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THE HISTORICAL CONDITIONS FOR DEVELOPMENT OF THE AUTOMOTIVE INDUSTRY

Abstract

Introduction. Development of automotive technology for military purposes has been transferred onto the civil dimension. A wooden car prototype from the second half of the 18th century in France was to serve as an artillery vehicle, and it was only at the beginning of the 19th century that steam stagecoaches in England were used for passenger transport. The rapid decrease in the demand for innovative, as for those days, technical solutions used in steam engine vehicles resulted from the growing competition of railway traffic in the form of railway, which dominated transport at that time. Only the use of an internal combustion engine for cars in 1895 in Germany sets the date of the birth of a modern car. The car industry developed in European countries, i.e. France, England, Italy, Sweden as well as in the United States of America and Japan. The history of the Polish automotive industry, in the field of construction and production of passenger cars, having its genesis at the beginning of the 20th century, shows signs of development only after the Second World War and there is no continuation in the period of the systemic transformation.

Methods. The research methodology involved the use of the existing sources. Content analysis of the published source materials has been carried out as well as a comparative analysis of the data on the development of the industry in the countries, where the structural thought contributed to the emergence of the automotive industry.

Results. It was not until the industrial era that universal access to the possession and use of a car for civil purposes, a car produced serially in standard technical and aesthetic parameters, became available.

Discussion. The two-hundred-year evolution of the energy resources used to power cars takes its origins from the tractive force of animals, through such mechanical solutions as those using wind power (sail), springs, human muscles (pedals), water vapor (steam engine), gasoline (gasoline engine) to the experiments with biofuels and electricity. The search for new solutions was a response to the demand to increase the speed of movement in physical space.

Keywords: automotive industry, car companies and brands, steam propulsion, gasoline propulsion, electric propulsion.

Introduction.

Development of automotive technology for military purposes has been transferred onto the civil dimension [1, p. 7; 11, p. 7-9]. A wooden car prototype from the second half of the 18th century in France was to serve as an artillery vehicle, and it was only at the beginning of the 19th century that steam stagecoaches in England were used for passenger transport. The rapid decrease in the demand for innovative, as for those days, technical solutions used in steam engine vehicles resulted from the growing competition of railway traffic in the form of railway, which dominated transport at that time. Only the use of an internal combustion engine for cars in 1895 in Germany sets the date of the birth of a modern car. The car industry developed in European countries, i.e. France, England, Italy, Sweden as well as in the United States of America and Japan [13, p. 5-6]. The history of the Polish automotive industry, in the field of construction and production of passenger cars, having its genesis at the beginning of the 20th century, shows signs of development only after the Second World War and there is no continuation in the period of the systemic transformation.

Analysis of recent research and publications.

At the end of the 20th century, over 500 million cars were registered in all countries of the world. E. Shove's forecasts predicted that by 2015 this number would have doubled and by 2050 it will triple [20, p. 411].

The prospects for the development of the automotive industry are illustrated by the forecasts of aluminum, carbon fiber microcars, with electric and hydrogen drive, with connection to the Internet through

a multifunctional 'smart card' that sends information from home to the car, to the website, to the bank, to the entertainment places. Combination of the use of communication and information technologies can personalize and integrate microcars and other forms of transport. A car with portable hands-free communication and information technology (ICT) devices installed can even become a work station [20, p. 425-427].

Purpose.

The aim of this article is to show the genesis of the development of the passenger car industry both in Poland and worldwide, illustrating the development of automobiles, from the first constructions ever to the car brands used presently. The subject of the article is the stages of car production, determined by the course of finding energy sources, from water vapor, through gasoline, to electricity.

Methodology of the study.

The research methodology involved the use of the existing sources. Content analysis of the published source materials has been carried out as well as a comparative analysis of the data on the development of the industry in the countries, where the structural thought contributed to the emergence of the automotive industry.

Results.

The beginnings of the automotive industry development in the world

First constructions of steam-powered cars were not produced serially. In France, Nicolas Joseph Cugnot from Lorraine constructed the first walking steam car (5 km/h) in 1764, which had been designed to be an artillery tractor and was improved in 1771. The next creators were Pecqueur – in 1812 and Jean Chretien Dietz – in 1830. Further development of steam-powered vehicles was led by England. A three-wheeled steam vehicle was constructed by Wilhelm Murdock in 1786. Another steam-powered car (16 km/h) was built by Ryszard Trevithick in 1870. Steam omnibuses created by Goldsworthy Gurney in 1827 and by Hancock in 1829 constituted the rolling stock of the 15 km-long permanent communication between London and Bath, while the steam omnibus built by Church in 1832 ran between London and Birmingham. In European countries, steam-powered vehicles were constructed by Josef Božek – 1815 in the Czech Republic, Guriew – 1835 in Russia, Borduno – 1854 in Italy, Blanchard – 1825 and Doble – 1912 in the United States, while in Japan – by Shintaro Yoshida and Torao Yamaba in 1902. Further steps in finding new ways of propulsion were initiated in the first years of the 19th century by a Swiss inventor Issac Rivaz, who used illuminating gas to move a piston in the cylinder of an explosive engine, by Italian engineers Eugenio Barsanti and Felice Matteucci, who, in 1856, constructed an internal combustion engine powered by a mixture of air and the illuminating gas in a 3-stroke cycle, and by a French engineer Alphonse Beau de Rochas, who invented a 4-stroke engine [12, p. 37-38; 13, p. 5-6; 14, p. 8-9].

The next stage in the development of motorization begun after the invention of a spark-ignition gas engine in 1860 by Etienne Lenoir in France. He did not implement any production of his heavy-duty vehicle with the power of one and a half horsepower, but organized a factory producing industrial engines. Based on the principle of operation of a four-stroke internal combustion engine, developed by a French engineer Beau de Rochas, a German engineer Nicolaus Otto founded the Deutz gas, petroleum and gasoline engine manufacturing plant in 1864, the patents of which were later on acquired by Americans. In 1868, in Paris, a Frenchman Piotr Ravel patented a motor vehicle with a combustion engine. In 1875, an Austrian inventor from Vienna, Otto Siegfried Marcus, built the first light car powered by a single-cylinder petrol engine. In 1884, Frenchmen Edouard Delamarre-Deboutteville and Leone Malandina constructed a vehicle with an engine powered by "light oil", not planning production on an industrial scale [12, p. 57-62; 14, p. 9; 17, p. 31-46, p. 48-49, 57; 18, p. 23-25].

Further, development of motorization was concentrated in America, where, in 1884, John and Tomasz Clegg built the first American car in the city of Memphis (USA). In 1885, August Butler built a petroleum tricycle [18, p. 25-27].

Combustion engines of those times were technologically primitive, with high weight in relation to power, with insufficient cooling and explosive mixture ignition systems. At that time, steam engines together with the steering system and an articulated-shaft drive were being improved in France, which was applied by Amedee Bollee for constructing a steam-powered omnibus 'L'Obéissante' in 1873. Another of his constructions were a steam tram, a steam buggy 'La Mancelle' invented in 1878, a heavy steam car 'Marie-Anne' and a steam car 'La Rapide' from 1881. This trend has been maintained by French motoring enthusiasts De Dion and Bouton, who constructed a steam vehicle in 1882 and a steam tractor in 1885 [12, p. 39-42; 14, p. 8; 17, p. 31-46, p. 48-49; 18, p. 27-29].

The breakthrough in the development of motorization took place in 1884, when a German engineer Gottlieb Daimler constructed an engine and the first gasoline vehicle with a 'modern' engine and a four-wheeled gasoline car in 1886 for a company Deutz. Regardless of him, a German engine designer Carl Benz constructed the first gasoline three-wheeler in 1885 and a light-eight gasoline car in 1886. Petrol cars replaced steam cars. Gottlieb Daimler, the founder (1890) of a car manufacture 'Daimler Motoren Gesellschaft' was competing with Benz - the owner of 'Carl Benz &Co'. The merger into one company called Daimler-Benz took place only in 1926. Based on Daimler engines, the 'Panhard & Levassor' company established in France constructed the first light four-wheeled car was using modern design principles in 1889. In 1891, 7 Benz cars, 6 Panhard-Levassorai and 4 Peugeot cars were produced. Large-scale car manufacture was possible in France, due to the most modern road network [12, p. 63-69; 14, p. 10, 148-156; 17, p. 61-63, 142-143; 18, p. 29-33].

At the end of the nineteenth century, America could not keep up with Europe in terms of the development of motorization, despite the fact that the birth certificate of an American car constructed by Charles and Duryea was dated in 1893, while in 1896, Duryea Motor Wagon Company produced 13 copies. In 1894, Elwood Haynes founded the first American gasoline car factory. In 1896, Henry Ford created a four-wheeled vehicle and in 1903 he founded the Ford Motors Company, which, for the first time, produced Ford cars on a production line. Jeep was founded in 1902. Between 1910-1920, over 30 companies (including Cadillac, Oakland, Chevrolet, Buick, Geo, Oldsmobile, Opel, Pontiac, Saturn) entered the General Motors company founded in 1908. In 1920, Walter Percy Chrysler founded a car company named Chrysler, which produces the Dodge, the Eagle and the Plymouth brands [14, p. 10, 54-63, 84-119, 237; 18, p. 33-35].

The Japanese Mitsubishi Corporation (1875) has been producing cars since 1917. In 1907, a small-lot production of the first Takuri Type 3 gasoline vehicle was discontinued. The Hamamatsu Suzuki Looms Works, founded in 1909, produced the first car in 1955. The origins of the Nissan Motor Co. date back to 1911. In 1914, the Kwaishinsha company produced the first car Isuzu. Since 1919, the Jitsuyo Jidosha has been manufacturing the Datsun car. The origins of the Fuji Heavy Industries Ltd., manufacturing the Subaru, date back to 1917. At the Toyo Cork Kogyo (1920), Mazda has been produced since 1931. In 1926, the Toyota Motor Co. was founded at the Toyoda Automatic Loom Works Ltd. Honda, the third Japanese car manufacturer for this sector, came in 1962. The Hyundai Motor Company (1967) launched production in Korea under the license of the English Ford. The Korean Daewoo Group, with 25 operating companies and 100 associations in various countries, entered the automotive sector in 1978.

Further development of the automotive industry in Germany, the homeland of the first car with an internal combustion engine, proceeded quite quickly, as evidenced by the development of the following car brands: Wartburg (1898); Audi (1900), BMW (1916), as a merger of Rapp Motorenwerke and Gustav Otto Flugmaschinenfabrik Horch-Landaulet, after taking over the Dixi producing Austin Seven cars, entered the automotive sector in 1929, Dixi DA1 (a British license 1927); Porsche (1931), Volkswagen (1932), Lloyd Alexander (1955); Trabant (1957).

In other European countries, the production of well-known brands began: Peugeot (France 1881), Tatra 11 (Czech Republic 1897); Renault (France 1899), FIAT (Italy 1899), Rover (Great Britain 1922), Rover, Land Rover, MG, Austin-Healey, Riley, Austin, Vanden Plas, Morris, Triumph, Wolseley; Rolls-Royce (Great Britain 1903); Alfa Romeo (Italy 1906), Lancia (Italy 1906), Maserati (Italy 1914); Citroen (France 1919); Aston Martin (Italy 1921); Jaguar (Great Britain 1922); Skoda (Czechoslovakia 1923 - Czech Republic), Skalowe Zavody in Austria-Hungary; Volvo (Sweden 1924); Ferrari (Italy 1929); SEAT (Spain 1931); SAAB (Sweden 1937), Svenska Aeroplan Aktiebolaget aviation company producing cars since 1947; Lotus (Great Britain 1947); TVR (Great Britain 1947), DAF 600 (Netherlands 1958); Zaporozhe (USSR 1960); Austin Seven (Great Britain 1961), Lamborghini (Great Britain 1963); Lada, Žiguli (USSR 1966) co-operation of the Soviet government with FIAT [7, p. 126-134; 8, p. 9; . 9, p. 220-230; 10, p. 5-16; 11, p. 53-60; 14, p. 10-11, 36-53, 64-83, 120-147, 157-239].

The success of using an internal combustion engine in car constructions has not stopped further searches for new energy sources. After the discovery of electromagnetic induction by M. Faraday in 1831, the attempts made to build a vehicle with electric drive using galvanic batteries by American blacksmith Thomas Devenport in 1835, Englishmen Robert Dawidson in 1839 and Georg Little from 1844 and German J. Wagner in 1855 did not bring the expected results. A hundred years after steam was used to propel the first vehicles in the second half of the 19th century, the possibilities of using electric power became more and more apparent. The first electro-mobiles were created in England by Radcliff-Ward in 1886 and JK Starley in 1888, while the first car with batteries was made by the Frenchmen M. Jeautand and M. Raffard in 1895. Production of electric cars in 1897 took place in the French company Krieger, the English Brithis Elektromobile, the German Namag and the Italian STAE, the American Electric Carriage and Wagen & Co. The American Morris (1896), the Stauderbaker (1902), the Becer (1907), the Bersey (1897), the French Hautiera (1898), the Russian Romanowa (1898) also signed their place in the history of electric vehicles. In 1912, there were 20,000 battery-powered cars in the USA. However, due to the limited range of electric cars and after the refinement of the parameters of the internal combustion engine, further experiments with electric motors were discontinued in 1910. The renewed interest in electric drive, which started as a result of the fuel crisis in the 1970's, was hindered due to the difficulties in overcoming high costs, the weight of the batteries, the limited range and the non-development of a hybrid engine. On the centenary of the first electric production in 1997, General Motors sold experimentally, in the form of leasing, the EV-1, Honda EV-Plus electric car, while other companies made electric versions of the RAV4Toyota models, the Ranger EV Ford, the Epic Chrysler minivan and the Prairie Joy Nissan, the Fiat Panda, the Cinquecento, the Renault Clio Elektro and the Mitsubishi Libero EV [12, p. 46-54; 14, p. 11].

The genesis of the passenger car industry in Poland.

The automotive industry developing worldwide in the first decade of the 20th century, did not find any fertile political and economic ground in the Polish territories that were under foreign annexation.

Attempts to manufacture passenger cars were made at the Ursus S.A. Motor and Tractors Plant founded in 1922 [19, p. 12-15]. In the interwar years, in Poland, there were Ford 1926-1928, General Motors, Chevrolet car assemblies functioning until 1931 and Citroen until 1932 [15, p. 19]. The foundations for the development of the Polish automotive industry were put together by Poland's cooperation with Italy, as a result of which the Italian car company Fabbrica Italiana Automobili Torino FIAT handed over the licenses for car models. The concerns established in 1930, called the State Engineering Works, produced the Polish Fiat 508-III Junak cars. In the years 1936-1939, licensed production of 1200 pieces of Fiat 518 was commissioned. The Italians handed over the construction of the Fiat 500 Topolino, the Fiat 1100 and the Fiat 1500.

In the post-war period, Fiat 1400 passenger cars were manufactured in Poland, as a continuation of cooperation with the Italian FIAT company. In 1948, construction of the Passenger Car Plant (original: Fabryka Samochodów Osobowych) begun in Warsaw. After breaking of the contract with FIAT, production of the Warsaw M20 passenger cars, based on the Soviet car GAZ M 20 Pobieda, began in 1951 and

lasted until 1972. Contacts in the automotive industry with Italy were resumed in 1965, along with the purchase of a car license for the car of the year – the Fiat 125 year, recognized as a European sensation.

The first Polish construction was the Mikrus prototype (1957) produced until 1960. The Syrena deserves the name of the cult car of the Polish People's Republic, as a Polish construction with serial production [6, p. 3-9]. Further development of Polish-Italian cooperation in the field of motorization was continued thanks to the purchase of a Fiat 126 car license (produced serially since 1973). In 1973-1975, five Italian Fiat models were assembled in Poland. In the years 1977-1979, the Zastava 1100 were being assembled in cooperation with the Yugoslavian factory of Crvena Zastava. Preparation for the production of the Polish construction of the Polonez car, which began in later on 1978, was being organized [16, p.; 17, p. 413-415; 21, p. 9-26; 22, p. 11-46].

After the political change in Poland in 1989, production and assembly of modified car brands continued: Fiat 126p BIS, Fiat126p Cabrio, Cinquecento, Seicento, Polonez Caro, Fiat UNO [2, p. 3-6; 3, p. 3-5; 4, p. 3-5; 5, p. 3-6].

Economic globalization, as one of many factors in the creation of international corporations, allowing territorial dispersion of the production process and assembly of high quality cars in search of cheap labor force, had a significant impact on the expiration of the domestic automotive industry in Poland. As a result of these processes, since the 1990s, car assembly plants for Opel, Volkswagen, Fiat and Ford brands in Gliwice, Tychy and Poznań have been launched. The system transformation in 1989 and Poland's accession to the European Union in 2004, which contributed to the release of the flows of goods and services and to the freedom of movement in border traffic, resulting in increased opportunities to buy used cars in the countries of their production, were also the reason for the decline in demand for domestic production.

The table below presents the production volume and the dynamics rate of the cars manufactured in Poland in 2014-2015 (Table 1., Chart 1).

Table 1

Production of motor vehicles in Poland in 2014-2015*

Specification	2014	2015	2014=100
	thousand pcs		%
cars in general	593,5	660,6	111,3
passenger cars	472,6	534,7	113,1

*Source: Statistical data from the Statistical Office in Rzeszow, own calculations.

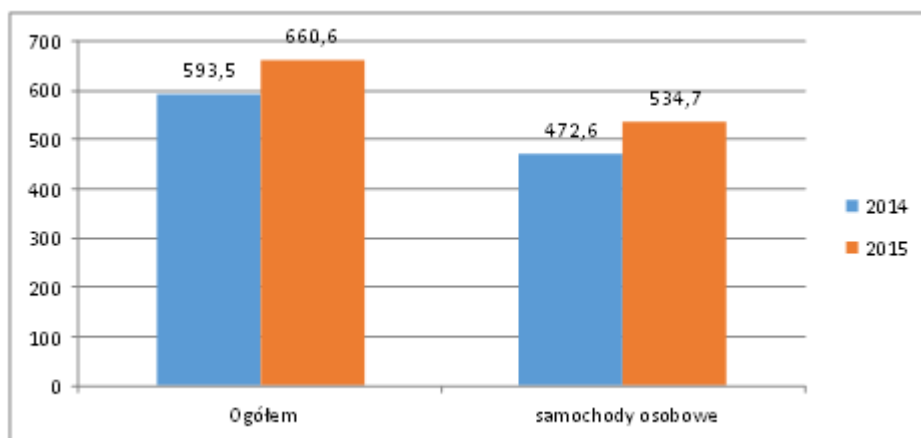


Chart 1. Production of motor vehicles in Poland in 2014-2015*

*Source: own elaboration.

Production of passenger cars in Poland in 2015 increased by 13,1%, compared to 2014 and amounted to 534 700 cars. The growth rate of passenger car production is faster than the growth rate of total car production, amounting to 113,3% (Chart 2).

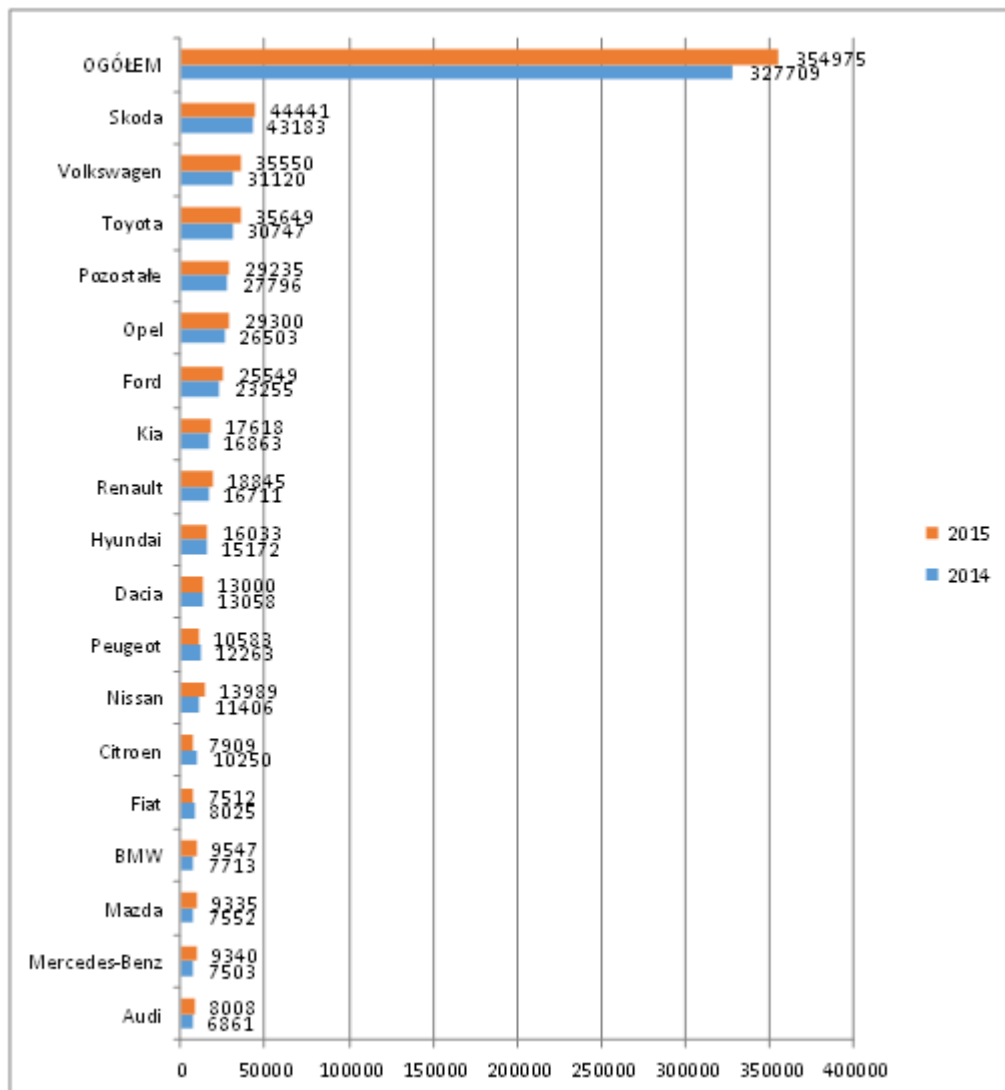


Chart 2. First new passenger car registration in Poland in 2014 and 2015*

*Source: own elaboration.

Between the provided volumes of domestic car production and the import of used cars, there is the number of new foreign brand cars registered for the first time in Poland. In 2015, 354 975 cars were registered, which constituted an increase by 8,3%, compared to the previous year. The most popular cars in Poland are the new Skoda, Volkswagen and Toyota, Opel, Ford, Renault and Kia and Hyundai. Taking into account the dynamics of the interest in individual brands, the highest growth is observed in the purchase of Mercedes-Benz, BMW, Mazda and Nissan cars, reaching over 20% in 2015, compared to 2014. However, interest in the Citroen, Peugeot, Fiat and Dacia brands is declining.

Conclusions and discussion.

The origins of the automotive industry date back to the period of the industrial revolution. Application of steam drive into industry inspired the constructors to build the first mechanical vehicles. However, the development of the automotive industry began after the invention of a gasoline-powered combustion engine. The origins of car production took place on the European continent. The first prototypes of motor vehicles were created before in England, before the use of steam drive. The first car with an internal combustion engine was built in Germany. Many car brands and automotive plants were established in France and Italy. Serial production on assembly lines was launched for the first time in the USA.

The Polish car industry in the pre-war and post-war period developed on the basis of the Italian FIAT license. Production and assembly of licensed cars and the work of Polish engineers in 1970's resulted in the Polish automotive industry bringing huge profits and a positive balance in the exports to capitalist countries.

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