonia: an Elizalde 20/30 hp tourer. Courtesy Fundación Elizalde.

Hispano-Suiza's models and engines in the sixth Automobile Exhibition of Barcelona. Courtesy Arxiu Nacional de Catalunya.

In the period leading up to 1921 a series of other firms tried to enter the sector, following first in the footsteps of Hispano-Suiza and later, and more discreetly, in the steps of Elizalde (Catalan 2000). Eleven new automobile brands were created in Barcelona during the period 1914–18 alone. Some of the most important constructors were Hereter (1915), Abadal (1916), and Batlló (1917). This birth of new brands confirms that an automotive cluster had already emerged in Barcelona (Porter 1998 & 2000; Klepper 2010).

However, during the 1920s the creation of new automobile brands in the Barcelona cluster generally went into decline. In the middle of the decade, the country was importing about 14,000 units per year, mainly from the U.S. and France and led by Ford and Citroën respectively. Hispano-Suiza's capacity stood below 2,000 vehicles (including cars and trucks). Elizalde could supply fewer than 100 vehicles per year, and increasingly directed its production resources to the manufacture of aircraft engines. During this decade, the remaining manufacturers rarely produced more than 20 vehicles each.

The competition created by the largest mass producers (led by Ford) proved to be disruptive for the emerging cluster of Barcelona during this period. Not only did the artisan producers tend to disappear, but the profitability of the local hub firms also suffered. This was seen, for example, in Hispano-Suiza's declining profits.

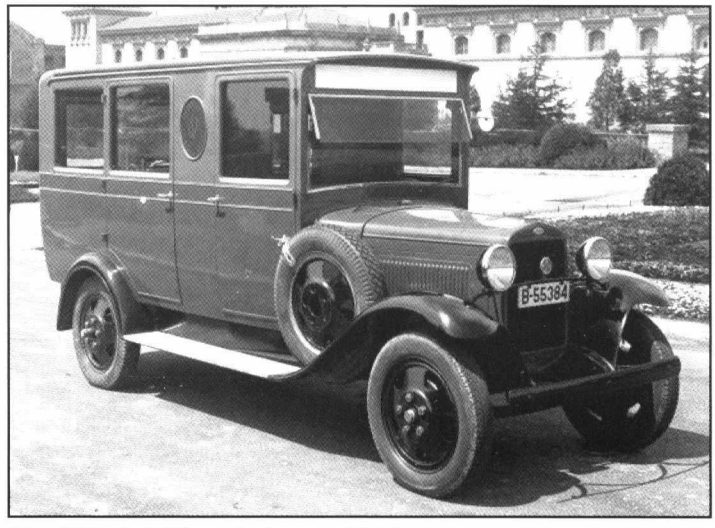
Ford Motor Company decided to build its first Spanish assembly plant in the free-trade zone of Cadiz, in the southern region of Andalusia (Nadal and Tafunell 1992; Estapé 1997 & 2003; Lebrancón 2009). Ford began to operate in the Cadiz free-trade zone in 1920 and its original plan was to assemble around 5,000 vehicles a year in Andalusia. But during the first year of activity only 1,132 units were assembled, and in 1923 Ford decided to move to Barcelona.

Ford's decision can be interpreted as proof of the advantages of locating within an industrial district, even for the firm which had most advanced technological resources at that moment. Barcelona not only benefited from a free-trade zone similar to Andalusia but could already provide the classical Marshallian externalities which did not exist in Cadiz: a trained labor force, parts suppliers and non-codified knowledge of the automotive industry (Catalan 1992 & 2000).

In spite of the cluster's increasing inability to compete with mass producers, there was notable institutional development. Riding on the shoulders of the Industrial Revolution, Barcelona benefited from the work of three influential institutions that were bringing structural change to the sector: the Chamber of Commerce, the School of Labor and the School of Industrial Engineering. The district had also created its own specific institutions. Among these was the Royal Automobile Club of Barcelona (later, RAC of Catalonia), which was established in 1906 (Pernau, del Arco & Arias 2006). Moreover, the first Automobile Exhibition of Barcelona took place in 1919; the show exhibited the products of 58 firms, both Spanish and foreign. In 1924, the third Automobile Exhibition of Barcelona already hosted 413 different firms.

First Depression During the Ford Era, 1923-53

During the 1920s, the Barcelona automotive cluster was already generating the classical Marshallian externalities of the industrial district, which led Ford to move its Cadiz assembly lines there. In addition, the cluster also benefited from the emergence of both hub firms and specific district institutions, which might have facilitated the successful development of local mass production. Nevertheless, whereas Spanish automobile imports were already greater than



Ford Model AA ambulance, 1934.
Courtesy ENDESA (Fons Històric FECSA, ANC).

16,000 units a year in 1926, the Barcelona cluster did not prove capable of comparable production of vehicles until 1958. Thus, at the end of the 1920s Spain began to design a strategic policy to support the development of its automotive industry.

In 1926 General Primo de Rivera's regime created the Official Committee on the Motor Industry (COMA), following the advice of a petition signed by Damià Mateu (Hispano-Suiza's main shareholder), Artur Elizalde and leading Basque industrialist Ramón de la Sota (Estapé 1997). COMA was created to ensure that government agencies would buy Spanish cars and to grant additional incentives to favor domestic production. In 1927 the Automobile Industry Protection Act restricted such benefits to firms whose assembled vehicles were made of parts that were at least 50 percent of Spanish origin. Nevertheless, local firms received COMA orders for only 200 cars (plus 100 motorcycles) during 1927 and 1928. The results of the policy for local producers in the Barcelona cluster were not very significant (San Román 1999 & 2010).

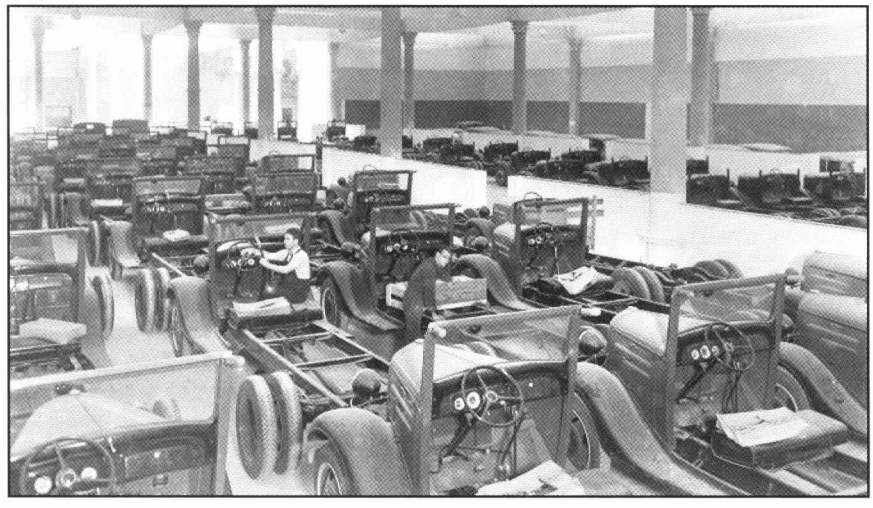
Elizalde decided to give up automobile production permanently in 1927, to focus its efforts on aircraft engines. Hispano-Suiza never attempted mass production. Moreover, the various industrial projects launched by craft producers to build automobiles in Barcelona were not economically successful either. For instance, the fifth largest manufacturer in 1926 was the firm founded by the bright Catalan engineer Wilfredo Ricart, who launched his first cars with his own four- and six-cylinder engine design. But with barely 100 employees in 1926 he could not benefit from appreciable economies of scale and tried to survive by merging with the fourth-largest firm, Batlló, which was not much larger than Ricart's firm anyway. When Batlló and Ricart merged to create APTA in 1928, this spin-off was no more successful than the previous ventures had been.

At the beginning of the Great Depression in the 1930s, Spain's serious problems with its foreign balance forced the country to raise tariffs and introduce import quotas for automobiles. In April 1931 the Second Spanish Republic was proclaimed. The Republican government approved legislation establishing tariff rebates on imports of automobile parts when and where an increasing share of domestic components was incorporated in cars assembled in Spain (Catalan 1992). This policy encouraged the use of local components in Barcelona's Ford Motor Ibérica assembly plant. The company employed 750 people in July 1936 and about 2,500 employees of the auto parts industry worked exclusively for the Barcelona production plant (Estapé 1997). On the eve of the Civil War, Motor Ibérica was actually one of Ford's most profitable European subsidiaries (Wilkins & Hill 1964; Carreras & Estapé 2002).

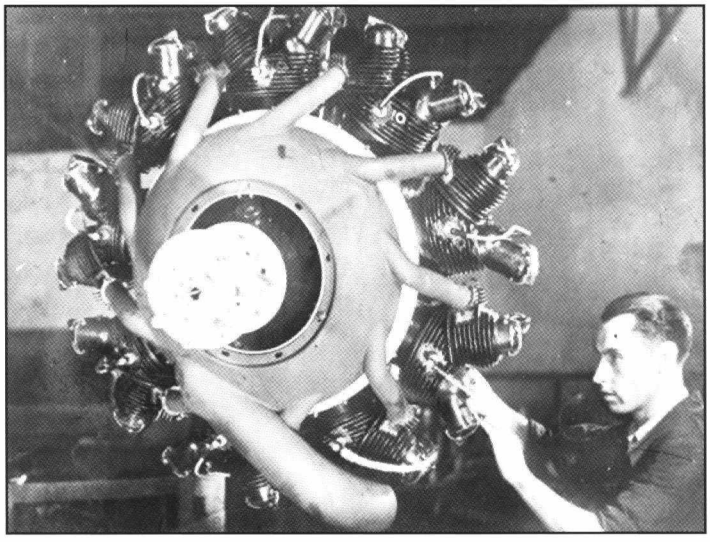
Moreover, the Barcelona district eventually attracted the main rival of the Dearborn colossus, General Motors (GM). GM transferred its Spanish headquarters from Madrid to Barcelona in 1932. On the eve of the Civil War, the firm designed a plan to build a new plant in Barcelona that would be able to assemble 20,000 vehicles a year and exports of 70 percent of its output (Catalan 1992).

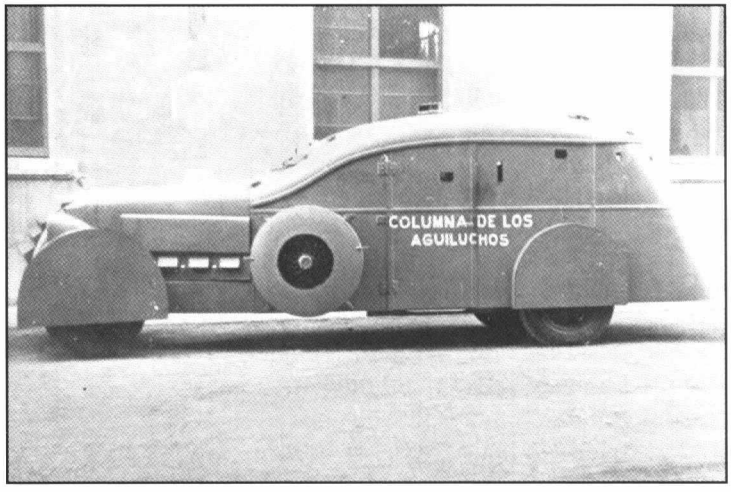
The outbreak of the Civil War paralyzed both Ford's and GM's plans for expanding their Barcelona subsidiaries. Hispano-Suiza and Elizalde, like all the local firms with more than 100 employees, were collectivized and their activities re-directed to the production and repair of war materiel.

The war ended on April 1, 1939, with the victory of General Francisco Franco. Both GM and the Fiat-related Sociedad Ibérica de Automóviles de Turismo (SIAT) submitted



Above, General Motors assembly plant in Barcelona, c. 1936. Courtesy Arxiu Nacional de Catalunya (Sagarra). Below, the Catalan president, Francesc Macià, on parade in a Hispano-Suiza in 1933. Courtesy Arxiu Nacional de Catalunya (Brangulí).





Left, a Hispano-Suiza worker with an aero engine in 1936. Courtesy Arxiu Nacional de Catalunya (Guerra Civil). Above, armored Hispano-Suiza during the Civil War, 1936. Courtesy Arxiu Nacional de Catalunya (Guerra Civil).

proposals to the new government to build assembly plants in industrialized parts of Spain (basically in Catalonia and the Basque Country). But neither company was allowed to proceed in the early years of the new Fascist regime (Catalan 1992; San Román 1995; Tappi 2009). The nationalist officials had already been making plans to promote an autarkic automotive industry.

At the end of 1939, Franco's Ministry of Industry passed a law limiting the maximum stake of foreign capital in Spanish manufacturing firms to 25 percent. In September 1941 the public holding "Instituto Nacional de Industria" (INI) was created to promote autarkic firms. Its first president, Juan Antonio Suanzes, was one of Franco's former colleagues and as an enthusiastic supporter of autarky. He was decidedly against the acceptance of foreign capital. At the end of World War II, INI made an offer to Ricart, who had spent seven years in Arese, Italy, as assistant production head of Alfa Romeo: the Spanish public holding would build a large factory in Madrid to produce light trucks and Ricart would supervise the operation. Suanzes wanted to strengthen his project by using the Hispano-Suiza plant in Barcelona for the construction of heavy trucks (Nadal 2010).

Finally in 1946, under pressure from Suanzes, Damià Mateu's son Miguel decided to sell the Barcelona factory to INI, which created Empresa Nacional de Auto Camiones SA (ENASA). The take-off of this completely state-owned firm can be considered as the clearest outcome of early Francoist policy with regard to the motor industry. ENASA began by building commercial cars and luxury vehicles, under the brand Pegaso.

Ford Motor Ibérica was granted very few licenses to import parts and assemble its vehicles. Real profits never reached the 1935 level (Wilkins & Hill 1964; Estapé 1997 & 2003; Carreras & Estapé 2002). In the early 1950s, Dearborn decided to sell some of its less profitable European subsidiaries. In 1954, its former Barcelona subsidiary, under totally domestic control, became Motor Ibérica (MI).

The severe scarcity of transport in autarkic Spain led many Barcelona entrepreneurs to launch projects to produce motorcycles, automobiles and parts. For instance, Eucort was launched by Eusebi Cortés (Ciuró 1970; San Román 1999). In 1948 Eucort produced 148 vehicles, but the series was so short that the firm could not survive much longer.

However, the failure of the autarkic project forced an about-face in Franco's industrial policies. The year of 1948 was a turning point for the automotive industry, with the INI finally approving the use of Fiat's technology to build a new factory to manufacture cars in Barcelona's tariff-free zone, the "Zona Franca." The promoter was the private investment bank Banco Urquijo, which was forced to accept that 51 percent of the capital of the manufacturing firm would remain in the hands of INI (Solé 1994; San Román 1999; Tappi 2008). Fiat, however, did not grant permission for the export of its licensed products from Barcelona (Catalan 2006b).

The "Sociedad Española de Automóviles de Turismo" (SEAT) was finally created in 1950. The private shareholders subscribed 49 percent of the capital, with seven percent stakes each for six large banks and Fiat. While most of the banks placed SEAT's shares among their Spanish customers, Banco Urquijo (7 percent), Fiat (7 percent) and INI (51 percent) remained as the strategic shareholders.

The ENASA factory in Barcelona, with a selection of models manufactured by the firm, 1955. Courtesy Associació d'Estudis Històrics de l'Automoció.

The Spanish government supported SEAT by granting it the right to expropriate the land where the new plant was to be built, and allowing the company benefits associated with firms of "national interest," which basically meant its exemption from the main forms of domestic taxation. Moreover, in 1952 SEAT obtained permission to import parts and equipment with tariff exemption, provided that 50 percent of its output would derive from local origin. In order to grant this permission, the government had to override certain autarkic policies and return to the legislation of the Republican years. In this sense, the end of Franco's autarky came hand in hand with the partial reintroduction of the 1930s policy of promoting local auto parts production (Catalan 2006a).

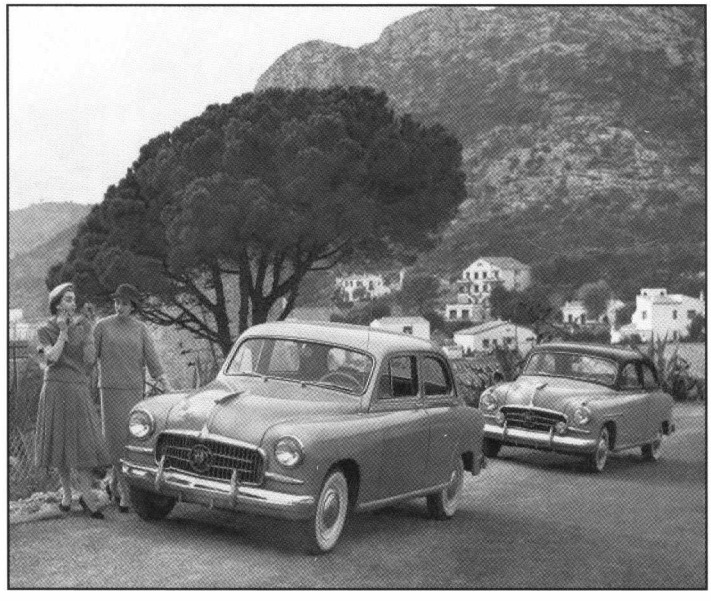
SEAT's Hegemony and the Triumph of Mass Production, 1954-72

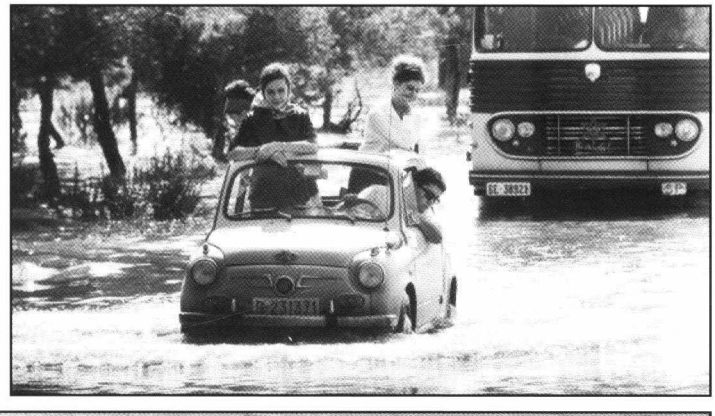
Spanish industrial policy during the 1950s sought not only to produce cars but to employ mostly local parts to do so (Catalan 2010). The first model manufactured by SEAT, the 40-hp 1400, was released in late 1953. During 1954, the first year of normal production, 60 percent of the parts of the vehicles manufactured in Barcelona's Zona Franca were of local origin.

Scarcity of cheap vehicles was so acute that a new surge of entrants into automobile manufacturing took place during the 1950s. They were craft producers who specialized in the construction of micro-cars. These brands were rarely manufactured in series of more than a hundred units. One of the most well known was Biscuter, which was produced by Autonacional with Voisin's patent and Villiers' engines (197 cc). At its peak, Autonacional claimed it would be able to manufacture as many as 10,000 vehicles a year. In the final event, however, it closed its doors in 1957, when it was producing about 3,000 units. Most of the main brands of micro-cars manufactured in Spain were also produced in the province of Barcelona: for instance, Maquitrans, David, Kapi, Aleu, Clua, Jorsa and PTV (Catalan 1992).

The creation of new brands declined again in 1957. The main reason was SEAT's launch of the 600 model, the first popular car mass-produced in the Barcelona district. With its 21-hp engine (633 cc), the 600 Model had only half the power of SEAT's 1400 model, but it cost only half as much (60,000 pesetas compared to 120,000 pesetas). In comparison to the Biscuter there was no possible competition: Autonacional's car sold for about half the SEAT price (27,000 pesetas on average), but had less than one third of its engine power.

Not only was the SEAT 600 the first true "people's car" being manufactured in the district, but 97 percent of its parts came from locally-produced materials. Auto parts producers also enjoyed a period of expansion during the 1950s. The cylinder block manufacturer "Fundiciones Industriales" and the producer of ignition systems "Auto Electricidad" increased their respective labor forces to more than 500 employees each. In 1953 a group of local entrepreneurs and the Italian firm Carello created a joint venture to produce lights, filters and other parts under the brand "FAESSA." In 1958 Ricart obtained a license to





Above, the first model launched by SEAT, the 1400, introduced in 1953. Courtesy SEAT SA. Below, a SEAT 600 defies the floods in the Costa Brava , 1965. Courtesy Reial Automòbil Club de Catalunya. Bottom, the David tricycle factory in Barcelona, 1954. Courtesy Arxiu Nacional de Catalunya (Brangulí).

SEAT 1500 Assembly line. Courtesy Memorial Democràtic Treballadors SEAT.

produce hydraulic brakes under the brand "Automoción." The general trend during the 1950s and 1960s was licensing technology from European groups which participated with minor stakes in the firms. After the 1959 Stabilization Plan, the presence of foreign interest increased because the new law permitted foreign participation in as much as 49 percent of a company's capital.

No other firm in the district recorded a success that could be compared to SEAT's people's car, but the pioneer companies also prospered in the late 1950s. In 1957 MI produced 404 light trucks in Barcelona under the Ebro brand, under license from Ford. ENASA manufactured 505 heavy trucks in the former Hispano-Suiza plant under the brand Pegaso. Even Elizalde tried to get back into automobile production. Throughout the 1950s, Elizalde had been producing aircraft engines as a partially state-owned firm under the name of ENMASA, but in 1959 it signed a contract with Daimler-Benz AG which licensed the Barcelona plant to produce diesel engines and vans with the German company's technology (Catalan 2006a).

Under the Franco regime the Barcelona Automobile Exhibition was unable to reopen its doors until 1966, which meant that between its seventh and eighth editions there was a gap of more than thirty years. However, from then until the crisis of the 1970s, both the number of exhibitors and the square meters of exhibits increased dramatically.

The Barcelona experience tends to confirm Klepper's theory on the importance of inheritance and spin-offs within automotive clusters (Klepper 2010), but with one notable difference: although three of the four leading firms were spin-offs of pioneer hub firms in the district (ENASA from Hispano Suiza, MI from Ford and Empresa Nacional de Motores Aeronáuticos SA, ENMASA, from Elizalde), the firm that emerged as the main leading firm of the cluster, SEAT, had actually grown from nothing, under its own steam. SEAT was mainly the result of strategic industrial policy, yet it generated the most important externalities in the cluster and provided the main thrust for the cluster's revitalization. Therefore, its experience tends to confirm the hypotheses of scholars such as Chang, who insisted on the need for industrial policy (Chang 2002).

SEAT launched its 1500 model in 1963 in order to renew its line in saloon vehicles, and its 850 model in 1966 with the intention of upgrading the offering for its customers. An agreement was reached in 1967 by which SEAT could export its vehicles from Barcelona in exchange for granting Fiat's Agnelli family a larger stake in the firm's capital: 36 percent (from just seven percent before the agreement), while in INI's case the share would be reduced from 51 percent to 36 percent. Moreover, Turin also agreed to lower the royalty fees paid by SEAT. And finally, INI's sale of capital helped to finance the investments required to produce a new model, the 124, which was launched in 1968 (Catalan 2006b).

MI surpassed ENASA as second hub-firm of the district. In 1965 the private firm decided to take a new technological partner, replacing Ford with the Canadian Massey Ferguson, who accepted a 32 percent rate of participation in its capital. MI's growth strategy combined to expand within the Barcelona cluster and also took over firms in other Spanish districts. During the early 1970s, the company had three large factories within the Barcelona district. It manufactured vans, light trucks and agricultural trucks (Estapé 1997).

As SEAT grew, the company's managers decided to solve the problem of cramped premises in "Zona Franca" by acquiring land near the town of Martorell, some 30 kilometers from Barcelona but still within the province. The 1969 decision to purchase this land (in an area that would eventually also contain a motorway connecting the Spanish Mediterranean coast to France) clearly indicated SEAT's desire to remain within the district, despite the cluster's growing labor conflicts (Tappi 2008). At first, the company had planned to use this land to build a production plant to manu-

SEAT 127, the company's blockbuster model of the 1970s. Courtesy SEAT SA.

facture its latest model, the 127 (another people's car which would replace the obsolete 600 Model); but the newly-appointed Minister of Industry denied permission for building the plant (and Martorell had to wait until the early 1990s to get its factory, after SEAT had come under the ownership of the Volkswagen Group). In fact, the 127 Model was finally produced in the Zona Franca, where it began manufacture in 1972 (Catalan 2006b).

The province of Barcelona had ten plants assembling cars during the 1970s and about 300 factories producing parts. Output surpassed 400,000 units. It had a direct labor force of some 55,000 people. Throughout the late Golden Age the rapid expansion of the cluster was accompanied by an increasing concentration of employment within the largest firms in the district. These provided the cluster with key capabilities, benefiting from scale economies in production, distribution and management. Importantly, they also took advantage of the cluster externalities that hundreds of auto parts suppliers and thousands of workers could provide.

Crises of Maturity and Takeovers by Volkswagen and Nissan, 1973-2000

The growing maturity of the Barcelona cluster coincided with the relaxation in nationalistic industrial policy by Franco's later governments and Spain's transition to democracy (Catalan 2000 & 2010). In 1972, Henry Ford II visited Madrid to ratify a marked shift in the automobile policy which had been negotiated with the Spanish Ministry of Industry. On the one hand, the share of the compulsory use of domestic parts in automobile manufacturing was to be reduced from 90 percent to 60 percent for new passenger car assemblers. On the other hand, Ford was to be granted permission to build a new plant to manufacture engines and cars in Spain, with the promise that it would export more than 90 percent of its production (García Ruiz 2001; Carreras & Estapé 2002).

Just months before Franco's death in 1975, SEAT took charge of AUTHI, a bankrupt British Leyland subsidiary located near Pamplona that built Austin and Morris models. This decision in the middle of the first oil crisis coincided with the Spanish government's decision to veto General Motors in Spain (Catalan 2010). Nevertheless, the agreement was not respected and, in the end, GM's European subsidiary Opel was granted permission to build a new factory near Saragossa in 1979 (Germán 2003). The new automobile policy also allowed all the assemblers to import up to 40 percent of their auto parts. Import quotas for vehicles were substantially reduced and the number of imported automobiles nearly tripled from 1978 to 1980 (increasing from 28,000 to 76,000 units).

Competition in the automotive industry intensified against the background of a dramatic slump in the Spanish economy. Incumbents in the automobile industry not only recorded dramatic labor cost rises in the period leading up to 1977, but also had to cope with mounting inflation and frozen prices. Moreover, the need to curb inflation led to the adoption of very stringent monetary policies and income austerity with the Moncloa Pacts, agreements between the government and political parties that established a framework of policy on pay, employment and social security. This resulted in a dramatic increase in real interest rates. As many incumbents had borrowed to finance the mounting wage bill in the early years of the crisis, the cost of debt servicing rocketed.

SEAT's losses, which had been moderate until 1977, dramatically increased with the launching of the Fiesta model by Ford. The latter was a slightly-upgraded counterpart to the SEAT 127, then the blockbuster of the Barcelona cluster main hub firm (Tolliday 2003). The major success of the Ford Fiesta in the medium-low segment of the Spanish market led to the multiplication of losses in SEAT, which was, moreover, handicapped by the cost of financing substantial increases in the wage bill, legal restrictions to fire redundant labor force, the obligation to buy 90 percent of their parts from local suppliers of inputs and the frozen prices of their outputs (Catalan 2010). As a result, INI decided to invite Fiat to take complete control of the company. After reaching an agreement in 1979, the mounting losses of the Barcelona subsidiary and Fiat's new managers' preference for diversification led Turin to disinvest, bringing back the firm to the public holding in 1980. At this time, the founding banks in Spain were also being faced by difficult times and SEAT entered the 1980s as a completely government-owned firm. Its output fell from about 360,000 vehicles in 1974 to less than 210,000 in 1981.

As the slump intensified in the late 1970s, MI's profitability was also increasingly squeezed. In 1979 Massey-Ferguson decided to sell its 36 percent stake in Nissan Motor Company. MI officially recorded losses in 1980 for the first time since Ford had left the company in 1954. Its output of commercial vehicles (mainly vans and light trucks) decreased from 29,000 in 1974 to just 18,000 in 1981. The production of farm tractors also experienced a dramatic reduction.

ENASA's demand also declined after the first oil crisis. Official losses emerged in 1976 and production continued to decrease in the period leading up to 1981. The output of vehicles (including all the Spanish plants) fell from about 20,000 in 1977 to less than 12,000 in 1981.

Catalan firefighters with two Pegaso trucks and a Land Rover in 1982. Courtesy Arxiu Nacional de Catalunya.

Under the absolute control of the public holding INI, SEAT tried to deal with its dramatic crises by adopting a five-point strategy. First, average costs were cut by reducing the size of the labor force and by forcing its agencies to finance their own stocks. Second, exports were fostered with the development of SEAT's own sales net in Europe. Third, the search for an international partner led to the signing of a collaboration agreement with Volkswagen in 1982. Fourth, mounting losses, which rose to 26 percent of sales in 1983, were covered by repeatedly resorting to government subsidies. And finally, a huge effort was also made to develop new products (Catalan 2011).

Giorgetto Giugiaro, who had already conceived the Volkswagen Golf and the Hyundai Poni, was hired to design a new SEAT model for the low-medium segment (Catalan 2010). Porsche was contracted to conceive the engine. As Fiat objected to Giugiaro's participation on the project, the final development was made by Karmann (Sleider 1991). The three companies worked together with the Martorell R&D center, which was built on the land bought by SEAT in 1969. The new model was launched in 1984 under the name "Ibiza." The successive versions of the Ibiza, a model conceived when the firm was completely state-owned, would remain the brand's blockbuster for nearly 30 years.

The government of Felipe González signed an agreement in June 1986 to sell 51 percent of SEAT's capital to Volkswagenwerk AG. Moreover, the contract also stated that Wolfsburg's group would increase its share to 75 percent at the end of the year. The Spanish Socialist government also agreed to assume any past debt from SEAT. On the other hand, VW agreed to invest some three billion euros in SEAT and to maintain the company as an independent brand with its own distribution network (Llorente 1997, Catalan 2000 & 2011).

In 1980, Daimler Benz took full control of MEVOSA, formerly Elizalde. The following year, the name of the company was changed to Mercedes-Benz Spain. The Vitoria and Barcelona plants were restructured to prepare for the launch of the M-B 100 van, which would become an export success in the late 1980s. While the Basque plant assembled the van, the Catalan factory produced the engines, gear boxes and other parts.

Most of the Barcelona cluster recovered during the second half of the 1980s. The expectations raised by Spain's entry into the Common Market in 1986, and the world recovery that took place after the stagflation crisis combined to favor a new period of expansion in the manufacture of automobiles and parts in the Barcelona cluster.

Externalization became a strategy to decrease both inventory and labor costs (Llorente 1995; Catalan 2000 & 2011). The aim was to imitate the success of Japanese manufacturers and Toyota in particular, with its just-in-time system. An indicator of the intensity of such a process is the percentage of employment generated by the cluster's top ten firms. In 1976 they accounted for 77 percent of the employment in the cluster (55,131 people). In 1989 their share had fallen to just 56 percent (though total employment in the cluster had remained quite similar, at about 55,202 people).

Innovation was also crucial at a time when the Spanish consumer could choose from a much wider range of products at a better price, as a member of the E.E.C. SEAT launched the Ibiza model in 1984 and also presented new passenger cars in 1985 (Malaga) and 1990 (Toledo), all designed by Giugiaro in collaboration with the R+D Center of Martorell and manufactured in Zona Franca (Sleider 1991). Moreover, SEAT marketed both Volkswagen and Audi models, particularly the Polo, which was produced in SEAT's plant in Pamplona. Nissan Motor Ibérica (Nissan MI) presented the four-wheel-drive model Patrol, which began production in Barcelona's Zona Franca in 1983. The following year, it launched the Vanette van. In 1988, the former Motor Ibérica presented another van (Nissan Trade), a new light truck and improved the engines of its Patrol and commercial models.

Above, the first Ibiza model, designed by Giugiaro and launched by SEAT in 1984. Courtesy SEAT SA. Below, Nissan Patrol manufactured in Barcelona in 1986. It participated in the Paris-Dakar Rally. Photo by the author (Museu Salvador Claret, Sils).

The 1990-1995 slump interrupted recovery. The outbreak of the First Gulf War, moderately, and the collapse of the European Monetary System (EMS), in a more dramatic way, sank Spain into a new crisis. Among the automobile producers, ENASA was the firm that first experienced the slump, suffering a tremendous erosion of market share: the output of its blockbuster, the Pegaso heavy truck, fell from 6,300 units in 1988 to 2,900 in 1990. INI decided to privatize the firm, which was bought by Iveco, a subsidiary of Fiat.

SEAT also suffered a dramatic slump, which reached its nadir in 1993, when nearly a billion euros of losses were recorded in one year (Díaz Ruiz 2010). The Volkswagen consortium had built a new plant in Martorell, which cost around 4,000 million euros and was mainly financed by credit. Spain had joined the EMS with a very optimistic parity of 65 pesetas per deutsche mark. Funds were borrowed in marks without exchange insurance. When Spain was unable to maintain its parity in late 1992 and its currency began to depreciate, the cost of servicing the loan went up. However, the main reason for the dramatic losses was that Martorell launched its first cars when European demand was dropping. SEAT experienced dramatic over-production with its three plants in the Barcelona cluster and its Pamplona/Landaben plant (mainly for VW products).

After substantial and repeated revisions of the peseta parity in the EMS, the Spanish economy experienced a new period of expansion until 2000. This led to a new phase of relative splendor of the cluster, which at the end of the century almost recovered the peak levels of employment reached in the mid-1970s and around 1990. At the same time, Spain climbed to sixth position in the world rankings of automobile manufacturers.

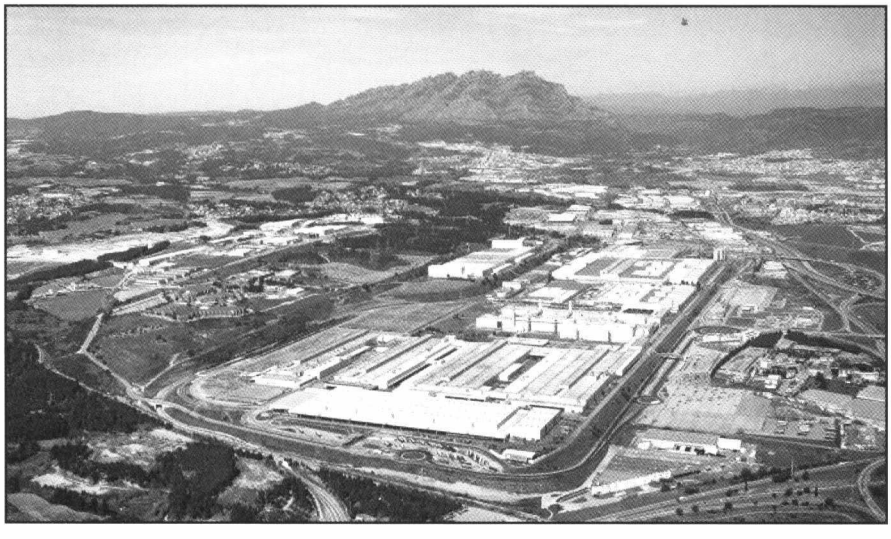
The leading firms in the district again benefited from the growing externalization of their production. Supplier parks were created on the outskirts of Martorell and Zona-Franca, to facilitate the extension of just-in-time processes. The Nissan R+D center in Barcelona presented new versions of the Terrano four-wheel-drive model, Serena compact vehicle and Vanette Cargo van. In 1997, it was separated from its parent company to be transformed into the Nissan Spain European Technology Center.

SEAT, which had launched its Cordoba model in 1993 (the last to be designed by Giugiaro), presented the Alhambra compact model in 1996 and the Arosa super-mini in 1997. However, SEAT's most successful model after the Ibiza was the Leon, which was launched in 1999. By this time, the company had hired a new Italian designer, Walter da Silva, who came from Alfa Romeo. Volkswagen tried to rid SEAT of its image as a producer of cheap cars by accentuating its association with sports and with the Mediterranean. A new design center was created in the Barcelona coastal town of Sitges. In SEAT vehicles manufactured in the Barcelona cluster, the proportion of local parts increased from 53 percent in 1993 to 72 percent in 1999. SEAT's brand sales surpassed 500,000 units for the first time in 1999.

The records of the Benz and Iveco plants in Barcelona were not comparable, but the production of engines and coaches tended to expand in the last few years of the 20th century. Barcelona partially benefited from the success of the Vito van and the Mercedes Benz Class V, both of which were assembled in the Basque town of Vitoria. IVECO and Renault created a joint venture to manufacture coaches under the brand Irisbus in 1998. The following year, Renault and Nissan signed a strategic alliance by which the French company bought 37 percent of the Japanese group's capital. In 2000, Nissan began to manufacture the Almera Tino, its new compact vehicle. It was the first time that the subsidiary had assembled a passenger car in Spain. By that time, the Barcelona automobile industry cluster again employed around 50,000 people.

Fighting for Survival, 2001-2012

Since the beginning of the 21st Century, which coincided with the replacement of the peseta by the euro in Spain, the Barcelona automotive cluster has experienced a marked decline (Catalan 2011). SEAT's share in its main market (Western Europe) increased from 2.3 percent in 1990 to 2.9 percent in 2000, but fell to 2.4 percent in 2007. The collapse has accelerated since then, and SEAT's market share in Western Europe stood at only 2.2 percent in 2011. The opposite pattern occurred with the other cheap brand in the Volkswagen consortium, Škoda. VW's strategy of trying to improve SEAT's image by strengthening its links with Audi failed disastrously. The Sitges research center and the Zona Franca factory were closed down. The brand's most successful vehicle is still the Ibiza model, which was conceived for the first time when the firm was still under local control and state-owned. However, SEAT's brand sales sank from 520,300 units in 2000 to just 321,000 units in 2012. Its underutilized capacity has been used to produce Audi's Q3 model in Martorell since 2011. Volkswagen claims that it wants to associate Barcelona's brand image with SEAT. However, the reality is that it has even used the city's famous football team, FC Barcelona, to advertise Audi instead of SEAT.



SEAT's new factory in Martorell. Courtesy SEAT SA.

In Barcelona, the manufacturing activity of Mercedes-Benz and Iveco also tended to decrease throughout the 21st century. The production of vans at Mercedes-Benz's Barcelona plant has remained below 75,000 units since 2000. Passenger car output has performed a little better, with the manufacturing of the Viano model, but the German parent company decided to concentrate its Spanish activity in Vitoria. Similarly, the production of buses and coaches by Iveco substantially declined in the Barcelona district, falling from around 1,500 coaches in 1999 to 254 vehicles by 2010.

Nissan MI's manufacturing activity in the Barcelona cluster fared better, though its research center was closed as well. The total production of 4x4 vehicles (including the Pathfinder and Navara models) increased from 45,000 units in 2000 to 106,000 in 2007, but later dropped to just 19,000 in 2009. The output of vans (which are also produced for Renault and Opel) rose from 41,000 in 1999 to 86,000 in 2008, but fell to only 25,000 in 2009. Since then, the output of four-wheel-drive models and vans has risen but still remains far below the previous maximums. Nissan is preparing the launch of a new passenger car, with a forecast output of 80,000 vehicles per year.

Depreciation of the currency was a policy move often used to maintain the district's competitive advantage in early critical episodes, and in particular during the 1973-1985 depression and the 1990-1995 crisis. However, this option was barred with the euro. The surrender of autonomy in macroeconomic policy has coincided with the cluster's accelerated decline in recent years, and Spain's fall to twelfth position in the world rankings of automobile producers in 2012.

Conclusion

Barcelona's automobile industry cluster lasted for more than a century. Until 1950, Spain was only a marginal automobile producer. In spite of the presence of notable firms like Hispano-Suiza and Elizalde, and although both Ford and GM set up assembly plants inside the cluster, mass production of automobiles failed to take off before the Spanish Civil War in the late 1930s. The Barcelona cluster developed slowly until the late 1950s when it suddenly accelerated due mainly to the involvement of a few leading firms, headed by SEAT, and a dense network of parts suppliers. As a result, by the end of the 20th century, Spain had climbed to sixth place in the world rankings of automobile producers.

In spite of its growing maturity, Barcelona has succeeded in maintaining its position as leader among the Spanish automobile districts. Its automotive industry did not begin to record significant long-term decline until the start of the 21st century. Since the adoption of the euro, both manufacturers and parts suppliers have experienced steady decreases in output and losses in employment. Several factories and research centers have been shut down. However, the SEAT and Nissan plants in the Barcelona district continue the struggle for survival.

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Above, 2009 SEAT Ibiza. Below, the 2013 SEAT Leon. Both photos by the author.

Korea and Spain, 1945-87," Business History *2010, 52, 2; "Francoist Spain under Nazi Economic Hegemony, 1936-1945," in Buchheim C. & Boldorf M. (eds.),* Europäische Volkwirtschaften unter deutscher Hegemonie 1938-1945, *Oldenbourg, München, 2012; and "Marshall in Iberia: Industrial Districts and Leading Firms in the Creation of Competitive Advantage in Fashion Products,"* Enterprise & Society *2013, 14, 2.*

References

Carreras, A. and S. Estapé Triay. (2002). "The Spanish Motor Industry, 1930-1975," in M. Lynskey and S. Yonekura eds., *Entrepreneurship and Organization*, Oxford: Oxford University Press, pp. 123-150.

Catalan, J. (1992). Fábrica y franquismo, 1939-1958. Cerdanyola: U. A. Barcelona Ph.D. Dissertation.

Catalan, J. (2000). "La creación de la ventaja comparativa en la industria automovilística española, 1898-1996." *Revista de Historia Industrial*, 18, pp. 113-154.

Catalan, J. (2006a). "Artur Elizalde i Rouvier (1871-1925)," in Cabana, F. ed., *Cien empresarios catalanes*. Madrid: Lid, pp. 311-319.

Catalan, J. (2006b). "La SEAT del desarrollo, 1948-1972." *Revista de Historia Industrial*. 30, pp. 143-193.

Catalan, J. (2010). "Strategic policy revisited: The origins of mass production in the motor industry of Argentina, Korea and Spain, 1945-87." *Business History*, 52(2), pp. 207-230.

Catalan, J. (2011). "La SEAT del Ibiza, 1981-2010: fuerza de una marca, resistencia de un distrito," in Catalan J., Miranda J. A., Ramon-Muñoz R. eds. *Distritos y clusters en la Europa del Sur*. Madrid: LID, pp. 259-316.

Chandler, A. D. (1964). *Giant Enterprise. Ford, General Motors and the Automobile Industry*. New York: Harcourt.

Chandler, A. D. (1992). "Organizational Capabilities and the Economic History of the Industrial Enterprise." *Journal of Economic Perspectives* 6 (3), pp. 79-100.

Chandler, A. D. (2005). *Shaping the Industrial Century*. Cambridge, Mass: Harvard University Press.

Chang, H. J. (2002). *Kicking Away the Ladder*. London: Wimbledon.

Ciuró, J. (1970). *Historia del automóvil en España*. Barcelona: CEAC.

De Castro, M. (1964). *Historia del automóvil*. Barcelona: CEAC.

Díaz Ruiz, J. (2010). *SEAT: Ambición de superarse*. Barcelona: Profit.

Estapé, S. (1997). *The Dynamics of the Firm in a Changing Environment*. Firenze: E.U.I. Ph. D. Dissertation.

Estapé, S. (2003). "Ford in Spain: the first stage (1920-1959). A multinational confronts political constraints," in Bonin H., Lung Y. and Tolliday S. eds. *Ford, 1903-2003: The European History, II*. Paris: P.L.A.G.E., pp. 439-450.

García Ruiz, J. L. (2001). "La evolución de la industria automovilística española, 1946-1999: una perspectiva comparada." *Revista de Historia Industrial*, 19-20, pp. 133-163.

García Ruiz, J. L. (2003) (ed.). *Sobre ruedas*. Madrid: Síntesis.

Germán, L. (2003). "Made in GM. Veinte años de Opel en España," García Ruiz, J. L. ed. *Sobre ruedas*, Madrid: Síntesis, 167-190.

Gimeno, P. (1993). *El automóvil en España*. Su historia y sus marcas. Madrid: R.A.C.E.

Klepper, S. (2010). "The origins and growth of industry clusters: The making of Silicon Valley and Detroit." *Journal of Urban Studies*, 67, pp. 15-20.

Lage M. (2003). *Hispano Suiza 1904-1972*, LID, Madrid.

Lebrancón, J. (2009). El recinto aislado. Santiago: U. Santiago de Compostela Ph.D. Dissertation Thesis.

Llorente, F. (1997). "Las estrategias de los fabricantes de automóviles. El caso SEAT, 1980-1995," in Roca, J. ed. *La formació del cinturó industrial de Barcelona*, Barcelona: Proa, pp. 275-289.

Markusen, A. (1996). "Sticky Places in Slippery Space: A Typology of Industrial Districts." *Economic Geography*, 72, 3, pp. 293-313.

Nadal, J. and X. Tafunell. (1992). *Sant Martí de Provençals, pulmó industrial de Barcelona (1847-1992)*. Barcelona: Columna.

Nadal, J. (2010). "Discurs d'acceptació del títol de doctor honoris causa." *Cerimònia Acadèmica d'Investidura com a Doctor Honoris Causa del professor Jordi Nadal*. Barcelona: U. Pompeu Fabra.

Pernau, G., del Arco, J. & Arias, J. (2006). *RACC Cent anys de passió 1906-2006*, Barcelona: RACC.

Porter, M. (1990). *The Competitive Advantage of Nations*. London: McMillan.

Porter, M. (2000). "Locations, Clusters, and Company Strategy," in Clark, Feldman & Gertler eds. *The Oxford Handbook of Economic Geography*, Oxford: Oxford U.P., pp. 253-274.

San Román, E. (1995). "El nacimiento de la SEAT: autarquía e intervención del INI." *Revista de Historia Industrial*, 7, pp. 141-165.

San Román, E. (1999). *Ejército e industria*. Barcelona: Crítica.

San Román, E. (2010). "Política económica y atraso automovilístico (1900-1936): El caso español en perspectiva comparada con Japón." *Revista de Historia Industrial*, 43, pp. 65-93.

Seidler, E. (1991). *Ole, Toledo!*. Lausanne: Editions JR.

Solé, E. (1994). *SEAT (1950-1993)*. Barcelona: La Tempestad.

Tappi, A. (2008). *Una impresa italiana nella Spagna di Franco*. Perugia: CRACE.

Tolliday, S. (2003). "The origins of Ford Europe: From multidomestic to transnational corporation, 1903-1976," in Bonin H., Lung Y. & Tolliday S. eds., *Ford, 1903-2003: The European History, vol. I*, Paris: PLAGE, pp. 153-242.

Wilkins, M. and F.E. Hill (1964). *American Enterprise Abroad: Ford on Six Continents*. Detroit: Wayne State U.P.

Defending Against the American Threat
The German Automobile Industry and the Challenge of Foreign Competition, 1918-1933

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Introduction

Although the internal combustion automobile was invented by the German engineer Carl Benz in 1885, the German automobile industry struggled mightily to hold its ground against the United States car manufacturers at the time of the Weimar Republic. In comparison to other nations, the German automobile market was rather small and the level of motorization was low from 1918 to 1933. For several reasons, the German market was not as developed as, for example, that of the French.

After World War I, the existing car builders lost their agencies abroad and were forced to concentrate on the domestic market. Although international competitors had not yet entered the market, the German companies started to prepare for the "American threat," as contemporaries called the competition of U.S. car producers (Adelt 1931, p. 114). The German manufacturers took several steps in order to protect the German automobile market from this "threat."

In this article, the steps of the overall automobile industry are contrasted with the particular strategies of two individual automobile companies. For this comparison, the later merged manufacturers Daimler-Motoren-Gesellschaft and Benz & Cie. represent the kind of German car builders that produced mainly luxurious vehicles. On the other side, the reactions of Opel will be used as examples of actions taken by a producer that focused on mass production. The comparison concentrates on four different areas and covers economic as well as management issues: tariffs, organizational change, rationalization and campaigns that were directed against foreign competition. Before the paper turns to these subjects, the overall situation of the German automobile industry and market, as well as the impact of foreign producers, are taken into account.

Motorization in Germany 1918-1933

During the time of the Weimar Republic (1918-1933), the German car market was not as developed as those of other countries. The level of motorization was much less than that of other nations like France, Great Britain or the United States. The year 1920 is the first that offers reliable data with regard to Germany after the war. In that year, Germany had 0.8 motor vehicles per thousand residents (Figure 1). This is fewer than the French or the British had in 1906. At the end of the given period, in 1933, the number had risen to 10.4, which can be seen as a sign of a slowly-increasing market. This rise is comparable to that of, for example, the United States during the period 1904 to 1912. Despite the growth, the stage of the German motorization in 1933 did not come close to either that of France or Great Britain, where 44.3 and 36 motor vehicles per thousand people, respectively, existed.

The low level of motorization after World War I was a reason why foreign automobile producers expected Germany to become a growing market in subsequent years (Flik 2001, p. 51f; Schulenburg 2008, p. 104). In contrast to the

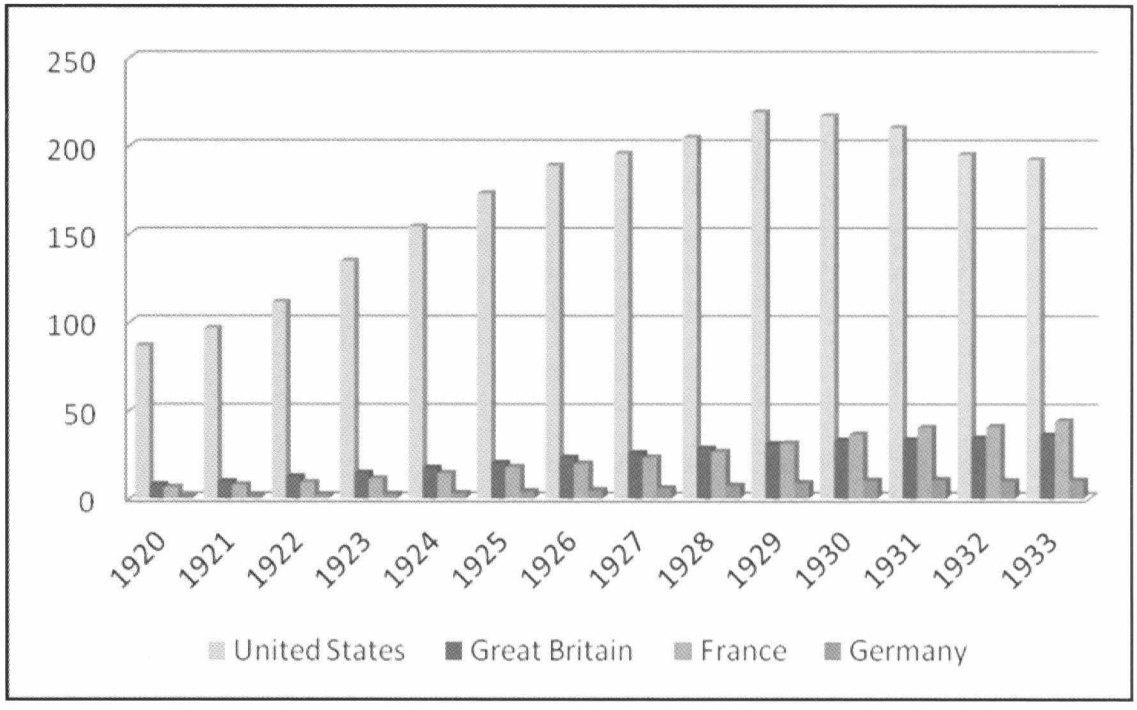


Figure 1. Motor Vehicles per 1,000 Residents 1920-1933
Data from Flik 2001, p 288.

small German market, the U.S. market had been much more driven by demand for cars in the past. About one fifth of U.S. residents owned a motor vehicle in the 1920s. The producers already considered the deceleration of consumption on the U.S. market (Addicks 1934, p. 46; Tessner 1994, p. 41; Thieme 2004, p. 123). This fact contributed to the attractiveness of the German market for U.S. producers. But why was there no comparable market and demand for automobiles in Germany similar to the United States?

A Small, Troubled Market

There are several reasons why there was no mass market for cars in Germany. First of all, there was hardly any production of automobiles after World War I. Until 1921, private cars were not permitted (Braun 1991, p. 192; Edelmann 1989, p. 36). When this restriction was abolished, the high cost of gasoline and other operating expenses contributed to the weak demand (Addicks 1934, p. 62; Edelmann 1989, p. 42ff.). In Reiner Flik's opinion, the comparatively low incomes of German households were the reason why very few persons were able to buy and maintain a motor vehicle (2001, p. 56). This tendency resulted in a small number and slow spread of motor vehicles. Therefore, in contrast to the United States, the German market remained focused on luxury cars. The social middle class and, particularly, the lower classes were not target groups for automobile producers before 1933.

Besides the operating costs, the production methods and construction costs were responsible for the limited demand. Although there had been efforts to rationalize the production of the automobile industry during the war, the German producers began to adopt methods of mass production quite late (Feldenkirchen 2003, p. 87; Hübner 1927, p. 13-16). Instead, they relied on handcraft and individual production. Assembly lines did not exist in the German automobile industry until the mid-1920s. Another major problem was the nonexistent standardization of automobile parts and the huge number of different cars the various builders produced (Zimmermann 1927, p. 16). One result was that German cars were much more expensive than those produced in the United States. For example, a car made by Ford cost one-third the price of a comparable model manufactured by the German car builder Brennabor (Addicks 1934, p. 26).

The growing inflation prevented the systematic rationalization of motor vehicle production after the war. War expenditures had led to the devaluation of money and resulted in an abnormal economic situation. Based on these external circumstances, German motor vehicles became quite popular for two reasons. First, Germans regarded cars as tangible assets they could invest in (Tessner 1994, p. 24). Second, foreign customers bought German vehicles due to the loss of value of the German currency and the fact that the export of German cars had been permitted in 1919 (Flik 2001, p. 140). Consequently, automobiles were acquired by foreign and domestic customers because of the circumstances and not because of the competitiveness of the producers and products. Due to the resulting number of sales, the incentives to implement new methods of production were limited (Addicks 1934, p. 22f.). Increasing their number of sales greatly, the producers were convinced that they were able to compete with other nations' automobile industries (Flik 2001, p. 157). Therefore, the German car builders had a competitive advantage which hindered the modernization of production until the inflation was finally contained at the end of 1923 (Edelmann 1989, p. 38; Feldenkirchen 2003, p. 87). Thus, Hübner regards the development during the time of inflation as a "catastrophic boom" (1927, p. 21). Taken as a whole, the consequences of the Great War, as well as low incomes, high costs and the existing production methods, contributed to the restricted market.

The Rise of Competition

The German automobile industry had basically no international competition during the period 1918 to 1925. The prohibition of imports, in combination with the low purchasing power of the German currency, had prevented the import of foreign cars until 1924-25 (Thieme 2004, p. 56ff.). Prior to that, foreign manufacturers had been allowed to export only four motor vehicles per month to Germany. At the end of 1923, the new German currency was established successfully. Due to this fact, the financial incentives to buy German cars decreased (Edelmann 1989, p. 58). Caused by the stability of the currency, the pressure to open the German market rose (Thieme 2004, p. 58). In 1925, the import restrictions for foreign cars were eased and the domestic car producers were faced with international competition for the first time since 1914. First of all, Ford got permission to export 70 cars per month to Germany. Afterwards, the U.S. automotive industry as a whole was allowed to export 500 motor vehicles per month (Flik 2001, p. 164). Finally, the prohibition of automobile imports to Germany was lifted completely in October 1925 (Edelmann 1989, p. 41).

In consequence of the new market conditions, the German automobile producers got into difficulty. The recently-authorized imports were seen as a serious threat by most of the car builders in Germany. They expected the demise of the whole branch due to the imminent foreign competition and anticipated a decrease in sales (Edelmann 1989, p. 62). Due to their manufacturing methods, the German producers appeared unable to compete with foreign suppliers and cars within Germany as well as in foreign markets. Contemporary witnesses considered the German cars and their methods of production to be old-fashioned and expensive (Addicks 1934, p. 24; Tessner 1994, p. 40f. p. 64). In order to protect the German market from international competition and to stay competitive, several strategies were developed and different organizations and companies began to take action.

Tariff Rates

As one reaction, the umbrella organization of the German automobile builders, the "Reichsverband der Deutschen Automobilindustrie" (German National Automobile Industry Association or RDA), asked for high import tariffs in order to protect the German automobile industry. As early as 1921, the RDA had started to discuss the issue of tariff rates with representatives of the government. The negotiations

times higher than the usual charges in other industries (Edelmann 1989, p. 41; Thieme 2004, p. 58). Needless to say, the producers would have preferred a total prohibition of imported cars (Flik 2001, p. 161). The new tariff rates were established for a period of three years beginning in autumn 1925. The charges were based on weight. In the beginning, the rates rose up to 36 to 90 percent of the value of the particular automobile. As a step to push the industry to rationalize its method of production, the charges decreased over time until they reached a low of 17 percent in 1928 (Thieme 2004, p. 59; Zimmermann 1927, p. 72).

The overall effects of the tariff rates are judged differently. On one hand, Tessner assesses that the introduced tariffs were successful since they prevented the prices on the German automobile market from decreasing. In addition, he stresses the opportunity which the diminishing tariff rates provided to establish new production techniques (1994, p. 117f.). On the other hand, Thieme estimates that the tariff rates were 10 to 15 percent lower than the international standard (2004, p. 62). Following this thesis, the tariff rates were not high enough to adequately protect the German automobile industry from foreign competition.

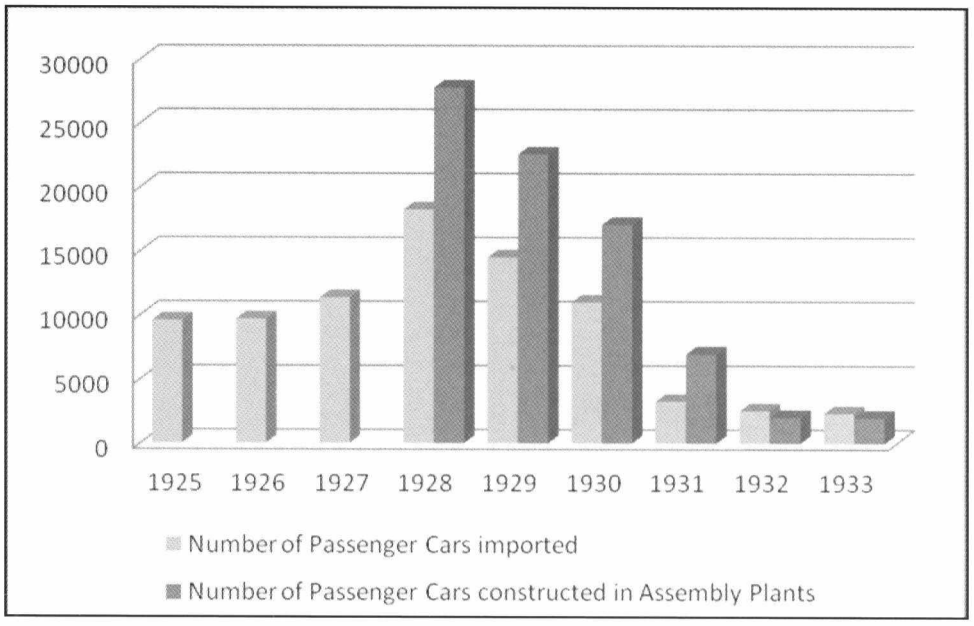


Figure 2. Number of Cars Imported or Constructed in Assembly Plants 1925-1933
Data from Flik, 2001, p. 174.

Regardless of the different opinions, it can be summarized that the tariff system did not stop the number of imported cars from rising. In 1925, 9,595 passenger cars were imported to Germany (Figure 2), while 1,491 were exported. At the same time, the total number of cars produced in Germany was 47,707. Most of the automobiles came from the United States. The share of U.S. cars was accounted to be one third of the total number of new automobiles in 1928 (Edelmann 1989, p. 111; Tessner 1994, p. 42).

In the same year, the number of imported cars peaked at a maximum of about 18,000 automobiles, whereas the number of exports was 4,809. Despite the existence of the tariff rates, the imports did not decrease but doubled from 1925 to 1928. After import restrictions were eased, the share of foreign cars within the total registration number steadily rose until 1929, when it reached more than 35 percent (Figure 3). From 1928 on, the number of imported passenger cars fell, to 2,343 cars in 1933 (Tessner 1994, p. 42). The apparent decrease after the years 1928-29 can be explained by the consequences of the World Economic Crisis. The crisis affected the automobile purchases. One result was that cars with lower gas consumption than U.S. vehicles became more attractive to German drivers (Tessner 1994, p. 117).

Besides the possible inefficiency of the tariffs, the foreign producers found an inexpensive opportunity for their products to enter the market. They set up assembly plants in Germany, so they had to pay lower charges for automobile parts. It was possible to reduce the tariffs up to 90 percent by using this option (Flik 2001, p. 170). For example, in 1927, the rates were as high as 150 Reichsmark (RM), then about $36 U.S., for 100 kg. of whole cars compared to eight to twelve RM per 100 kg. of automobile parts (Addicks 1934, p. 46). Starting with this strategy in 1924 and 1925, Ford entered the German market and opened up its first assembly plant in Germany five years later. As it is explained in more

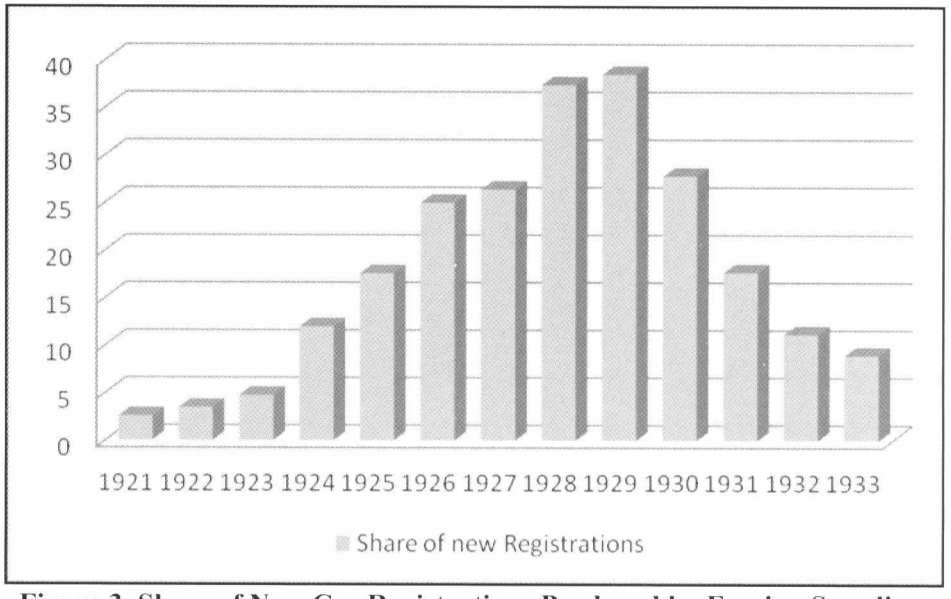


Figure 3. Share of New Car Registrations Produced by Foreign Suppliers in Percentage 1921-1933
Data from Flik, 2001, p. 176.

detail later on, General Motors (GM) went its own way on the German market by buying the German car builder Opel, although this happened after the reduction of the automobile tariff. Even though GM bought Opel, it also maintained its assembly plants in Berlin (Bönig 1993, p. 429-433; Flik 2001, p. 172).

The effects of the assembly plants exceeded the impact of the imported automobiles on the German market. Unfortunately, the data for the time before 1928 are not exact (Flik 2001, p. 174). In the year 1928, 27,500 passenger cars were built in assembly plants, which makes up 22.7 percent of the German market (figure 2) (Tessner 1994, p. 87). Afterwards the number declined, which can be seen as a result of the modification of the tariff legislation in December 1927. From then on, vehicle parts could no longer be separately classified, but had to be declared using the same tariff as that for whole automobiles (Edelmann 1989, p. 114f.; Flik 2001, p. 175).

The Daimler-Motoren-Gesellschaft strongly supported the efforts of the RDA to establish high import tariffs for foreign cars. After the rates had been determined, the company was not satisfied with the achievements of the organization. Daimler asked for charges similar to the tariff rates of other countries. The company justified the claim with the disadvantages the German automobile industry had to face due to inflation and other economic circumstances as for instance high taxes (Thieme 2004, p. 59ff.).

The debates on tariff rates did not concern Opel in the same way. From 1918 to 1930, Rüsselsheim, the location of the Opel Company, was occupied by French troops. As a result, the car builder was part of the French market and the German tariff rates did not affect Opel until 1930 (Bönig 1993, p. 442f.). In the occupied area, the import of foreign cars was eased by the French government. Until 1921, Opel was not allowed to export vehicles to the rest of the German Empire (Kugler 1987, p. 333). Opel was confronted with tough competition. Unlike the Daimler-Motoren-Gesellschaft, they had to find other strategies than pressing for the establishment of a protective market (Bönig 1993, p. 442f.; Kugler 1985, p. 28).

Organizational Change

Other attempts to reinforce the position of German automobile builders were plans to use the positive economic effects of organizational changes, e.g. mergers and cooperation. This idea was encouraged by the organization of automobile producers *Reichsverband der Deutsche Automobilindustrie* (RDA). Cooperation between carmakers was seen as a way to decrease the costs of production and distribution. In 1919, nine German car builders established two different organizations, "Gemeinschaft Deutscher Automobilfabriken" (Community of German Automobile Factories) and "Deutscher Automobilkonzern" (German Automotive Group), in order to benefit from shared sales organizations. But the individual companies agreed on neither prices nor profits. Moreover, they did not determine the fields of activities. Because of the loose character of these organizations, it is not surprising that both were shut down, in 1926 and 1929 respectively (Flik 2001, p. 206-211). Another example of organizational change is the creation of Auto Union. In 1932, four German car builders, Audi, Horch, DKW and Wanderer, founded the Auto-Union Company. The merger was completed in a strained situation, due to an economic crisis. The banks and the state of Saxony, which financed the four car builders, took the leading role in the process of the merger (Addicks 1934, p. 80; Flik 2001, p. 217-220).

Besides the case of the Auto-Union, there was one additional important merger that took place in the automobile industry at the time of the Weimar Republic. Carl Jahr, member of the supervisory board of Benz & Cie., laid the foundations for the merger of the two oldest car builders, Daimler-Motoren-Gesellschaft and Benz & Cie. He was able to give the impetus for the creation of a community of interests in 1924. One reason he did this was to ensure the international competitiveness of the two companies (Mercedes-Benz AG 1990, p. 168). Jahr acknowledged the fact that foreign competition was a crucial threat to the German automobile builders. He was convinced that the advantages of such a community were synergetic effects that would help to rationalize and also reduce the costs of production (Feldenkirchen 2003, p. 98; Stahlmann, 1993, p. 154f.). Two years later, the community of interests finally resulted in the merger of the two companies.

After the merger, the banks involved tried to create an even bigger company based on the newly established Daimler-Benz Corporation. The proposed cooperation of several automobile producers was intended to repel foreign competition (Neliba 2000, p. 34f.). The formation of a company like GM was envisioned. For that reason, the planned company was supposed to offer a range of different car types. In the beginning, Daimler-Benz and "Bayerische Motorenwerke" (Bavarian Motor Works or BMW) laid the groundwork for cooperation in that regard, but this did not prove to be successful. When GM took over Opel in 1929, the plan was finally abandoned. In the absence of Opel, the projected cooperation was considered to be ineffective (Feldman 1999, p. 8f.; Flik 2001, p. 215f.).

In March 1929, GM bought the newly-founded stock corporation Opel. The acquisition of Opel by the U.S. company was a big change because it modified the structure of the whole branch, the rest of the German industry and even the foreign automobile market. Afterwards, GM kept its plant in Berlin until 1931, but refrained from producing vehicles that competed with Opel cars. Due to the affiliation with GM, Opel gained some important advantages. It was able to use the distribution network of GM, its patents, and had access to technological knowledge and research of the U.S. company (Flik 2001, p. 186f.).

The motives for selling Opel are not totally clear (Kugler 1985, p. 85). Tessner considers the insufficient competitiveness of the German automobile industry as a possible reason (1994, p. 100). Financial problems are also regarded as the reason why the family-owned company was offered to GM. The Opel family knew they had to modernize production and that this would require money which the family was not able to spend (Bönig 1993, p. 450; Neliba 2000, p. 31). Another factor may have been the death of two family members, resulting in the payment of two sets of death taxes in a row. Wilhelm von Opel him-

self stated that he sold the company because he had anticipated the decline of the German automobile market in the following years (Lewandowski 2000, p. 62f.). Regardless of the reasons, the outcomes of organizational change concerning Opel and Daimler-Benz differed markedly.

Rationalization

A further tactic to enhance the competitiveness of German automobile producers was the rationalization of production. Further mechanization and rationalization leading to higher productivity was needed to make the industry competitive with foreign companies (Tessner 1994, p. 68). Rationalization is a term with various implications which have altered through different periods and contexts (Hachtmann 1996). Here, rationalization is understood as a process that is aimed at "... effectiveness of work organization and production ..." (Braun & Kaiser 1992, p. 57). The implementation of flow production and assembly lines, new machines and the reorganization of employment are some examples. Although the German automobile industry had not been progressive with regard to rationalization in the period 1918 to 1924, there were several later attempts to modernize production methods. Even though these did not lead to the establishment of mass production as in the United States, a couple of steps proved to be successful, particularly with regard to the comparatively small market that did not promote mass motorization (Hachtmann 1996, p. 219). By 1928, 24 out of 28 car producers had begun to implement some changes in their production (Tessner 1994, p. 66f.). But the intensity of mechanization and rationalization in the German automobile industry was not comparable to, for example, that of the Ford Company. Contemporaries did not consider the automobile industry to have adapted to mass production efficiently, and therefore criticized the industry for having failed rationalization (Ledermann 1933, p. 47). Most of the producers established only short assembly lines and used them to produce just short series of automobiles (Flik 2001, p. 224).

Opel, as the largest German supplier of automobiles prior to World War II, was the first car builder to introduce assembly lines, in 1924, having previously relied on job shop manufacturing. Subsequently, the company built a green four-hp motor vehicle, the so-called "Laubfrosch" (tree frog). It was the first German vehicle to be produced using flow production and became the most popular car in Germany during the 1920s. From 1924 to 1931, Opel sold 120,000 Laubfrosch cars. The company concentrated on the production of the Laubfrosch, one other vehicle, a later 10/40 hp car, and different variants that were based on them. Production time was greatly reduced, due to standardization and new machinery. Opel increased its production tenfold by 1928 and reached a maximum of 250 vehicles per day (Edelmann 1989, p. 81f.; Neliba 2000, p. 27; Tessner 1994, p. 95). Simultaneously, the car builder cut the price for its Laubfrosch from 4,500 RM (about $1,070 U.S.) in 1924 to 3,000 RM (about $713) in 1927 (Bönig 1993, p. 443).

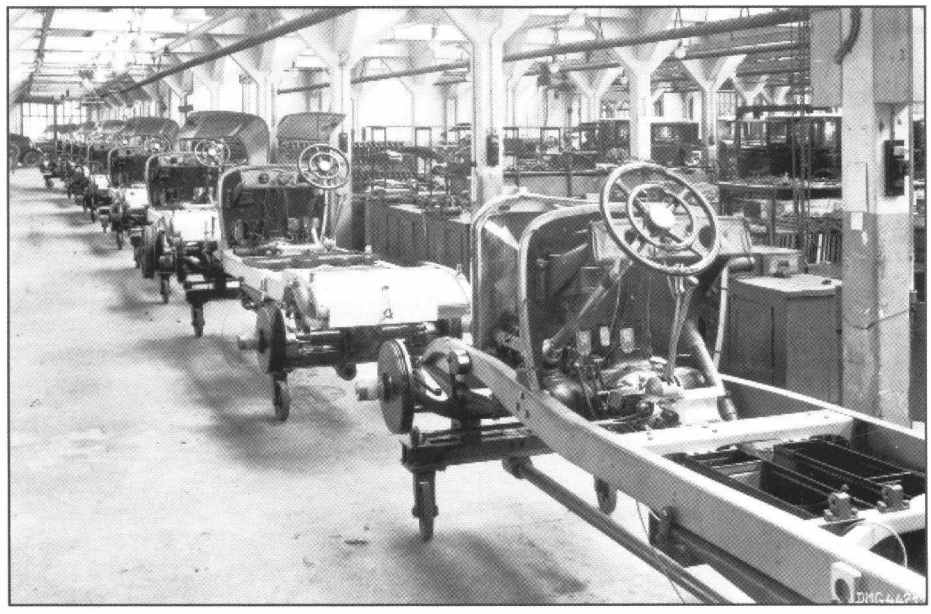
Opel's 4 PS "Laubfrosch" (tree frog) was introduced in 1924, the first German vehicle to use flow production.
Adam Opel AG

Despite all these achievements, the German car builders cannot be considered as rationalized as the huge U.S. producers at that time. The implementation of assembly lines included only parts of the production, and Opel did not come close to the productivity of U.S. suppliers like Ford. The installation of assembly lines was a slow process that took several years. In 1924, the total length of the assembly lines was 45 meters (147 feet). It reached 2,000 meters in 1929 (Bönig 1993, p. 445). All in all, Opel used a system that combined flow production and assembly lines (Kugler 1987, p. 337). Still, the company was the first German auto-

"Laubfrosch" cars on the Opel assembly line, 1926. *Adam Opel AG*

mobile supplier to produce for an expanding market and focus on mass production.

As stated earlier, one of the objectives of the community of interests and the subsequent merger of Daimler and Benz had been to rationalize production in order to reduce production costs. To accomplish this goal, the two companies had to compromise on methods of rationalization. Both companies were known for quality luxury cars and sports cars. This was the reason why Daimler and Benz did not plan to become producers of low-priced, mass-produced automobiles, like Ford in the United States or as Opel was about to become. As Schulenburg puts it, "the principle of mass production was not compatible with the self-conception of the company" (2008, p. 153). In this case the challenge was to change the production process and maintain the established quality at the same time, in order to decrease prices and remain competitive with foreign as well as domestic car builders.



Above, construction of chassis using assembly dollies at Untertürckheim, 1925. Below, certificate of the Daimler-Benz merger, 1926. Daimler AG

For Daimler-Motoren-Gesellschaft, as well as the Daimler-Benz company later on, the Untertürckheim plant served as a model plant. New processes tested there were later adopted by other company plants. Before assembly lines were set up at the end of the 1920s, assembly dollies were introduced at Untertürckheim in 1925. The assembly dollies were moved by workers and eased the transport of vehicles from one production station to another. Whole cars were assembled on them (Feldenkirchen 2004, p. 106f.).

As previously mentioned, Opel implemented flow production directly in the 1920s. In contrast, Daimler established cellular manufacturing prior to the use of flow production at Untertürckheim. Cellular manufacturing involved the creation of working groups that produced individual automobile parts. Different from the earlier job shop manufacturing, transportation was limited and the production process was clear (Braun 1995, p. 62f.). At Untertürckheim, the establishment of cellular manufacturing was completed in 1925. The new system resulted in reduced cost and faster production (Kugler 1987, p. 331).

When finally introducing flow production, Daimler-Benz tried to maintain its traditional quality by relying on a system that Feldenkirchen calls "flexible quality production" (2003, p. 108). It is characterized by the loose use of assembly lines combined with frequent control stations. As a result, reduced production costs and increased production volumes were realized. Unlike Opel, Daimler-Benz did not have the funds for the installation of a whole new set of production machines (Schulenburg 2008, p. 116). Therefore, the company additionally tried to rationalize the organization of workers (Feldenkirchen 2004, p. 105; Thieme 2004, p. 186).

Although Daimler-Benz did not use methods of rationalization in the same way as Opel, the company introduced flow production and assembly lines quite early in comparison to other German automobile producers (Flik 2001, p. 223). Concerning the progressiveness of the production, Bönig stresses that Daimler-Benz was comparable to other German car builders and their process of rationalization (1993, p. 471). Even so, when the company is contrasted with Opel, one is able to see that there was a huge difference. Opel converted its production directly from job shop manufacturing to flow production, whereas Daimler used cellular manufacturing as an intermediate step. Daim-

ler accomplished 5.9 units. With regard to foreign competition, Daimler-Benz did not reach the same stage of effectiveness. But Daimler-Benz tried to outperform the U.S. producers by focusing on quality (Schulenburg 2008, p. 124, p. 155; Tessner 1994, p. 70). The company advertised for its products by stressing that its division of work was not as advanced as in the U.S. automobile industry, but that it relied on precision and consistency of production instead (Thieme 2004, p. 186).

Campaigns

Facing foreign, especially American, competition, the German automobile industry began a campaign to support the spread of German cars on the national market. Using booklets, posters and advertisements in newspapers, the RDA, as well as car builders like Opel, announced that it was a German duty to buy German cars (Adelt 1931, p. 178). Buying a German automobile was associated with contributing to the domestic economy and the employment of German workers. By acquiring a foreign car, a driver was suspected of damaging the economy (Klemm 1929, p. 84). The RDA even sent letters to foreign car owners. Another step influencing the public was the establishment of a news service that promoted the German automobile industry in the press (Adelt 1931, p. 108).

The campaign also introduced a criterion whereby a car could only be called and certified as German when two-thirds of the value creation took place in Germany. These cars were equipped with the symbol of an acorn and were therefore readily identifiable. In 1931, the Department of Transportation decided that public authorities were allowed to order only cars that had a German certificate (Thomes 2003, p. 158). All in all, it is difficult to determine the effects of the campaign on the German automobile market, but with regard to Ford in Germany it is clear there was an impact. The German Ford company tried hard to adapt to the situation by proving that its cars were certifiably German (Thomes 2003, p. 158). The RDA declared itself satisfied with the effects of the campaign (Adelt 1931, p. 109).

With respect to Opel, it is known that the former owner of the company, the Opel family, strongly supported the campaign. The company tried to prevent foreign competition by stressing that Germans were supposed to buy domestic cars. In some of its newspaper advertisements, the company requested that people drive German cars and thereby support the domestic economy (Klemm 1929, p. 87). Another example of the company's involvement in this campaign is the fact that suppliers who drove foreign cars were not welcomed by Opel (Neliba 2000, p. 36).

Daimler-Benz did not explicitly take advantage of this campaign. Nevertheless, it has been criticized for instrumentalizing the threat of foreign competition to disguise the weakness of the German automobile industry, due to slow changes to the process of production (Thieme 2004, p. 63). On the other hand, Daimler-Benz always presented itself as a strong company that was competitive because of its focus on quality and handcraft.

Conclusion

The German automobile industry attempted to prevent foreign producers and products from penetrating the German market in different ways. Being aware that particularly U.S. suppliers were able to build competitive low-priced cars, the industry and its umbrella organization RDA took several steps to protect the German market. As one step, the protagonists asked for the establishment of high tariff rates on automobile imports. The tariffs could not stop the import of cars to Germany. The lower tariff rates on parts encouraged the spread of foreign motor vehicles. Daimler supported the establishment of high tariff rates and was not satisfied with the implemented charges. Opel was not affected by the German tariff rates in the same way since it was situated in an occupied area.

Mergers and cooperation were other strategies adopted by German automobile builders. In 1924, Daimler-Motoren-Gesellschaft and Benz & Cie. joined in a community of interests. Two years later, this resulted in the merger creating the Daimler-Benz Company. An important reason for this cooperation was the intent to stay competitive compared to foreign automobile producers. Opel chose another form of organizational change. The family business was sold to GM because of various reasons. The extent to which foreign competition influenced this decision cannot be easily quantified.

Several automobile builders rationalized their production after the end of inflation. Opel, as well as Daimler-Benz, introduced assembly lines and flow production in order to achieve cheaper and more efficient production. Opel was the first German automobile supplier to install assembly lines. Because of the new methods of production, Opel was able to reduce the production time and increase the number of automobiles produced. Daimler-Benz stuck to the production of quality cars and tried to find a compromise between the rationalization of production and the building of individual luxury vehicles.

As an obvious way of preventing the spread of foreign competition on the domestic market, a campaign against it was launched in the inter-war period. The RDA used different methods to convince Germans to buy domestic automobiles. Opel definitely identified itself with the contents of the campaign and supported it, while Daimler-Benz instrumentalized the imminent danger of foreign competition as a way to distract from the failures of the industry as well as the company itself.

With regard to Daimler-Benz, there have been lots of strategies to prevent competition, and the impact of foreign competition played a major role in the formation of the Daimler-Benz merger. But the company was able to adjust itself to this challenge by relying on the production of quality luxury cars and by introducing necessary changes to its process of production. Opel also tried to defend foreign competition. It was able to use its position on the market and become the first German mass producer of cars, but in the end became part of the U.S. producer General Motors.

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References

Addicks, Almut (1934). *Die deutsche Kraftfahrzeugindustrie in der Nachkriegszeit (seit 1924)*. Würzburg: Buchdruckerei Richard Mayr.

Adelt, Richard (1931). *Die Krise in der deutschen Personenautomobil-Industrie*. Munich: no publisher.

Bönig, Jürgen (1993). *Die Einführung von Fließbandarbeit in Deutschland bis 1933. Zur Geschichte einer Sozialinnovation (Vol. 1)*. Münster; Hamburg: LIT Verlag.

Braun, Hans-Joachim (1991). "Automobilfertigung in den USA und Deutschland in den 20er Jahren ein Vergleich." In Pohl, Hans (Ed.), *Traditionspflege in der deutschen Automobilindustrie* (pp. 183-200). Stuttgart: Steiner.

Braun, Hans-Joachim, Kaiser, Walter (1992). *Energiewirtschaft. Automatisierung. Information seit 1914 (Propyläen Technikgeschichte Vol. 5)*. Berlin: Propyläen Verlag.

Braun, Hans-Joachim (1995). "Automobilfertigung in Deutschland von den Anfängen bis zu den vierziger Jahren." In Harry Niemann & Armin Hermann (Eds.), *Die Entwicklung der Motorisierung im Deutschen Reich und den Nachfolgestaaten* (pp. 58-68). Stuttgart: Franz Steiner Verlag.

Edelmann, Heidrun (1989). *Vom Luxusgut zum Gebrauchsgegenstand. Die Geschichte der Verbreitung von Personenkraftwagen in Deutschland*. Frankfurt a.M.: no publisher.

Feldenkirchen, Wilfried (2003). "Vom Guten das Beste." *Von Daimler und Benz zur DaimlerChrysler AG (Vol. 1)*. Munich: Herbig.

Feldenkirchen, Wilfried (2004). *DaimlerChrysler Werk Untertürkheim*. Stuttgart: Motorbuch Verlag.

Feldman, Gerald D. (1999). "Die Deutsche Bank und die Automobilindustrie." *Zeitschrift für Unternehmensgeschichte*, 44 (1), 3-14.

Flik, Reiner (2001). *Von Ford lernen? Automobilbau und Motorisierung in Deutschland bis 1933* (Wirtschafts- und Sozialhistorische Studien Vol. 11). Köln; Weimar; Wien: Böhlau.

Hachtmann, Rüdiger (1996). Industriearbeiterschaft und Rationalisierung 1900 bis 1945. Bemerkungen zum Forschungsstand. *Jahrbuch für Wirtschaftsgeschichte*, 1996, 211-258.

Hübner, Erich (1927). *Das Krisenproblem der deutschen Kraftwagen-Industrie. Eine volkswirtschaftliche Untersuchung als Grundlage für eine Stellungnahme zum Automobilzoll (Gesetz über Zolländerungen, Position 915, vom 17. August 1925)*. Berlin: Buchdruckerei der Holzmarkt.

Klemm, Friedrich (1929). *Die Hauptprobleme der Entwicklung der deutschen Automobilindustrie in der Nachkriegszeit und der Wettbewerb dieser Industrie mit dem Ausland, insbesondere mit den Vereinigten Staaten von Nordamerika*. Marburg: Dalmersche Buchdruckerei.

Kugler, Anita (1987). Von der Werkstatt zum Fließband. Etappen der frühen Automobilproduktion in Deutschland. *Geschichte und Gesellschaft. Zeitschrift für historische Sozialwissenschaft*, 13 (3), 304-339.

Kugler, Anita (1985). *Arbeitsorganisation und Produktionstechnologie der Adam Opel Werke (von 1900 bis 1929)*. Berlin: Wissenschaftszentrum.

Ledermann, Fred (1933). *Fehlrationalisierung. Der Irrweg der deutschen Automobilindustrie seit der Stabilisierung der Mark (Betriebswirtschaftliche Studie eines Beispiels der Investitionskonjunktur)*. Stuttgart: C.E. Poeschel Verlag.

Lewandowski, Jürgen (2000). *Opel. Das Unternehmen. Die Automobile. Die Menschen*. Bielefeld: Delius Klasing.

Mercedes-Benz AG (1990). *100 Jahre Daimler-Motoren-Gesellschaft 1890-1990*. Stuttgart: no publisher.

Neliba, Günter (2000). *Die Opel-Werke im Konzern von General Motors (1929-1948) in Rüsselsheim und Brandenburg. Produktion für Aufrüstung und Krieg ab 1935 unter nationalsozialistischer Herrschaft*. Frankfurt a.M.: Brandes & Apsel.

Schulenburg, Caroline (2008). *Renault und Daimler-Benz in der Zwischenkriegszeit (1919-1938). Eine vergleichende Unternehmensgeschichte zweier europäischer Automobilhersteller*. Stuttgart: Franz Steiner Verlag.

Stahlmann, Michael (1993). *Die erste Revolution in der Autoindustrie. Management und Arbeitspolitik von 1900 bis 1940*. Frankfurt a.M.; New York: Campus Verlag.

Tessner, Magnus (1994). *Die deutsche Automobilindustrie im Strukturwandel von 1919 bis 1938*. Köln: Botermann & Botermann Verlag.

Thieme, Carsten (2004). *Daimler-Benz zwischen Anpassungskrise, Verdrängungswettbewerb und Rüstungskonjunktur 1919-1936*. Vaihingen/Enz: IPa-Verlag.

Thomes, Paul (2003). "Searching for Identity. Ford Motor Company in the German Market (1903-2003)." In Hubert Bonin, Yannick Lung & Steven Tolliday (Eds.), *Ford, 1903 2003: The European History (Vol. 2)* (pp. 151-195). Paris: P.L.A.G.E.

Zimmermann, Friedrich (1927). *Die Lage der deutschen Automobilindustrie und der Kampf um den Automobilzoll*. Wertheim a.M.: Bechstein.

The Automobile Industry Paradigm

Economies of Scale

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Introduction

Peter Drucker called it "the industry of industries" for good reason (Drucker 1972); the manufacturing of automobiles has necessitated, since the time of Henry Ford, production systems that are complex in nature and massive in physical size. Indeed, Mr. Ford himself is said to have coined the very phrase "mass production" (Ford 1926). Yet mass production should not be taken to imply limitless production. While the maxim seems to be that "bigger is better" there does come a point where the various production inputs need to be synchronized in order to maximize overall efficiency. It is the purpose of this article to demonstrate that this figure is lower than generally thought, thanks to a singular technology and a tightly defined paradigm.

Growing Pains of an Infant Industry

Henry Ford's great innovation was to adapt the production flow concept to the nascent automotive industry. With the Highland Park site bursting at the seams, the River Rouge plant was built in 1928 as a fully vertically integrated operation that even had its own steel mill (Rae, 1984). The trick was repeated in Britain with the Dagenham plant east of London in 1931, the expense of which was magnified when it was discovered that it would be built on marshland. The real challenge, though, was in bringing the output rates of the different processes into alignment. When a steel plant is supplying a number of customers across different industries the diversification of demand helps to smooth production output. Not so when the only customer is the in-house car plant where production rates can exhibit seasonal volatility; blast furnaces do not take kindly to stop-and-start production.

Synchronization of output volumes for the various processes was not the only challenge, as the 1920s also brought in the next great technological leap forwards for the car industry. Until then, the style of production was still essentially craft-based, with carpenters installing unstressed wooden body frames on structural steel frames or chassis. Conceptually this was no different from the production of horse-drawn carriages, albeit with the vehicle's motive power being engine rather than equine based. The frame as foundation allowed enormous freedom in automotive design since the body was little more than a shed bolted to a solid platform. One of the reasons Ford's Model T was so ubiquitous was the staggering number of variants, everything from roadsters to trucks, a degree of diversity that was only possible when the underlying frame took all the major stresses. For the same reason, the approach continues today for trucks.

This freedom in design meant that the same basic vehicle could appeal to all market segments. Yet as a defined production process it also had serious limitations. Despite the innovation of the moving production line, the techniques utilized in the body construction stages were still dependent on skilled craftsman who could not be readily replaced by machines. Another problem was that paint could not be baked at high temperature to speed the curing process for fear of burning the delicate wood and fabric body. With ambient temperatures being the only option, black paint was the quickest to dry and even that took up to 30 days (Maxton and Wormald 1995). Henry Ford may have stipulated that "any customer can have a car painted any color that he wants so long as it is black" (Ford 1922) but stockpiles of cars were still unavoidable.

At around that time, Edward Budd and Joseph Ledwinka were establishing the practice of fabricating steel bodies for automotive applications. Like every other technique in vehicle production, the principles were not new. The practice of stamping out parts shaped from sheets of metal had been used in the New England clock and lock industry since 1860, and in 1899 Latil had proposed an all-steel body for cars (Niewenhuis and Wells 1997). As the automotive industry expanded, Budd and Ledwinka were able to argue that the huge American market demanded rates of output that panel-stamping machines could provide.

Manufacturing the complete vehicle from sheet steel meant that whole vehicle sections could be stamped out in an instant. In 1915, Dodge was redefining the automotive industry with car bodies that used the cowl, roof, side and rear panels as load-bearing structures. The vehicle could then be painted and baked at 450°F (230°C), reducing paint curing times to just a couple of hours. The Dodge Brothers contracted Budd to build 5,000 bodies per year but by 1916 the company was taking 500 per day. The new style of production was rather experimental, resulting in overweight vehicles and suffering heat distortion from the welding, but by 1940 the technique had matured with the Nash 600. This model exhibited a unitary body that dispensed with the frame altogether and boasted a weight saving of over 500 pounds (Daimler Museum 2013).

The all-steel, load-bearing body marked the point where automobile production went on its own diversion from the rest of the automotive industry. Until then, cars and commercial vehicles had been differentiated only by their body styles, all the strength being in the separate frame. Most commercial vehicles continue with this approach, as well as pick-up trucks, since it facilitates total flexibility in the body style. The bodies can even be fabricated from a variety of materials, from metal to glass fiber and all manner of quirky alternatives. Passenger cars, though, became much more constrained in style and production technology.

Birth of the Automobile Paradigm

It is the strict limitations imposed on passenger car manufacturing by the load-bearing steel body that prompted Niewenhuis and Wells (1997) to coin the term "Budd Paradigm." In science, paradigms are a familiar concept (Kuhn 1970), two typical examples in medicine being bacteriology and virology. The first is concerned with bacterial diseases that are treated with antibiotics, while the second is concerned with viral diseases that can be neutralized prophylactically with vaccines. The two approaches are quite distinct from one another and the treatments for one are totally inappropriate for the other. Casting our gaze wider we begin to see paradigms almost everywhere: astronomy and astrology, mechanical and electrical engineering, even into the ways in which human society is organized.

With the automobile industry the paradigm has a very clear technical basis in the fabrication of the steel bodies. With the move to frameless steel bodies much of the freedom in design was lost. With all the vehicle stresses now contained within a scientifically engineered body it was no longer possible for individual customers to engage coachbuilders to design unique variants. To do so could seriously compromise the structural integrity of the body and thus the vehicle as a whole. Automobile manufacturers standardized their products around a limited number of variants, usually closely related to a core sedan design. No longer served by a wide variety of custom body builders, the automobile companies found that they were completely dependent on the few body suppliers that had made the heavy capital investment in panel stamping machinery.

The automobile companies found themselves in an extremely vulnerable situation. As explained by O.E. Williamson (1987), there is a danger of holdups where suppliers have the opportunity to exploit their positions of power and extract higher prices from the automobile companies. The only way to resolve the predicament is for the automobile company to internalize the threat through vertical integration of the supplier. Once the supplier is part of the automobile company's own internal corporate structure the hold-up menace is nullified. In one famous case, GM was obliged to acquire Fisher Body in order to guarantee supplies of bodies to its vehicle assembly plant in Flint (Klein 2000).

Standardization around a limited number of body designs was not the only imperative of the newly defined automobile industry. Although the stamping of steel panels offered advantages of lighter vehicles and higher rates of production, the presses and dies that fabricated the bodies represented multi-million dollar investments. Even now, GM's new stamping plant in Arlington, Texas, is costing U.S. $200 million (GM, 2012). With such capital commitments it is inevitable that companies will run their presses as fast as possible for as long as possible. The presses themselves can last for years. Chrysler presses in the early 1990s averaged slightly more than 25 years of continuous use and 40 years is not unknown (Stoll 2004). The dies, naturally, have a shorter lifespan and tend to be pensioned off after around two million pressings (Rhys 1972).

The implications of an inflexible vehicle design and a capital-intensive stamping process are frighteningly clear: the industry is doomed to churning out huge numbers of standardized products. Since the 1950s the whole purpose of automobile manufacturers has been to maximize the commonality of their models and to keep the production system running without cease. For those manufacturers that succeed in keeping the production lines rolling there is the hope of benefiting from economies of scale, the optimum plant size that means no rival can beat it on costs. It has become an article of faith in the industry that these economies are not fully exploited until total output levels climb beyond six million units per annum. The nightmare scenario, then, is of a tight circle of mega-corporations, each producing millions of identical cars a year.

Measuring the Economies of Scale

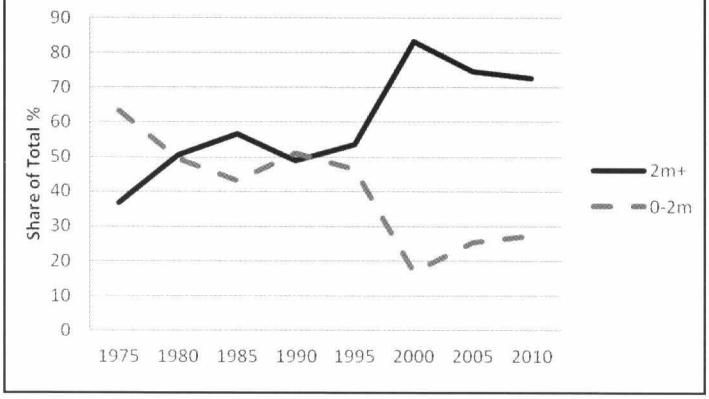
Economies of scale are said to exist in an industry if the building of successively-larger plants results in the reduction of unit production cost. The various plants differ only in their output capacity, not in the basic production technology. It is not a characteristic of individual companies but the entire industry, each industry having its own unique optimum plant size. In furniture production there is such a high level of labor input that a doubling of output requires the same increase in the workforce, so each unit is produced for the same cost. There is therefore little advantage in building ever-larger plants. More capital-intensive industries, though, can install larger machines that have the potential to lower per-unit production costs, assuming that the production lines are kept busy. Should the larger machines result in higher per unit costs, then the company will experience diseconomies of scale, a commercially irrational position.

If the theory of economies of scale seems simple enough, the attempt to measure the point of optimum efficiency is a complex task. The problem is that the costs facing a company can arise in a multitude of ways, from the logistics of obtaining the raw materials to the more subtle influences of the national trading position. An engineering approach would attempt to measure all the physical inputs, while an econometric one would take a wider perspective and allocate some sort of measurable costs to each relevant item. Both studies can involve teams of researchers working for extended periods and then still not in agreement on the result. Fortunately, a seminal study of the steel industry by George Stigler concluded that the most efficient plant size must be the one that survives for the longest. Survivor analysis is simply a method for observing the level of output that firms in the industry are converging towards, given enough time (Stigler 1958).

If we apply this approach to the automobile industry over the 35-year period 1975 to 2010 then it should capture a record of an industry absorbing the entry of the major players in Japan and South Korea with Chinese manufactures beginning to creep in at the bottom. Rather than identifying specific companies, which have their own unique circumstantial and historical advantages, survivor analysis looks at companies grouped together into production output ranges and assesses the extent to which they are gaining global market share dominance. Prevailing wisdom in the automobile industry would lead us to expect that those

manufacturers with output above several million units per annum would progressively gain a greater share of the world total.

Figure 1: Two Output Range Share

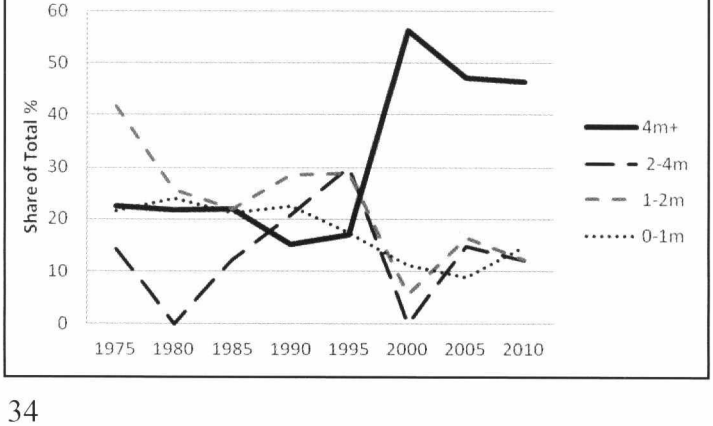


Using data from the Organisation Internationale des Constructeurs d'Automobiles (OICA, which translates as "International Organization of Motor Vehicle Manufacturers"), Figure 1 shows the results from segmenting total global automobile production into just two arbitrarily chosen output ranges. To be quite frank, the graphs depict a researcher's worst nightmare. Although it is clear that the manufacturers producing more than two million units per annum enjoyed their biggest boost between 1995 and 2000, thereafter their share of the total stabilized. Meanwhile, the smaller manufacturers, which should have been suffering the kinds of relative inefficiencies that would propel them out of the industry, seem to bounce back with impressive elasticity.

For a researcher, the problem with Figure 1 is that it indicates that the advantage of size is dichotomous, the largest and the smallest manufacturers apparently dancing around each other in opposition. To try and tease out more detail Figure 2 takes four output ranges. The very largest manufacturers, i.e. four million plus per annum, maintain the previous profile, with a big boost in 1995 to 2000 but little of interest otherwise. The next two smaller ranges suffer a downward trend, only the smallest range, zero to one million units per annum, delivering a little optimism from 2005 to 2010.

It is not too difficult to concoct an acceptable rationale for this behavior. The largest manufacturers went through a burst of mergers and acquisitions at the end of the last century, the most rash of which were then unwound in the new century. This meant that they bobbed up and down like driftwood on the tide, moving into and then back out of the highest range. In the lowest output range, in its last period, we see some uplift due to the emergence of domestic Chinese manufacturers.

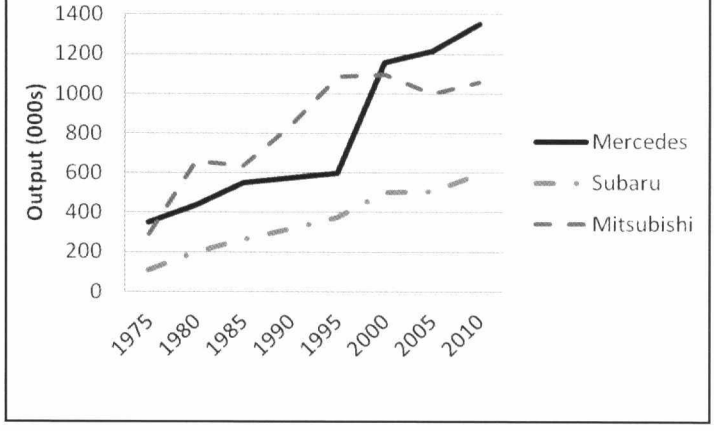
Figure 2: Four Output Range Share



The waters are further muddied by the possibility that in a continually expanding global market the smaller producers could be losing their share of the total while maintaining, or even increasing, their actual rates of production. Attractive though this reasoning may be, it flies in the face of the survivor analysis logic. If the economies of scale are available in one narrow output range, then no other output range should get a look-in. If the advantages exist above four million units per annum then there should be a clear upward trend to this output range as the member corporations progressively dominate markets around the world with their affordable, yet highly-specified, products. So the smaller manufacturers should be suffering declines in both global market share and actual rates of output.

For curiosity's sake it is worth investigating the kinds of companies that inhabit the lower reaches of the production output ranges. This is against the survivor analysis theory because each company will have its own specific factors, but nevertheless some clues for their continuing existence might be uncovered. Figure 3 shows three manufacturers, and as feared (from a research point of view) they are enjoying healthy rates of growth even while being consigned to lowest ranked output range. All three have been established for many decades, and Mercedes-Benz, of course, can claim descent from the very first motor manufacturer. Clearly there is no disadvantage to a relatively small size.

Figure 3: Tenacious Survivors



Bottom-Up Analysis

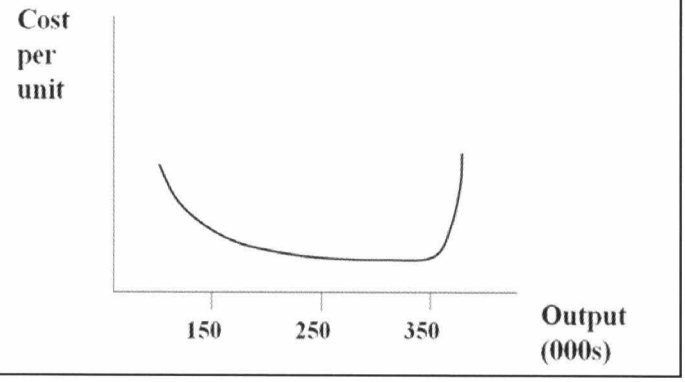
If we return to Stigler's theory of survivor analysis we can see that he conducted his analysis of a single-process industry, steel, whereas the multi-process automobile manufacturing industry presents a more complex picture. An alternative method, then, starts with output of identifiable processes and build up to the corporation as a whole.

Most industry commentators divide the production of automobiles into four main processes (Rhys 1982; Niewenhuis and Wells 1997):

1. Research and development (R&D) – the design and engineering of automobiles up to the point of being put into series production.
2. The body-in-white (BIW) – comprising the stamping and welding of steel panels to form the load bearing body. This is the process pioneered by Budd and Ledwinka.
3. Powertrain – the forging, casting and assembly of engines and transmissions.
4. Final assembly – the Ford innovation.

If we look at the output size for each of the manufacturing processes there is remarkable stability, suggesting that economies of scale at the plant level are understood and practiced. This is revealed by looking at the planned output capacity of new plants and including the actual output of established plants. The output capacity should tell us the most efficient plant size, while the actual output levels will indicate the acceptable levels of output. For example, final assembly plants are often configured for output in the region of 300,000 to 330,000 units per annum (upa), while actual output can be as low as 150,000 upa. Between these ranges will be an infinite number of other possible plant sizes but we can consolidate them all into one economies-of-scale curve for assembly, as in Figure 4 below.

Figure 4: Economies of scale curve for final assembly



The economies of scale curve can be thought of as an aid to planning. It joins together all the minimum points for all the cost curves for every conceivable plant size. If a manager considers that the market can absorb 250,000 upa then the curve shows that when a plant of that capacity is being fully used it will not be quite as efficient as one at 350,000 upa, but the difference will be barely significant. It is certainly far better than cautiously building capacity by building first one, then another plant of 125,000 upa, since they are of a comparatively inefficient size. What Figure 4 does not tell us, because it does not show the cost curve for each plant size, is that the worst option is to build the largest, potentially most efficient, plant size and then operate it well below its capacity.

As was noted, the largest new assembly plants being built have capacity up to 330,000 upa. We might conjecture that the ideal final assembly plant could be configured for even higher production rates, and the only reason why we have not witnessed this plant size yet is that it would demand the achievement of perfection in all aspects of the plant. For the sake of argument this ideal output level has been given as 350,000 upa, which is therefore minimum efficient plant size (MEPS), anything smaller being less efficient. Crucially, to build a plant much bigger would be to create an industrial monster that is actually much less efficient. Such a plant would be experiencing diseconomies of scale, perhaps due to overcrowding, and the cost per unit produced in such an operation would rise rapidly.

The same approach to estimating economies of scale can be used for the two other industrial processes. All the way through we are making the assumption that if plants have survived with a certain level of output, or are being planned for a particular capacity, then we can include them in the range of economically acceptable production rates. For powertrain and BIW the economies of scale curves are flat-bottomed, indicating a wide range of outputs that are not substantially worse than the MEPS optimum. The research indicates MEPS for powertrain is around one million upa, though with output of half that being acceptably close on efficiency, and MEPS for BIW of around 500,000 upa but again, with a very wide range on either side of the figure offering reasonable efficiencies.

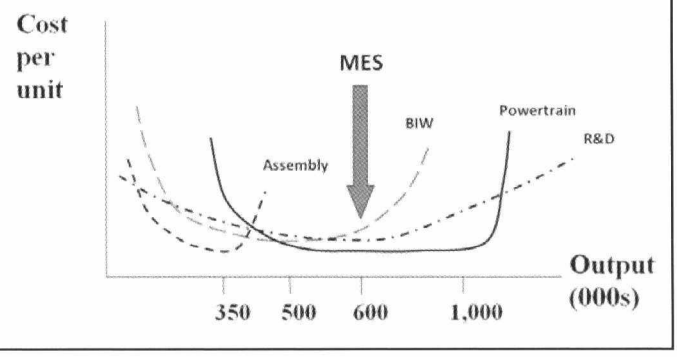
The MEPS for R&D is much more elusive, although some research suggests that engineering teams work most effectively with small numbers, perhaps as few as 150 engineers (Cooper 1964). Since we are trying to converge on a single output number for the minimum efficient scale (MES) of a complete automobile manufacturer, i.e. one that is not dependent on outside assistance, we need instead to find the lowest output level that can justify having an R&D function capable of engineering all the major aspects of the product range, from body styling to powertrain. Relating R&D expenditure to sales volumes, number of models and the number of employees reveals that Subaru, owned by Fuji Heavy Industries, has one of the most efficient R&D operations. This company exhibits spending of around U.S. $500 million per year spread over four platforms and nine models, all supported by production of around 600,000 upa. Automobile companies smaller than that tend to not have complete R&D functions, looking instead to external support.

Since the overcrowding effect is much less likely to occur in R&D than for the industrial processes, for the simple reason that a single R&D function can be divided into smaller teams working in different locations, the economies of scale curve is likely to be shallow. Furthermore, companies will not fear advancing into diseconomies of scale in R&D because the less aggressive rise in costs is more than compensated for by the proliferation of model variants and competitive specifications. This broadening of the model range diversifies sales in the market and so smooths out production fluctuations, which is a major driver of efficiency. Toyota may have a relatively inefficient R&D function compared to Subaru, but it has an expansive model range and production plants working at full capacity.

Having derived the plant level MEPS for each process by survivor analysis we can combine the curves to reveal the MES for the complete, vertically integrated automobile manufacturer. The MES for the company as a whole occurs where all the individual MEPS curves coincide at

their minimum points, or at least as close as we can get. This is shown in Figure 5 below and we can define a manufacturer at this point as being a prototypical automobile company, one that represents the basic format of company for the automobile industry.

Figure 5: Automobile minimum efficient scale



Although there is no point where the MEPS curves cross at exactly their minimum points there is enough flexibility in plant size that we can achieve reasonable proximity. The resultant prototypical company would comprise BIW, powertrain and R&D functions all configured for output of 600,000 upa, with the final assembly plants of 300,000 upa doubling up to match. This is the automobile industry paradigm and it means that the prototypical manufacturer that can consistently achieve these output numbers from all its plants will benefit from the minimum costs possible in the industry. No other manufacturer will be able to compete with it on cost, price or profitability. So why are senior managers so ambitious to grow their companies beyond this scale?

Increasing Returns Beyond Scale

Sadly, consumer demand is too fickle to allow production levels to stabilize for long. For whatever reason, they like to sell the car they bought just a few years before and change it for something shiny and new. A perfectly decent model will then suffer the vicissitudes of the product life cycle, enjoying brief popularity before going into a terminal decline. Woe betide any manufacturer that does not offer the customer a new product, even if it is little more than a warmed over version of the one they have. Henry Ford made this mistake with the Model T, being so reluctant to develop a new model that GM was able to take the industry leadership and relegate Ford to playing perennial catch-up.

If there is a purpose to senior management, then, it is to find ways to smooth out the production peaks and troughs. One way would be to produce at a constant rate oblivious to market demand, discounting prices when stock levels build too high. This works very well but only if the demand cycle recovers to a point where discounting becomes unnecessary.

Advances in production technology also help because they offer flexible manufacturing. First proposed in the United States, the ability to mix different models on the same production line found its home in the varied demand of the smaller Japanese market (Williams et al. 1994). In a flexible system, output can be diversified across related model variants so that if one should falter in the market another can take its place. For example, Subaru can withstand a demand shift from passenger cars to sports utility vehicles (SUV) because the Outback wagon is basically the same vehicle as the Legacy sedan and made in the same facility.

While flexible manufacturing allows the manufacturer to maintain access to economies of scale, because it has a diversified model range to hold total production constant, the advantages of diversification increase as the company expands to become a global giant. Toyota, for example, has around fifty models in the market, including Lexus but excluding Daihatsu and joint venture partners (Toyota 2013). The company can therefore hold shares of almost every possible market, insuring itself from the vagaries of nearly all sources of demand fluctuation, from the product life cycle to economic recessions.

Crucially, Toyota has reached a level of total output where further expansion can be achieved by constructing complete new plants. For example, in 2012 Toyota produced 8.7 million passenger cars, of which a complete new assembly plant would represent less than a 4 percent expansion. For Mitsubishi Motors, a new full-size assembly plant would necessitate a global sales expansion of 30 percent or more to justify the increased output capacity. Mitsubishi would be facing the predicament of either forcing existing plants into inefficiently high rates of production, or building a new plant that will be expensively underused for many years. It is salutary to note that Mitsubishi is still far from filling capacity at its much-reduced Normal, Illinois, plant, and yet can justify neither expanding nor closing it.

This shows us that the prototypical automobile manufacturer, producing around 600,000 upa, may have no cost disadvantages, but the larger manufacturers gain additional benefits from their diversified markets and product ranges. For automobile manufacturers like Mitsubishi Motors and Subaru, that are close to the prototypical company format, expansion and contraction represent such disproportionate risk that their interests are better served by cautiously staying close to their current sizes and instead making sales stability the first priority. To achieve this they must offer highly differentiated products that can occupy market niches that are mostly safe from attack by the global giants and where the product life cycles can be stretched out. During the recent sales downturn in the U.S., Subaru was one of the few brands to raise their volumes, such was the uniqueness of the model range.

Surviving Below the Scale Line

Life is much harder for manufacturers below the economies of scale target. At less than 600,000 upa they carry the higher production costs of less-efficient plant sizes. They need to find strategies that will permit them to survive.

The first of these, and most obvious, is to head upmarket. Prestige brands can practice premium pricing, or cost recovery, to claw back some of the cost disadvantages of low production by obtaining higher revenues per unit in the marketplace. This would explain the long existence of

such brands as Ferrari, Porsche, Rolls-Royce and so on. The technology for these models is fundamentally the same as it is for mainstream models, indeed they are often technically less advanced, so they are subject to the same economies of scale. Fortunately, by dint of their impressive histories they can attract small numbers of customers prepared to pay much higher prices.

An alternative approach would be to team up with another manufacturer in a joint venture. The traditional relationship is horizontal, the sharing of a common operation. The purpose is to make up for a lack of scale, resources or commitment. Toyota is famously cautious, so its first plant in the U.S. was shared with GM, the New United Motor Manufacturing, Inc. (NUMMI) plant at Fremont, California (JAMA 2006). Other manufacturers have explored new technologies together when individually they lacked the resources, such as Ford, Daimler and Ballard on fuel-cell technologies. Still more have cooperated on joint production when they could not justify a full-scale operation on their own, such as Volvo Car and Mitsubishi Motors at the NedCar assembly plant in Holland (VDL Nedcar 2013).

Horizontal joint ventures can be of short-term benefit, but once their purpose has been served they tend to break up. Toyota and GM quickly outgrew NUMMI and almost all of Toyota's subsequent North American plants have been wholly-owned. Ballard reduced its involvement in automotive applications for fuel-cell technology once the project moved beyond the research stage in which it specialized. Ford and Daimler were subsequently joined by Nissan as it looked to reduce its exposure to pure electric vehicles (Bloomberg 2013). NedCar, meanwhile, has lost both Volvo and Mitsubishi and is now preparing to assemble Minis for BMW.

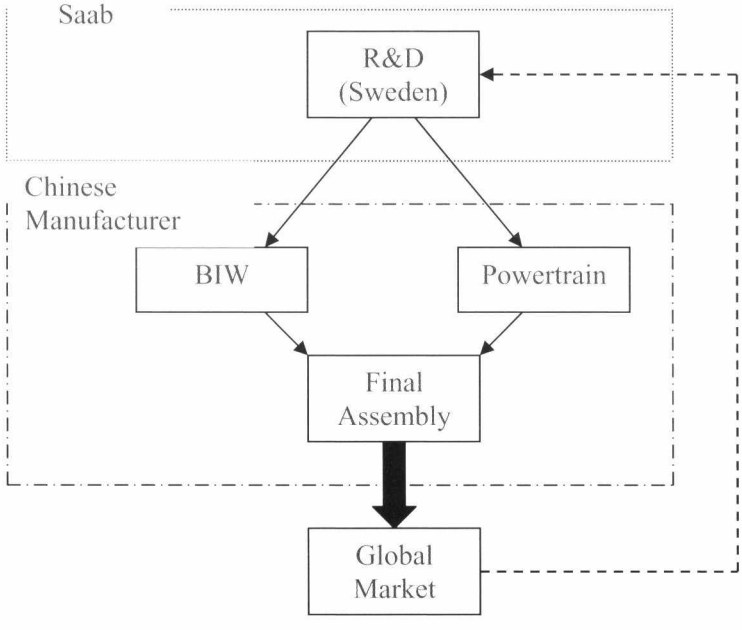
A potentially longer-term structure is the vertical joint venture. Instead of sharing any given function, the partners continue to specialize in their core areas but relinquish those functions where they lack scale or resources. For example, there might be an established manufacturer that has built up expertise in vehicle design but lacks scale in production. It would therefore team up with a new manufacturer that has little or no skills in vehicle design but has somehow expanded its output to approach the magic 600,000 upa figure. This relationship could have described Saab of Sweden with any number of rising Chinese manufacturers. This is illustrated in Figure 6.

The partners in a vertical joint venture are tied together in a co-dependency, each focusing on their specialized skills, and thus should achieve the same longevity as a single, vertically-integrated manufacturer. So far, though, no such relationships have emerged in their pure form in the industry. First, the conditions for the partnership tend to be short-lived, as it depends on at least one partner suffering an acute weakness in an area that it is willing to then abandon. For example, Saab's production had fallen so far below a sustainable level it would have taken years to recover. There was the promise of some interesting new model development, which would have found immediate volume production with a Chinese partner. Saab needed to put the partnership into effect before its lack of sales dragged it into bankruptcy, and this it failed to do.

A second obstacle to vertical joint ventures is that of political resistance, both corporate and governmental. To enter into a full vertical joint venture, the companies must give up those functions where they were weakest. Staying with our Sino-Scandinavian example, Saab would have relinquished production to the Chinese partner while the Chinese would have abandoned car design. This is a high risk commitment for any company to take, since once completed there is no route back, unlike with horizontal joint ventures, and there would doubtless be strong objections from the workers involved. Furthermore, any government would find itself unable to condone a strategy that might benefit the two partners in the long term but would be a short-term loss to the country.

To date there have been no pure vertical joint ventures that have survived the discussion process, usually because the desperate straits of one partner have meant its demise before the protracted negotiations have reached their conclusion. MG Rover of the U.K. had been in negotiations with Shanghai Automotive Industry Corporation (SAIC) of China for a similar alliance to the one Saab had been seeking, but mortally low sales meant that MG Rover succumbed reportedly hours before the agreement was signed (Wynn-Williams 2009). Even so, the logic of the vertical joint venture was so powerful that the relationship was born again

Figure 6: Vertical Joint Venture between Saab and a Chinese manufacturer



under a different ownership structure when SAIC eventually purchased the remains of MG Rover and effectively closed the production facility but retained the U.K. R&D site. This now designs MG and Roewe cars, the latter a Chinese market brand. Apart from a trickle of assembly output in the U.K. from Chinese kits, almost all the cars are produced in China.

Most efficient automobile research and development? Subaru Outback models leave the assembly line at Lafayette, Indiana, U.S.A. Subaru of America.

The Long-Term Future of the Automobile Paradigm

A defining feature of any paradigm is that its future is broadly predictable, and history abounds with examples. The principles of jet engine design were known long before the first practical prototype reached the test bed and they spurred the rapid early development. Thereafter, the engineering challenges have been to refine jet engine technology, not to replace it. Equally, and contemporaneously, the fundamental definition of the automobile was accomplished immediately following World War II. Despite continuing development, most automobiles from that era are conceptually the same as modern cars. Even if we cannot know the specifics of future developments, we can have a fair idea of the form they might take in terms of the process and the product.

First, there is going to be no significant change in economies of scale in the industry. The cost efficiencies available in production are fully exploited at around 600,000 upa. The savings that higher company production rates make are related to diversification in order to maintain constant rates of capacity utilization. Any advances being made in production technology are either marginal, and soon replicated by rivals, or allow greater flexibility in the interests of further widening diversification. Be aware, though, that flexibility by itself increases production costs.

A second area of development in the paradigm concerns the kind of legal and consumer requirements for automobile development. The most pressing need is to ensure that automobiles are more sustainable in terms of running costs and environmental impact. Reductions in fuel consumption hit both of these targets, achievable through lighter body materials, such as aluminum, and engine downsizing. Again, though, economies of scale will remain as before. Even new technologies, such as hybrid powertrains, only introduce new elements to the economies of scale picture. Production costs for engines and metal load-bearing bodies will be unaffected.

Of course, speculation surrounds the emergence of a new paradigm, one that does not compel high rates of production for identical automobiles. Some suggest that this is now emerging in the shape of electric vehicles such as the Nissan Leaf. It is true that the battery plants coming on stream have much lower rates of production than traditional powertrain plants, thereby indicating commensurately lower economies of scale. Even if this is true, their efficiency relative to alternative battery plant sizes tells us nothing about the absolute production costs of each battery. Nissan has budgeted U.S. $1.7 billion for its Smyrna, Tennessee, plant to assemble the Leaf along with a neighboring plant for 200,000 battery packs per annum (Nissan 2012). Picking apart the figures, it would appear that battery production facilities cost around double that of engines. To counter this cost burden, battery materials would have to cost far less than those relating to engines, but there is little reason to believe this is so. In any case, the economies of scale for the steel body are unchanged. The Nissan Leaf is not the new paradigm.

Indeed, this is where the paradigmatic view of progress lets us down. While each paradigm is predictable in its purpose, the move to the next paradigm represents a revolution, a leap into the dark. Just as the automobile did not replace the horse, rather it completely refashioned society, so the following transport paradigm will involve changes that we cannot foresee. The new technologies, such as fuel cells, may be far more suited to public modes of transport and personal transport will become an historical artifact of the twentieth century. It may well be that the electric car is not the future of motoring, but represents the death throes of the old paradigm.

Michael Wynn-Williams is a senior lecturer for international business and automotive researcher at the University of Greenwich. He has extensive automobile industry experience, in both professional and academic capacities. At IHS Automotive he was senior analyst for Japan, South Korea and Australia. He is a member of the Guild of Motoring Writers, contributing articles to the national media as well as his own blog, autocognition.wordpress.com. Dr Wynn-Williams holds a PhD in automotive economics from Cardiff University, an MBA from Heriot-Watt University and a BSc (Hons) in psychology from Hertfordshire University. He is the author of Surfing the Global Tide: Automotive Giants and How to Survive Them *(Palgrave Macmillan, 2009).*

References

Bloomberg (2013). "Daimler adds Nissan as partner on Ford fuel-cell project." Bloomberg, January 28, 2013 <http://www.bloomberg.com/news/2013-01-28/daimler-plans-joint-fuel-cell-project-with-nissan-ford.html> accessed March 10, 2013.

Chrysler Museum (2013). "An Engineering Odyssey: From All-Steel to True Unit Bodies 1914-1960." Walter P. Chrysler Museum website <http://wpchryslermuseum.org/document.doc?id=47> accessed February 25, 2013.

Cooper, Arnold C. (1964). "R&D is more efficient in small companies," Harvard Business Review, 42 (3), pp.75-83

Drucker, Peter F. (1972). *Concept of the Corporation*. New York: John Day.

Ford, Henry with Samuel Crowther (1922). *My Life and Work*. New York: Garden City Publishing Company.

Ford, Henry (attrib) 1926. "Mass Production," *The Encyclopaedia Britannica*; Volume 30, pp.821-23.

GM (2012). "GM Will Build $200 Million Stamping Facility in Texas." General Motors press release January 31, 2012, media website <http://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2012/Jan/0131_arlington.html> accessed March 2, 2013.

JAMA (2006). *2006: The motor industry of Japan*. Japan Automobile Manufacturers Association.

Klein, Benjamin (2000). "Fisher-General Motors and the nature of the firm," *Journal of Law and Economics* 43 (2000), pp. 105-141.

Kuhn, Thomas S. (1970). *The Structure of Scientific Revolutions*. London: University of Chicago Press.

Maxton, Graeme P. and John Wormald (1995). *Driving Over a Cliff?: Business Lessons from the World's Car Industry*. London: EIU.

Nieuwenhuis, Paul and Peter Wells (1997). *The Death of Motoring: Car Making and Automobility in the 21st Century*. Chichester, UK: Wiley (John) & Sons, Limited.

Nissan (2012). "Nissan celebrates two years of Leaf sales with announcement of U.S. battery plant." Nissan press release, December 12, 2012, media website <http://www.nissan-global.com/EN/NEWS/2012/_STORY/121213-01-e.html> accessed March 16, 2013.

Rae, John B. (1984). *The American Automobile Industry*. Boston, Massachusetts: Twayne Publishers

Rhys, David Garel (1972). *Motor Industry: An Economic Survey*. London: Butterworths

Stigler, George J. (1958). "The Economies of Scale," *Journal of Law and Economics,* I, Oct. 1958, p.54-71

Stoll, John D. (2004). "Stamping strategy," *Ward's Auto World*, August 1, 2004, <http://www.findarticles.com/p/articles/mi_m3165/is_8_40/ai_n6156148> accessed June 1, 2006.

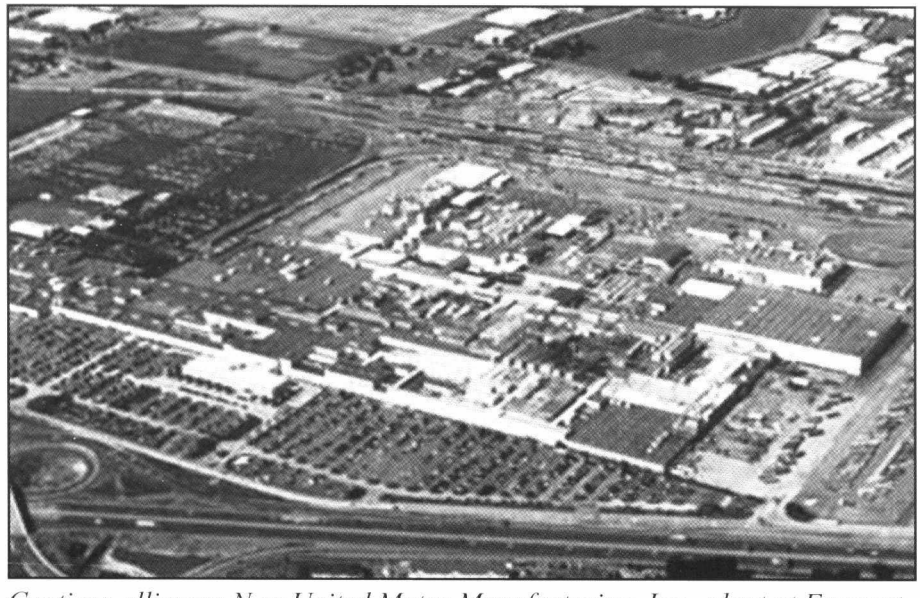
Toyota (2013). Vehicle gallery, <http://www.toyota-global.com/showroom/vehicle_gallery/> and <http://www.lexus-global.com/models/index.html> accessed March 10, 2013.

VDL Nedcar (2013). VDL Nedcar. Company website <http://www.vdlnedcar.nl/?page/4842402/Profile.aspx> accessed March 10, 2013.

Williams, Karel, Colin Haslam, Sukhdev Johal and John Williams (1994). *Cars: Analysis, History, Cases*. Providence, Rhode Island: Berghahn Books.

Williamson, Oliver E. (1987). *Antitrust Economics: Mergers, Contracting and Strategic Behaviour*. Oxford: Basil Blackwell.

Wynn-Williams, Michael S. (2009). *Surfing the Global Tide: Automotive Giants and How to Survive Them*. Basingstoke: Palgrave Mcmillan.



Cautious alliance: New United Motor Manufacturing, Inc., plant at Fremont, California, was a joint venture between Toyota and General Motors, operated for 26 years. It reopened as a factory for Tesla electric cars in September 2010. *Toyota Global*

Abstracts of Other Papers Presented

The Color Revolution in Detroit

Regina Lee Blaszczyk
Visiting Scholar, Department of the History and Sociology of Science, University of Pennsylvania

The first issue of *Fortune*, published in 1930, described the "color revolution" that had transformed design practice in American industry during the 1920s. One major color innovation was Duco nitrocellulose lacquer developed by E. I. du Pont de Nemours & Company in collaboration with the General Motors Corporation.

The story of Duco's role as one of GM's winning weapons in its battle against Ford is well known in the annals of automotive and business history. Less familiar is the story of the professional colorists who helped Detroit manage the proliferation of colorful finishes available to coachbuilders from the mid to late 1920s onward. Harley J. Earl is a name recognized by every auto historian, but the names of his colorist contemporaries—the ex-camoufleur H. Ledyard Towle and the ex-adman Howard Ketchum have long been forgotten. From the 1920s through the mid 1930s, these colorists, working for both DuPont and for GM, introduced revolutionary design practices such as visual streamlining and design management tools such as color forecasting. The practice of visual streamlining, based on reverse camouflage techniques and popular during the mid to late 1920s, paved the way for body streamlining in the 1930s.

This paper draws on original research in corporate archives (DuPont archives at Hagley, Ford archives at The Henry Ford), personal papers (Kettering papers; Towle papers), trade journals (*Motor*, *Automotive Industries*, etc.), popular magazines, and oral histories (Edsel Ford Design History Collection at The Henry Ford) to focus on the work of Detroit's first professional colorists. It is based on the author's new book, *The Color Revolution*, published by The MIT Press in Fall 2012.

Champion of the Lark: Harold Churchill and the Presidency of Studebaker-Packard Corporation

Robert R. Ebert, Ph.D., Professor Emeritus of Economics, Baldwin-Wallace College

Harold E. Churchill, a 30-year veteran of the Engineering Department of Studebaker, became President and Chief Executive Officer of the Studebaker-Packard Corporation, succeeding James J. Nance, in August 1956. Churchill's tenure as CEO of the corporation ended in September 1960, when Clarence Francis was made CEO and Board Chair, and his title of President was terminated in early 1961 with the advent of Sherwood H. Egbert as President and CEO of Studebaker-Packard. Churchill, however, continued as a board member and consultant to the corporation for several years thereafter and made various contributions to engineering and the corporate diversification programs.

The question explored in this paper is whether the presidency of Harold E. Churchill was a positive development for the Studebaker-Packard Corporation and whether his strategies, managerial style, and product programs were successful. In addressing this question, considerable reliance is placed on primary materials, including corporate board of directors minutes, oral histories of Churchill and several dozen former Studebaker-Packard Corporation employees by the Indiana University at Bloomington, and miscellaneous corporate records and correspondence.

The conclusions of the paper are that Churchill, possessing a combination of technical, and administrative skills as well as having a unique personality and vision for the company, was able to exert leadership that saved the corporation from bankruptcy, extended the life of the automotive division, and laid the groundwork for a successful transformation of the company as a diversified manufacturer.

This paper was developed into a book with the same title, published by McFarland & Company in 2013.

Stealing Cars: Some International Aspects of Auto Theft, the United States and Mexico, 1919-2011

John Heitmann, Ph.D., University of Dayton
Rebbeca Morales, Independent Scholar and former curator, San Diego Automobile Museum

The history of automobile theft in the 20th century bridges the interstices between science, economics, technology, and society. As such, it is a powerful handle in exploring the development of a variety of anti-theft technological countermeasures; institutional rejoinders from government, the insurance industry, and manufacturers; international diplomacy; and finally criminal motives, techniques, and organization. It seems that during every era authorities proclaimed that auto theft had been largely solved. Yet, subsequent to every announcement, new criminal strategies thwarted the best of efforts, and the problem became bigger than ever. In this presentation, we will highlight international aspects related to auto theft, with particular emphasis to the movement of "hot" cars from the U.S. to Mexico throughout the 20th century. In terms of more recent history, this presentation explores the introduction and effectiveness of electronic surveillance devices (LoJack, OnStar, and plate recognition technology), regionalism (Southern California), and international relations, particularly with Mexico. While problems with the movement of stolen cars to Mexico were significant to WWII and resulted in a treaty between the U.S. and Mexico in 1937, issues of return coupled with the rise of the drug trade and cartels has only intensified the problem during the past 30 years. Further questions addressed include how auto theft has occurred over time, why, by whom, and the responses. This work is a history of technology, but also of transnational legal issues and an American society that is continuously assaulted by the crime and constantly regrouping in the face of complexities to meet a variety of challenges.

On the Shoulders of Steam Giants: Necessary Evolutionary Precursors to the Automobile

John Laurence Busch, Independent Historian

When the first practical horseless carriages appeared at the end of the 19th century, they were the culmination of more than a century of trial and error. That their proponents finally succeeded in creating automobiles depended upon more than improved design, engineering and fabrication. It also rested upon an important psychological foundation laid by groups of innovators and entrepreneurs who, in some cases, had risked their lives to prove that the human race could in fact overcome the forces of nature to practical effect.

This presentation will begin by offering a new, additional definition for the term "high technology," as any invention which allows humans to alter artificially time and space to practical effect faster than by natural means.

Then it will examine what the world was like when Nicolas-Joseph Cugnot first built his steam-powered vehicle in 1769, exploring the psychological predispositions of the human race, as well as the physical limitations in place which prevented the advance of Cugnot's creation.

This will be followed by an examination of the successful challenge and defeat of those predispositions, first by Robert Fulton and his North River Steam Boat in 1807, then by Captain Moses Rogers and his "steamship" *Savannah* in 1819, and then by the creation of the first steam-powered passenger railroads in the 1820s. Once again, the physical characteristics of the early-19th century world will be analyzed to illustrate why these innovations occurred as a natural progression.

Only with the design, engineering and manufacturing expertise gained from the advance of these first two high technologies – steam-powered vessels and trains – did the necessary precursors exist that allowed automobiles to emerge from the shadows of experimentation and into the light of utility.

The New Biomorphs: An Emergent Trend on the Automotive Design Scene

William Porter
General Motors Design Staff and
Wayne State University, Retired

Amid all the recent concerns involving the health of the automobile industry both in the U.S. and abroad, a profound shift in the look of the automobile itself is going largely unnoticed. A number of designers have turned away from the traditional vocabulary of cylindrical and axial shapes that have characterized their products since the concepts of Streamlining along with envelope body forms evolved in the second quarter of the 20th century.

It is a truism in design, and indeed art in general, that artists often draw inspiration from nature. The term biomorphism is used by art historians to describe images or designs made up of abstracted forms drawn from plant and animal life (including human beings); in short, biological sources. This paper attempts to identify the most significant types of biomorphism currently in vogue among automobile designers.

Two very distinct, although at times intermixed, biomorphic strains have emerged as the strongest. The first strain refers directly to nature, most specifically to marine life forms, usually of a cartilaginous and predatory nature: sharks, rays, etc. The second is humanoid in content and comes from exaggerated or caricatured human images, as in cartoons. The latter, often with super powers, have populated the cast of characters of comic books, animated movies, video serials and electronic games for decades. Add in humanoid robotic and transformer toys. Younger designers who have grown up in Europe, America, or the Pacific Rim have ingested a steady diet of these images since their toddler days. "The New Biomorphs" advances the theory that many contemporary automobile designers, consciously or unconsciously, are sourcing these fantasy forms for their car shapes.

A number of the most striking prototypical examples of this new genre are examined and analyzed. The design organizations of several major European and Asian automobile manufacturers are leading this style trend. Examples of biomorphic motifs occurring in both their concept cars and their more recent production vehicles are identified and discussed.

The 1903 Gordon Bennett Race: Did It Really "Save" Racing?

Patricia Lee Yongue, Associate Professor of English,
University of Houston

The nascent sport of motor racing had been dealt a severe blow with the disastrous May 1903 Paris-Madrid race, which occasioned several deaths, including Marcel Renault's, and many injuries before it was aborted in Bordeaux and the cars were ordered towed back to Paris by horses. The Automobile Club de France was horrified. Not only were many proponents as well as opponents of the controversial new sport appalled by the Paris-Madrid and compelled to rethink the prudence of continuing so dangerous a sport, Britain refused to host the July 1903 Gordon Bennett Cup race. As winner of the previous Cup race, Britain should have been the next venue, but outraged by the Paris-Madrid and unwilling to create a closed road circuit, Britain backed out. Official Britain had always voiced serious objections to the "stinking" motor car itself and to vehicular speed in general. Racing and its recent outcome only inflamed Parliamentary rage. The Auto Club of Britain and Ireland, however, was a spunky organization committed to the industry's and sport's sustained development. Ireland, which sorely needed an economic boost, agreed to host the race. A great deal of publicity was generated and pre-race inspection of every detail, car, and driver demonstrated fervor for a cause. I will try to flesh out what promises the race fulfilled and failed to fulfill in terms of the Irish economy and nationalism and the preservation of auto racing.

The Ecological Challenge: The Reaction of the German Automotive Industry to Ongoing Changes Concerning Raw Material Supply and the Resulting Technological Changes

Philine Sander, RWTH Aachen University

The affordable production of automobiles strongly depends on the accessibility of raw materials like oil and various metals. Nowadays 99 percent of all motor vehicles rely on gasoline or diesel fuels. Therefore the industry needs to accommodate to the diminishing supply of those materials. Between 2002 and 2008 the price for noble metals more than tripled while energy prices increased even more rapidly by about 700 percent. These rising prices were not only a result of the relative scarcity of raw materials but also triggered by an increased demand for oil, metals etc. by emerging nations such as China and India.

To counter possible future raw material shortages and to comply with more rigid environmental constraints most car manufacturers have been heavily investing in alternative technologies. As a result of these investments Toyota introduced its Prius hybrid car in 1997 and became a pioneer in that market segment. Even though German car manufacturers are main players in the world's automotive market they appeared to lag behind when it came to developing those alternative technologies. Asian car manufacturers somehow managed to outrun the German industry by simply being more flexible and less bound to the existing, well-established technologies.

In this analysis the role of Daimler-Benz as a German car manufacturer will be examined within the context of the ecological, economic and technological changes mentioned above. The coping of the German automotive industry with these global challenges will be explored using the example of Daimler-Benz with respect to the company's history as well as the more recent developments.

An emphasis will be put on the examination of strategies that were made within the German automotive industry during the last twenty years which were implemented to stay competitive, recover from crises, or catch up in terms of new technologies. Furthermore, the developments especially within the electric mobility section will be looked upon in more detail to allow a careful forecast of the German automotive future.

The Logistic Challenge: Changing Patterns of Locations and Logistics in the Automotive Industry: The Case of the Daimler AG

Florian Wöltering, RWTH Aachen University

Since the development of the automobile with combustion engine in 1886, the manufacturing method for cars changed twice.

The first method dominated the automobile industry until World War I and was characterized by workshops with individual production procedures and autonomous craftsmen. In these early stages Daimler and Benz set up numerous sales companies as well as the first international production facilities. Back then, suppliers already played an important role within the production process; an example would be the first successful Daimler-Mercedes car in 1901 which was equipped with an ignition system supplied by Bosch. Despite the interdependence of suppliers and producers and the serving of an early global market, logistic support for these interactions seemed to be of no importance yet.

The second change, the method of mass production, began with the introduction of the assembly line in 1913 by Henry Ford and determined the production of automobiles for the following 60 years. With this method, the CKD-system was established. At that point, it was possible to outsource labor-intensive production, evade tariffs and to get easier access to foreign markets. In 1949-50 the now-merged Daimler-Benz slowly began to create a system of assembly plants and suppliers throughout the world. Because of increasing distances and higher interaction frequencies between each facility, the importance of logistic services increased.

Activated by a highly competitive Japanese automobile industry, the method of lean production diffused in the early 1970s within American and European corporations. In this flexible system suppliers took over bigger shares of the production process and tended to locate in proximity to the automobile manufacturers. However, there are still a lot of suppliers which are located far away from the manufacturers. In such a system, based on just-in-time and just-in-sequence, logistic services became the backbone of the production.

When Daimler-Benz started their globalization campaign in the 1990s and founded new facilities, for example in Tuscaloosa, Alabama, U.S.A., and Hambach, France, they designed their manufacturing plants with regard to innovative production, organization and management methods.

This paper compares the patterns of locations and logistics in the automobile industry in the case of Daimler-Benz, its suppliers and customers during the period of each of the three different manufacturing methods. It will analyze how the locational structure and the logistical network of Daimler-Benz changed in the last 120 years and if the relevance of logistic services has grown verifiable over time, or if it was just underestimated in the earlier production methods.

Get Your Kicks on Route 141: The Z. Taylor Vinson Transportation Collection at Hagley Museum and Library

Emily Cottle, Project Archivist/Cataloger for the Z. Taylor Vinson Transportation Collection at Hagley Museum and Library

In January 2010, Hagley Museum and Library was gifted the Z. Taylor Vinson Transportation Collection. This collection contains 700 linear feet focusing on all modes of transportation, but with heaviest emphasis on automobiles. The collection contains tens of thousands of trade catalogs for

makes and models from around the world, including companies that only existed very briefly. In addition to the trade catalogs, there are color and upholstery samples, company histories, postcards, photographs, press kits, annual reports, and much more. The collection also contains three-dimensional objects, which include model cars, hub caps, and promotional ephemera like buttons and lanyards.

Books and magazines also make up a significant portion of the collection. The books include company-specific histories, reference works, as well as books on other modes of transportation, such as planes, trains, boats, and blimps. The magazines include company specific serials (e.g. *Ford Magazine*) as well as large runs of a wide array of general automotive titles (e.g. *Road & Track*, *Motor*, *Antique Automobile*).

In December 2010 Hagley Museum and Library was awarded a CLIR Hidden Collections grant to fund the processing of this important collection. I was hired in February 2011 to begin this three-year project. This presentation provides an overview of the wealth of resources this collection has to offer. Though the physical collection will not open to researchers until processing is completed in early 2014, there are a number of ways currently available to begin to explore the collection, which include the following:

- A sizable digitization initiative has digitized several hundred items.
- The collection contains over 700 books which have already been cataloged and are searchable through the online catalog and generally available via interlibrary loan.
- A project blog was established highlighting unique finds and discussing the arrangement methodology.
- Cataloging of the vast number of magazines in the collection has begun, and are available to researchers.

After presentation of this paper, attendees visited Hagley Museum and Library, and were shown highlights of the collection.

Ford in Shanghai

Judith Endelman, Benson Ford Research Center, The Henry Ford, Dearborn, Michigan

This presentation was drawn from a recently-discovered scrapbook compiled over the period 1930-35, during which William Cowling of Ford Motor Company searched for a suitable plant site in China. A sales and service branch had opened in 1928, and Henry Ford was exploring options for assembly of automobiles, and possibly manufacture. The economic and political situation in the region, however, prevented realizaton of the plans.

The Chrysler Minivan in Global Perspective

Tom Adamich, Independent Historian

This paper discussed the business plan, economic realities and international market of Chrysler Corporation's iconic minivans. The Caravan is the first Dodge vehicle to be built and sold in China.

Creating an American Icon: Theodore F. MacManus, James R. Adams and the Coming of Cadillac, 1909-1956.

Edwin Benson, Independent Historian

This paper explored the influence of advertising created by MacManus, whose agency for many years handled Cadillac advertising, and Adams, who managed the account. In addition, Cadillac advertising was contrasted to that of competing American luxury cars.

Letters

The Convenient, Reviled Freeway

I just finished reading Andrew Mabon's article "The Automobile, the Interstate and Suburbia" (*AHR* 54). I live in San Francisco and so especially enjoyed the section "Revolt Against Excess" for its description of Highway 480, the Embarcadero Freeway, that ran along the SF waterfront. It was damaged in the Loma Prieta earthquake of 1989 and demolished after that. Mr. Mabon was correct in that the citizens here were not pleased with the freeway (parties were held when it came down) but not that it existed "...never having carried a single vehicle..." In fact, it carried thousands of vehicles every day for decades. It was convenient, but we don't miss it. *Mike Jacobsen, San Francisco, California.*

Learning More From M.G.

I thank you for publishing my "correction" in *AHR* Issue No. 54. In the aforesaid *Cecil Kimber Centenary Book*, to quote Kimber's own words (p.26) "I went to Oxford in 1921 to take charge of Morris Garages..." However it would appear he was gilding the lily, as Wilson McComb in his *M.G. by McComb* has him appointed Sales Manager in 1921 and promoted to General Manager in 1922. I have now also consulted my esteemed friend's *Beaulieu Encyclopaedia of the Automobile* (as I should have done in the first place), and this confirms what you say. Mea Culpa. *Keith Munro, Guernsey, Channel Islands.*

The Editor Responds:

*Cecil Kimber may well have "taken charge" at Morris Garages, even with the title Sales Manager. Jan Norbye (*An Historical Who's Who of the Automotive Industry in Europe*) says he was Sales Manager in 1921, promoted to General Manager in 1922 (agreeing with McComb), and managing director from 1930 to 1935. After the sale of William Morris's shares to Morris Motors, Ltd., in the latter year, Norbye cites "unspecified duties" until he was pushed out in 1941.*

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