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Innovation and competition in the automotive industry

Part 1: Lessons learnt from the early years

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Abstract

The German automotive industry was once characterised by overwhelming competition and the question of drive technology. We look back to the beginnings to learn for the future.

Zusammenfassung

Schon einmal prägte eine übermächtige Konkurrenz und die Frage nach der Antriebstechnologie die deutsche Automobilindustrie. Wir blicken in die Anfänge zurück, um für die Zukunft zu lernen.



Competitiveness of German car manufacturers is in question

With the market entry of Chinese electric cars, the competitiveness of German car manufacturers is being fundamentally called into question. In order to remain competitive, German manufacturers will have to face a multitude of different, simultaneously occurring challenges. These range from e-mobility to the use of new technologies, the trend towards sustainability and changes in consumer demand.

We take a look back at the beginnings of 140 years of automotive history

This is not the first time that the automotive industry has faced fundamental problems. We look back to the beginnings of 140 years of automotive history to learn how German car manufacturers dealt with the challenges of the time. The state shaped competition through regulation and trade barriers, thereby weakening the pressure to innovate.

Battle for drive technology

Before the First World War, it was an open question as to which drive technology would prevail for automobiles. The state and other institutions in Germany, England and the USA inhibited the spread of the combustion engine and promoted the electric motor. Nevertheless, the combustion engine was able to prevail. It was the most efficient solution given the level of technical development at the time. State control could not override this.

State achieves fictitious successes for the industry

After the First World War, Germany's international trade almost came to a standstill. In addition, the monetary financing of state budget deficits caused the currency to plummet. Both led to the domestic automotive industry experiencing a brief period of growth. However, the hyperinflation of 1923 revealed that the state framework had created a market structure that was not viable.

International competition creates pressure to innovate

As the 1920s progressed, it became clear that protectionism meant that the German automotive industry was far inferior to its international competitors in terms of quality, manufacturing processes and price with the new mass production method. The isolationist policy had inhibited the exchange of knowledge and neutralised the pressure to innovate through international competition. Only the gradual dismantling of trade barriers created the incentive for technical innovation. Assembly line production in the 1920s could not be profitably established in Germany because the sales market was too small. Domestic manufacturers suffered from the overwhelming international competition in the short to medium term. In the long term, however, they emerged stronger from the difficult phase as they were more flexible due to their small size. They were able to absorb technical innovations more quickly and concentrate on a market niche. This laid the foundation for the later successes of the German automotive industry.

Open markets are a necessary instrument for innovation



Against the backdrop of today's challenges for the German automotive industry, there is an important lesson to be learnt from history. Even if open markets pose a threat to the entire industry in challenging times, history has shown that they are a necessary tool for innovation. Analysing the history of the automotive industry and the parallels with today's situation does not allow any strict economic laws to be derived. Nevertheless, our analysis reinforces the validity of the normative concept of competition as a driver of innovation. Since economic and social realities are diverse and complex, the state must take care not to suppress innovation processes for the good of society.

Over 100 years ago: The battle for drive technology

When mankind first attempted to build a vehicle that was not dependent on draft animals, the question of how to propel it was always at the top of the agenda. The first successes of technical drives date back to the beginning of the 17th century in the Netherlands. At that time, Dutch engineer Simon Stevin built a carriage that was propelled by wind power via a sail. However, it was not until the invention of the steam engine in England in the early 18th century that development gained momentum. In 1769, the Frenchman Nicolas Cugnot used a steam engine to drive a trackless vehicle for the first time. In Germany, the year 1886 is considered the birth of the automobile with the patenting of the vehicles of Gottlieb Daimler and Carl Benz, which were powered by an internal combustion engine.

However, it took many years and a number of improvements before the car became a reliable means of transport. In Germany, it had a difficult time until the First World War, as the high purchase and maintenance costs meant that it only seemed to serve the pleasure of a few wealthy citizens. However, the social costs in the form of noise, odour, road damage and danger had to be borne by the majority. Consequently, the state imposed high taxes on the purchase and maintenance of motor vehicles.

The battle for drive technology characterised the early years of the automotive industry not only in Germany, but worldwide. This lasted until the 1920s. Engineers competed to drive engines with wood, steam, gas, benzene, petrol or diesel. A technical drive was to replace the horse-drawn carriage.

The competition for drive types was influenced by various forces that positioned themselves in favour of or against certain drive types. The earliest documented state intervention took place in England in 1865 in the competition between horse-drawn and self-propelled vehicles. The "Red Flag Act" severely restricted the speed of motorised vehicles. A pedestrian had to walk in front of the vehicle with a red flag to warn other road users. This made

*England: State
hinders
development of
motorisation.*



cars even slower than horse-drawn carriages. In the long term, however, the Red Flag Act was unable to prevent the development of motorised road traffic. The law was applied less and less and was finally repealed in 1896.¹

*USA: Patents
hinder free competi-
tion*

In the USA, the "Selden patent" initially hindered competition for drive types. George Baldwin Selden's application to patent a theoretical design for a steam-powered car in 1879 meant that licence fees were demanded for cars with any type of drive. It was only after lengthy legal disputes with the Ford Motor Company that the patent lost its effect in 1911 and allowed more competition between drive technologies.²

Thanks to the Selden patent, around 40 per cent of all automobiles on the road in the USA in 1900 were powered by a steam engine.³ Steam propulsion had the technical advantage of high power transmission. Steam engines could reach speeds of over 200 km/h (under test conditions), which still seemed impossible for combustion engines at the time.⁴ Although the time needed to preheat the steam boiler could be reduced from just under an hour to a few minutes, a comprehensive supply of water and heating agents was not possible. As a result, the heavy weight of the vehicle due to the need to always carry fuel and water remained a fundamental and unresolved problem.⁵

The electric motor also benefited from the Selden patent and was used in around 38 per cent of the drives in use in the USA in 1900. The electric motor was characterised by its ease of use, low noise level and low wear. The biggest disadvantage was the ratio of mass to power of the vehicles, as there were no compact accumulators with a sufficiently high energy density. Due to their high weight, electrically powered cars could neither achieve high speeds nor a long range.⁶

In Germany and other countries, the state and regulatory authorities influenced competition for drive types. Taxes were levied on fuels for combustion engines, annual boiler inspections were prescribed for steam engines and the state-owned Reichspost, for example, was equipped exclusively with vehicles with electric motors.

*Germany: State pro-
motes electric drive*

¹ Cp. [Legislation.gov.uk](https://www.legislation.gov.uk).

² The Henry Ford Museum (2016): Selden Patent Lawsuit Collection ([Link](#)).

³ Cp. Kirchberg (2021) p. 64.

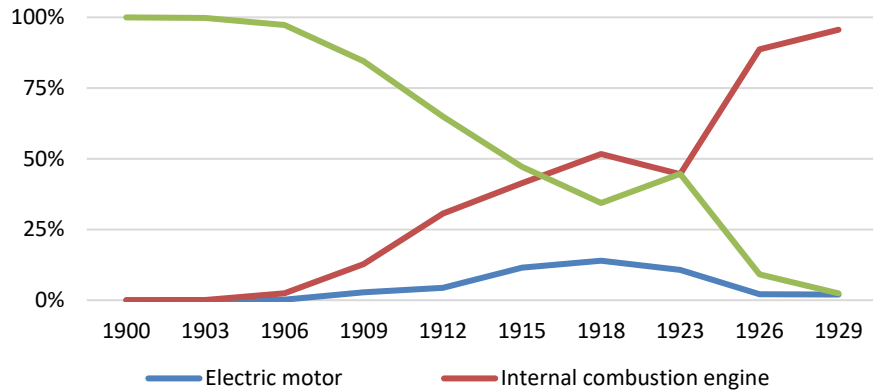
⁴ In 1906, the American Fred Marriott reached 205 km/h in a steam car from the Stanley Motor Carriage Company.

⁵ Cp. Kirchberg (2021) p. 62.

⁶ Cp. Kirchberg (2021) p. 64.



Fig. 1: Battle of the drive types
Exemplary for cabs in Berlin 1900-1929



Source: Merki (2001)

The combustion engine is catching on.

From 1909, the city of Berlin promoted taxis (the taxis of the time) with electric drives by making the registration of an electric cab dependent on the return of a horse-drawn cab licence. For a cab with an internal combustion engine, on the other hand, ten horse-drawn cab licences had to be surrendered. As a result, motorised hackney carriages in Berlin achieved a high market share of 14 percent in 1914 compared to the overall automobile market. In addition, after the First World War, the market share of cabs with internal combustion engines suffered a setback, as alternative drives were cheaper to maintain due to state fuel management. Due to their lower speed and range, electric hackney carriages were unable to prevail against the combustion engine in the long term, despite the state's favouritism.⁷

While various types of drive were still to be found on the roads until the 1920s, the internal combustion engine with petrol, benzene or diesel prevailed towards the end of the 1920s. Horses disappeared almost completely from the streets of German cities.

Historical examples show that a drive technology can only become established in the long term if the technical and social framework conditions for economic utilisation are in place. Attempts by the state and individual market players were only able to help steam and electric engines achieve temporary success. Despite the obstacles, the combustion engine prevailed.

However, the state promotion of individual types of drive led to a misallocation of labour, materials, capital and energy. Resources were tied up even though they did not serve any long-term economic goal.

⁷ Cp. Merki (2002), p. 91ff.



From the 1920s onwards, the internal combustion engine was the most efficient drive in terms of the level of technical development and availability of resources at the time. As a result, it was able to establish itself worldwide in the long term.

After the First World War: trade barriers and monetary policy

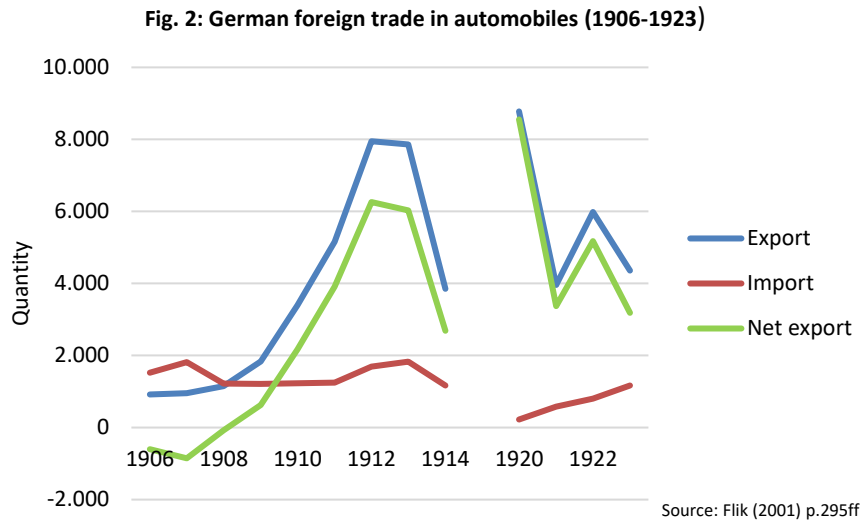
The automotive industry in Germany had overcome its start-up phase after the First World War and society had become accustomed to the new road user. However, the former warring parties sealed off their economies from each other from 1918 onwards, meaning that there were few international sales markets for German manufacturers and access to resources was made more difficult. Nevertheless, German car manufacturers experienced a significant period of growth between 1921 and 1923. There were two main reasons for this: Firstly, the restrictions on the registration of private motor vehicles that had prevailed after the First World War were lifted. As a result, the excess demand that had built up in the post-war period could be met. On the other hand, the inflation-induced devaluation of the Reichsmark had a positive effect on national and international demand for German automobiles. In the period between the abolition of the gold standard in 1914 and the period before hyperinflation in 1921, the devaluation of the Reichsmark was over 90 per cent and the exchange rate against the US dollar fell by 95 per cent.⁸

As German car production primarily utilised domestically produced primary products, German cars could be purchased cheaply in neutral countries. Although other countries also had import duties on German cars, the currency devaluation largely offset these. A car also offered wealthy households the opportunity to store value during hyperinflation.

⁸ Cp. [Deutsche Bundesbank](#)



Trade barriers lead to false successes



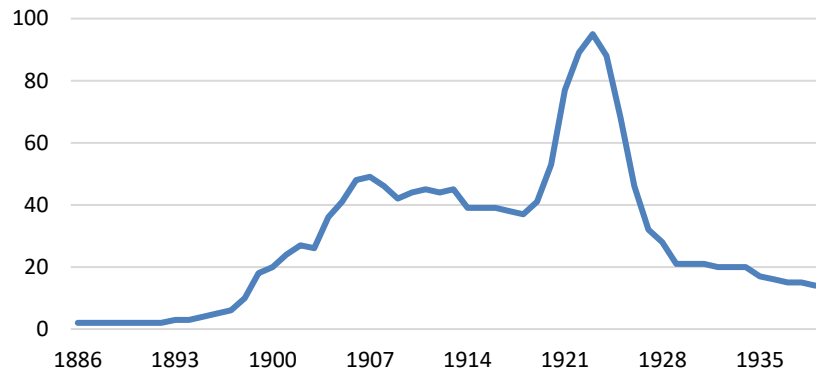
As a result of the high national and international demand, car manufacturers' capacities were fully utilised in 1921 and 1922. Numerous new car manufacturers were founded, often producing small cars of inferior quality without much experience. In 1923, there were over 90 manufacturers of passenger cars with internal combustion engines in Germany, more than ever before.

However, the accelerating hyperinflation in the course of 1923 brought the brief growth phase to an abrupt end. Demand for cars collapsed, both from private households and companies. In 1924, more than a third of all manufacturers filed for bankruptcy. This led to the first major wave of consolidation and rationalisation. Demand for automobiles only stabilised again towards the end of 1924, when foreign loans flowed into Germany again after the currency reform and made it possible to finance production and purchases again.

The state protective measures for the domestic industry in combination with the politically induced currency collapse thus helped German car manufacturers to achieve economic success until 1923. However, the framework conditions set by the state created an uneconomical market structure with many non-viable suppliers.



Fig. 3: Number of active passenger car manufacturers in Germany



Estimate of the number of vehicle manufacturers in Germany that produce cars with internal combustion engines. Source: Flik (2001).

Highest number of manufacturers reached in 1930

In the 1920s: American competition as a key moment

A direct consequence of the policy of protection and isolation was that the international exchange of new technical developments had come to a standstill since the outbreak of the First World War. For almost ten years, German car manufacturers had virtually no access to the industry's international technical achievements. Even before the First World War, German automobiles had an international reputation for high quality. The renewed export success due to the currency created the impression that German automobiles were internationally competitive and still technically leading. This proved to be a fallacy in the mid-1920s.

German manufacturers are inferior to the international competition

After the First World War, there were only a few new imported cars due to trade barriers. It was not until the occupation of the Rhineland from 1923 onwards that a few US cars made their way across unguarded borders into the unoccupied parts of the German Reich. As more US cars were now seen on German roads, German car manufacturers also realised that they were far inferior to American manufacturers in terms of price, equipment and driving experience.⁹

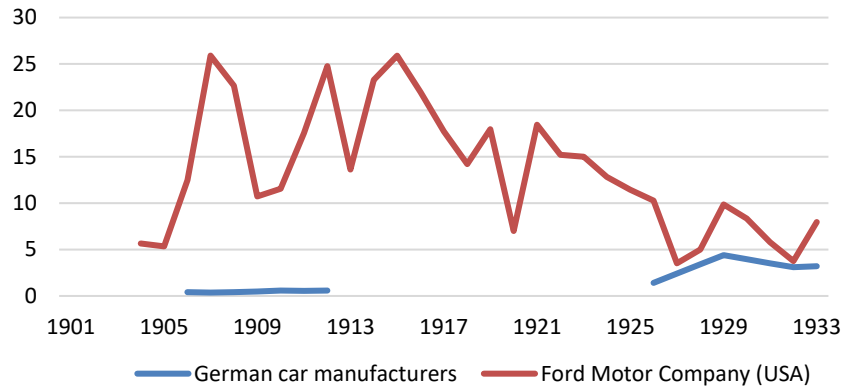
From the outset, the automobile met with a completely different demand in the USA than in densely populated Europe, where public transport was well developed and was initially able to satisfy the demand for mobility. As there was little public transport in the USA and the distances between towns and villages were often great, the automobile offered the rural population a new opportunity to participate better in public life. Craftsmen and farmers

⁹ Cp. Flik (2001), p.157.



Fig. 4: Productivity of the German automotive industry compared to the Ford Motor Company (USA)
Cars produced per employee

Insufficient competitiveness without assembly line



Note: Due to the mixed structure of the companies at the time, the employees of German manufacturers cannot be unequivocally assigned exclusively to vehicle construction. Car and truck manufacturers taken into account
Source: Benson Ford Research Centre, Flik (2001).

opened up new sales markets. After the railway, the car was the final link in the creation of the large American domestic market.¹⁰ This created a much higher demand for cars at lower prices in the USA than in Germany. In addition, US drivers benefited from low operating costs thanks to the country's abundant oil reserves. In contrast, the German middle class did not have sufficient purchasing power as a result of the war and hyperinflation and also had less need for its own motorisation.

The Ford Motor Company took the decisive step towards reducing production costs even before the First World War. With the introduction of assembly line production based on the concept of Taylorism, it was possible to significantly increase production speed.¹¹ While the production of a car in German factories took around three quarters of a year and tied up capital over this period, at Ford it only took a few days. Although labour wages at Ford were around twice as high as in German factories, cars could be produced at half the cost in Germany.

Due to its size, US assembly line production was more capital-intensive than workshop production in large German factories. While the productivity of German car manufacturers before the First World War was less than one car per employee per year, Ford was already achieving figures of between 10 and 26.

¹⁰ Cp. Flik (2001), p.247.

¹¹ The term goes back to the American engineer Frederick W. Taylor, in which work processes are broken down into the smallest sub-processes and for the individual worker there is no longer a recognisable connection to the company goals.



Manufacturers could only survive with assembly line production if they built up large capacities and utilised them to the full. Manufacturers without assembly line production suffered from high unit costs, which meant that they could not compete in the price war. This gave rise to the first oligopoly in the automotive industry in the USA in the 1910s. An oligopoly is a market form in which a market is dominated by a few large companies. The automobile oligopoly in the 1910s consisted of the manufacturers Ford Motor Company, Chrysler and General Motors, as well as a few smaller market players.

As the first-time buyer market in the USA became increasingly saturated over the course of the 1920s, Ford Motor Company's capacity utilisation fell. In order to remain profitable, the oligopolists were forced to open up new sales markets and expand internationally. As vehicle density in Germany was still low, the German sales market was seen as having great potential.

On the German side, there were different views on how to deal with the new and overpowering international competition. Car manufacturers feared for their business and urged the government to impose high import duties, which were tantamount to an import ban. However, companies in other sectors of the economy argued against this because they feared retaliatory tariffs on their goods. Car dealers were also against tariffs, as importing cars was lucrative for them. Even workers and trade unions were in favour of US imports, as they would force German companies to improve their production methods. It was hoped that assembly line production would also lead to higher wages due to higher productivity. This expectation was fuelled by the common narrative at the time that Ford Motor Company employees could afford to buy their own cars as they were paid four times the wages of German workers. In contrast, only the wealthiest households were able to buy a car in Germany.¹²

With the German Automobile Customs Act of 1925, a compromise was reached between the interests of automobile manufacturers, automobile dealers, labour and the foreign automobile lobby. In the sense of an "educational tariff" (according to Friedrich List (1841)¹³), German manufacturers were granted a grace period of three years. Import duties were initially raised sharply and then lowered again every six months until they ended in 1928 at a lower level than in 1925. Manufacturers were to use the grace period to build up international competitiveness. From 1928 onwards, the German Reich had almost the lowest import duties in the world.¹⁴

State allows competition

¹² Cp. Flik (2001), p.165.

¹³ Cp. List (1841), p. 31.

¹⁴ Cp. Kirchberg (2021), p. 265.



As a result, new competitors gradually entered the German market, importing cars to Germany, setting up local assembly and production plants or taking over domestic manufacturers. In 1928, there were ten foreign car manufacturers in Germany, which together covered a quarter of the German sales market.¹⁵

After the US manufacturers had increasingly gained a foothold in the German market, they dominated the mid-range market due to their favourable prices. German manufacturers were forced to modernise their production facilities and adapt their model range to meet the changing demand. As a result, German manufacturers focussed either on the large luxury class models (e.g. Daimler-Benz, Adler) or on small cars (Hanomag, Dixi, BMW, Opel). Large-scale production with the assembly line was introduced step by step, so that labour productivity tripled between 1925 and 1929.¹⁶ Despite the improvement, however, assembly line production never led to the success of the US competition, as the necessary size of the sales market was still lacking in Germany.

The international competition also meant that the wave of consolidation that began in 1923 continued and lasted until the global economic crisis of 1929. This period saw, for example, the merger of Daimler Motorenwerke and Benz & Cie to form Daimler-Benz AG (1926), as well as the takeover of Adam Opel AG by General Motors (1928). By 1933, the transition of the German car manufacturer market from a polypole with over 90 suppliers to an oligopoly with four groups was complete: Daimler-Benz, Auto-Union, Opel and Ford. In addition, there were five medium-sized manufacturers, including BMW, and 11 smaller companies.

The German car manufacturers had a decisive advantage over their superior US competitors: their smaller size. While the assembly line production of the US manufacturers could only be adapted at enormous cost for technical innovations, the German factories had greater flexibility to make small changes without having to stop the entire production. Due to the high pressure to innovate in the 1920s and 1930s, a compact small car with low fuel consumption, high reliability and good driving characteristics was developed step by step. The high productivity pressure on the automotive industry until 1933 laid the foundation for the industry's success, both after the National Socialists came to power and during the 1950s and 1960s.¹⁷

*German
manufacturers
benefit from small
company size*

¹⁵ Cp. Flik (2001), p.173.

¹⁶ Cp. Flik (2001), p.233.

¹⁷ Cp. Flik (2001), p.240.

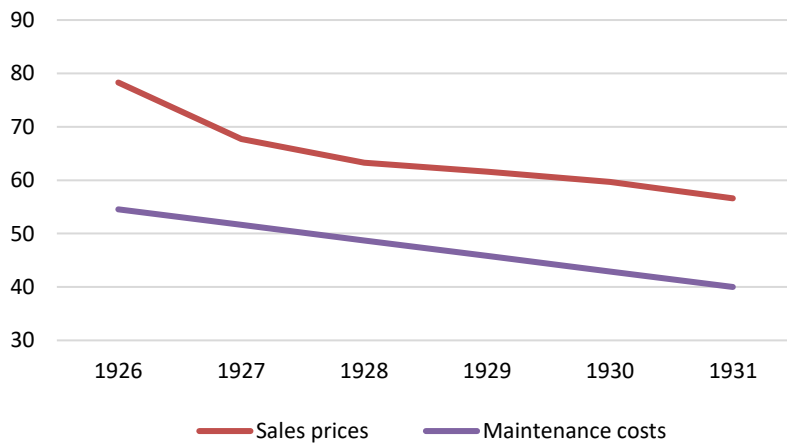


International competition coupled with technical progress meant that car prices fell steadily in the second half of the 1920s. In 1931, cars cost only 58% of their pre-war price and maintenance costs fell by 60%. However, this still did not make cars affordable for the German middle class.

Although many German car manufacturers were able to operate profitably before the First World War, the environment in the interwar period was much more challenging. The consequences of the war and inflation made the start of the 1920s difficult and US imports put pressure on the market.

Price pressure from competition

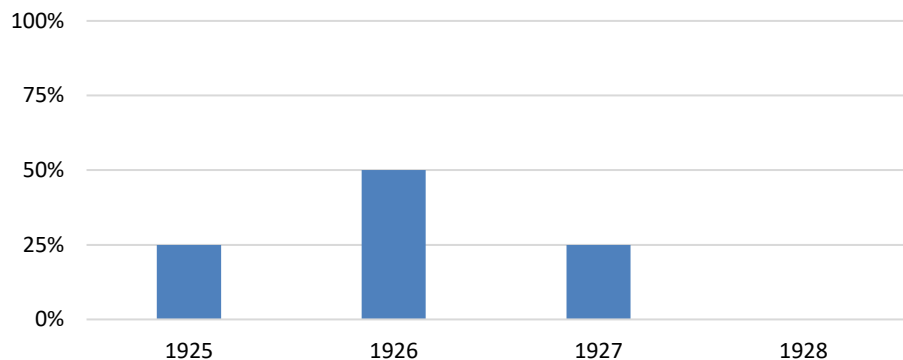
Fig. 5: Price indices for the purchase and maintenance of cars in Germany



1913 = 100 Source: Kirchberg (2021), p.294, Flik (2001), p.55.

Profitability remains low

Fig. 6: Proportion of German car manufacturers with dividend payments (sample)



Stichprobe comprises the 12 companies Adler, DMG/Benz/Daimler-Benz, Dürrkopp, Hanomag, Horch, Magirus, NAG, VOMAG, Wanderer, Presto, Dux, Ley. Source: Kirchberg (2021), Seherr-Thoss (1974)



Developments in the second half of the 1920s show that state regulation and monetary policy were partly to blame for the internationally uncompetitive state of the German automotive industry. The stabilisation of the currency and the dismantling of trade barriers put pressure on the industry to innovate, which weighed heavily on the industry in the short and medium term, but created the conditions for its subsequent success in the long term. The state and society contributed to this by allowing foreign competition. This laid the foundations for the success of the German automotive industry until the Second World War and in the early years of the Federal Republic.

Conclusion

The first 50 years of German automotive history show how important competition is for the future viability of an industry, even in the early days of development. Against state intervention, competition produced the most efficient drive technology of the time. Allowing foreign competition encouraged the pressure on German manufacturers to innovate, enabling the automotive industry to emerge stronger from the difficult phase of the interwar period and lay the foundations for its later successes.

Today, the state is once again intervening in the battle for drive technologies with subsidies and taxes. However, competition with Chinese car manufacturers could also provide the necessary innovative pressure on German car manufacturers today. The experience of the 1920s shows that state intervention is clearly inferior to competition when it comes to creating an economically successful car industry.

Bibliography

Büchner, Karl (1910): "Der gegenwärtige Stand des Automobilismus", in Zeitschrift des Mitteleuropäischen Motorwagen-Vereins, pp.1-20.

Flik, Reiner (2001): "Von Ford lernen? Automobilbau und Motorisierung in Deutschland bis 1933", Böhlau Verlag, Cologne.

Kirchberg, Peter (2021): "Automobilgeschichte in Deutschland - Die Motorisierungswellen bis 1939", Georg Ohms Verlag, Hildesheim.

List, Friedrich (1841): "Das nationale System der politischen Ökonomie", Tübingen.

Merki, Christoph Maria (2002): "Der holprige Siegeszug des Automobils 1895-1930", Böhlau Verlag, Vienna.

Roe, Mark J. (2021): "Dodge v. Ford: What Happened and Why?", in Vanderbilt Law Review (74) 1755.



Seherr-Toss, H.C. (1974): "Die deutsche Automobilindustrie / Eine Dokumentation von 1886 bis heute", Deutsche Verlags-Anstalt, Stuttgart.

Thieme, Carsten (2004): "Daimler-Benz zwischen Anpassungskrise und Rüstungskonjunktur 1919-1936", Wissenschaftliche Schriftenreihe des DaimlerChrysler Konzernarchivs, Vol. 7, ed. Niemann/Feldkirchen.



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