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Path Dependent Historical Development at Turkish Automotive Industry*

Sıtkı Selim Dolanay
İstanbul Ayvansaray (Topkapı) University, Istanbul, Turkey

Turkey's automotive industry has begun to occur at a much earlier date compared to other developing countries, through licensing agreements to establish automotive industrial facilities, by importing a kind of technology. Attempts have been made in order to produce the domestic automobile road providing sectoral developments could enter another technology pathway. Moreover, the inventor of a very early date in the Fordist production system, such as 1929 by Ford Motor Company with the license agreement, as if he could provide for setting up production facilities in Istanbul's company, this bad experience has refrained for years from entering as a manufacturer Ford Motor Turkey market. Thus, while Turkey is an attractive market for car production, on the other hand, sufficient improvement over time in the production of trucks and other automotive products, such as buses has not been achieved. The 1929 experience seems to have been effective in terms of Turkey. Because, it was necessary to wait until 1971 for OYAK and TOFAŞ to establish automobile assembly facility with license agreements. With the start of production of two automotive industry facilities, there has been a significant increase in sectoral production figures, but this increase trend has not been sufficiently supported by the government through the incentive system and in the late 1970s the production of the automotive industry has declined. For the first time in 1961, efforts were made to produce a completely domestic automobile, although the prototype of the revolutionary car was successfully produced, mass production could not be started. Subsequently, the production of the Anadol automobile for the second time was tried by means of technology transfer from multiple sources and the serial production of this automobile continued for a while. However, since fiber glass bodywork was used instead of hair bodywork and export opportunities could not be found, production was stopped completely in the end of 1980s. In the 1980s, automobile production continued in two assembly plants and product diversification was carried out to increase the production volume. In the 1990s, three new assembly facilities, Honda, Toyota and Hyundai, were established and the number of assembly production facilities in the country increased to five and technology loyalty based on technology imports continued. Until 2014, the automotive industry continued to consist of five automobile assembly plants and other automotive products assembly plants. In 2015, it was announced to the public that a new domestic car prototype was produced. It was announced that the project will start mass production in 2019. However, it was determined that the prototype would be re-manufactured at the end of 2019 by making changes in the project and that it would be possible to start mass production in 2022. Thus, it is understood that the efforts to start mass production since 2015 can be concluded in 2022, i.e. 7 years after the first prototype was produced. It can

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Sıtkı Selim Dolanay, Ph.D., Dr. Faculty Member, Department of Economics, Faculty of Economics, Administrative and Social Sciences, İstanbul Ayvansaray (Topkapı) University, Istanbul, Turkey. Email: sitkiselimdolanay@topkapi.edu.tr. ORCID iD: 0000-0002-3971-2887.

produce prototypes in a short period of four months in Turkey in 1961, as evidenced by an indication of the dependency on a long time wasting which is not technology importation pathway, such as five years. How to break the path of devotion demonstrates that it is a difficult job. Path dependency is thought to result from the education system.

Keywords: automotive industry, import of technology, technology transfer, domestic automobile, automotive industry production, path dependency, education system

Introduction

When David (1985) first mentioned the concept of path dependency, he compared computers with F keyboard and Q keyboard. He showed the technical and economic advantages of the F keyboard compared to the Q keyboard, and stated that generally choosing the Q keyboard to be used is not an economically or technically rational choice. He stated that if computers with F-keyboards were commonly used, it would have been possible to reach computers that could develop rapidly with a much faster technological development path. Therefore, we can say that David has determined that it is possible to adjust the speed of technological development with the choices we have made in history.

It is possible to make the same determination regarding artificial intelligence. Indeed, the issue of artificial intelligence or giving intelligence to machines has been discussed since the 1950s (Nilsson, 2011, pp. 73-166). It must be admitted that a great time has passed for artificial intelligence researches from the first computers to the present day, and artificial intelligence became available only with the use of very complex mathematical formulas.

Although it took a long time to become applicable, although very complex mathematical formulas must be used for its implementation, let's continue with the explanations about the automotive industry, leaving detailed research on artificial intelligence to the experts.

David (2001) continued his studies on path dependency approach and stated that in order to be able to talk about a path-creating development in any industry, the figures showing the development of industry branches such as production etc. should increase linearly. He stated that if this is not the case, he was locked on a path due to a certain social phenomenon in history and that the established path attachment could be strengthened by subsequent historical events and could last for many years.

Similar to David's, it is possible to explain the slowness of development of the Turkish automotive industry in a historical perspective through the path adherence approach. As a matter of fact, when Turkey, which entered into an effort to produce its own domestic automobile in 1961, gave up its efforts to produce domestic automobiles and went back to establishing automobile production facilities through license agreements, it gave up its effort to create a new path and break the lock of path loyalty. Thus, the path that was formed in 1929 and before was returned, and the slow development process continued within the path attachment.

A Brief Overview of Automotive Industry History

Under the development of science and scientific methods, the 18th and 19th centuries witnessed new political, intellectual and economic formations along with inventions. These changes, which took place under

scientific approaches, led to technical developments, and as a result, these inventions, which were commercialized and spread, revealed the birth of the industrial revolution. The invention of steam engines in-vehicle technologies in the previous period and their taking place under global practices created the elements of migration from rural life dependent on the settled order in societies to city life, which became the center of industry and trade. The changing and dynamic life model in the social field in question has restructured human life and basic needs. Therefore, in the light of these developments, the initial purpose of the research is to reveal the structure of the rapid transport culture, which has emerged as a result of socialization or radical change in the social structure, that has changed the effect of industrialized products on individual life or the social structure, in its natural environment. The dynamism that constitutes modern culture, the increasing need for acceleration of humanity, came to life in this period when historically intense discoveries and scientific methods came to life (Paker, Alppay, & Sertyeşilışık, 2018).

The first working steam-powered vehicle was designed—and quite possibly built—by Ferdinand Verbiest, a Flemish member of a Jesuit mission in China around 1672. It was a 65-centimetre (26 in)-long scale-model toy for the Kangxi Emperor that was unable to carry a driver or a passenger (it is not known with certainty if Verbiest's model was successfully built or run)[1].

After the cars started to be designed to be able to drive alone on the roads, the first steam-powered car in history was founded by Joseph Cugnot in 1769[2] (Dolanay & Oğuztürk, 2019).

The development of external combustion engines is detailed as part of the history of the car but often treated separately from the development of true cars. A variety of steam-powered road vehicles were used during the first part of the 19th century, including steam cars, steam buses, phaetons, and steam rollers. In the United Kingdom, sentiment against them led to the Locomotive Acts of 1865[3].

Jean Joseph Etienne Lenour produced the first single-cylinder internal combustion engine. The four-cylinder engine was first manufactured by August Otto. Gotlieb Daimler manufactured the first four-wheeled automobile in 1886. Gotlieb Daimler and his team also manufactured the v-tilt motor. Karl Benz, the founder of Mercedes Benz, invented the car that works with an internal combustion engine for the first time. Gotlieb Daimler, Wilhelm Maybach and Karl Benz together founded the Daimler-Benz Manufacturing Company in 1926. The joint venture company continues to produce under the Mercedes-Benz and Daimler-Chrysler brands. Henry Ford is the founder of the world's largest and most famous automobile manufacturing facility. In 1927, 15,000,000 Ford Model T models were produced at the Ford factory[4] (Dolanay & Oğuztürk, 2019).

Vehicles powered by electric motors emerged in the 1830s and were used until 1870. Steam engines were not the only engines used in early automobiles. Vehicles with electrical engines were also invented. Between 1832 and 1839 (the exact year is uncertain), Robert Anderson of Scotland figured favorably in the history of cars when he invented the first electric carriage. Electric cars used rechargeable batteries that powered a small electric motor. The vehicles were heavy, slow, expensive, and needed to stop for recharging frequently. Both steam and electric road vehicles were abandoned in favor of gas-powered vehicles. Electricity found greater

[1] https://en.wikipedia.org.
[2] https://depts.washington.edu.
[3] https://en.wikipedia.org.
[4] https://depts.washington.edu.

success in tramways and streetcars, where a constant supply of electricity was possible[5] (Dolanay & Oğuztürk, 2019).

In the 1900s, Ford produced more steam and electric powered vehicles than gasoline powered vehicles. The first hybrid commercial truck was built in 1910. However, with the widespread use of gasoline commercial vehicles, the production of hybrid vehicles was abandoned. However, today, with the increase in environmental problems, the production and use of hybrid vehicles has come to the fore again[6] (Dolanay & Oğuztürk, 2019).

Today, the activities of all companies in the automotive industry consist of the production of motor vehicles and their parts. The main products of the industry were passenger cars and trucks. The engines used in the automotive industry are composed of gasoline and diesel engines. However, the history of the passenger car industry has shown us that passenger car production has a special place in the production of all motor vehicles and has a profound effect on the economic developments in the 20th century. Although passenger cars were first started to be produced widely in Europe at the end of the 19th century, mass production was first started in the USA and this innovation influenced the whole world in the first half of the 20th century. In the second half of the 20th century, Western European countries and Japan became major producers and exporters[7] (Dolanay & Oğuztürk, 2019).

Although steam engines were used in the first vehicles produced for driving on the road, the automotive industry developed rapidly with the production of cars with gasoline and diesel engines. The first gasoline powered cars started to be produced in France and Germany in the 1860s and 1870s, and with the beginning of the 20th century, British, Italian and US manufacturers were added to the German and French manufacturers. Firms in the early stages of the development of the automotive industry consisted of small shops. Handmade cars were produced in workshops by many manufacturers. Some of these companies left the business shortly after entering the car manufacturing business. Some of them tried to turn their business by continuing production in other fields, for example, German Opel and British Morris bicycle, US Durrant and Studebaker horse-drawn carriage and machine, German Daimler, British Lanchester and US Olds ship engine, US Leland machine parts, British Wolseley ship machines, US Peerless washing machines, USA White weaving machines, French Panhard and Levassor wool spinning and weaving machines, USA Buick produced pipes and stabilizers. The two major exceptions to this general trend are the British Rolls Royce and the US Ford. Both of them have engineering knowledge and business skills and have concentrated only on automobile production with the guidance of their partners[8] (Dolanay & Oğuztürk, 2019).

Almost all manufactured product manufacturers in the USA have produced by assembly. After all automobile parts were manufactured by independent subcontractors, the automobile manufacturer came to the company and assembled here and the finished product was manufactured. The assembly technique has provided companies with a great financial advantage. While all parts of motor vehicles could be purchased with credit, the manufacturer was able to sell the finished product to the distributor for cash. On the other hand, European firms in this period were not only able to solve in a more self-sufficient situation, but also to decide what to produce. After the initial success of gasoline powered engines, they have gained from experience with steam

[5] https://www.anythingaboutcars.com.
[6] https://depts.washington.edu.
[7] https://www.britannica.com.
[8] https://www.britannica.com.

and electric vehicles[9] (Dolanay & Oğuztürk, 2019).

It was easy to operate the steam car after 1900s; when the water in the water tank started to boil, the steam started to rise rapidly. The operating principle was simple, as steam-powered cars did not require a transmission mechanism. However, the engine had to be sufficiently ignited to obtain the necessary vapor pressure to keep the car on the road, making this mechanism difficult to maintain as well as costly to build. Since 1910, many steam vehicle manufacturers have switched to gasoline-powered engines. The US firm Stanley Brothers continued to manufacture steam cars until the early 1920s[10] (Dolanay & Oğuztürk, 2019).

We can say that technological progress in the automotive industry accelerated when the automotive industry was introduced to the mass production method by the US company Ford and this method became widespread throughout the industry. It can be said that the mass production method has been a US innovation. We can say that the fact is that the USA has a larger population compared to other European countries, the population's standard of living is high, and the long distances between settlements have made the country the natural birthplace of mass production technique[11] (Dolanay & Oğuztürk, 2019).

Most of the cars produced in the 1930s had four wheels and hydraulic brake mechanisms, and many cars had a heater and a radio. In addition, unlike the 1920s, the design of the cars changed and the hard lines became softer. Thus, they were less exposed to the speed-reducing effect of the wind. Driver comfort has also increased. US manufacturers, whose numbers have increased gradually, have started to produce different kinds of cars and cars have started to become safer with safe glasses. Suspension was used for the first time in automobiles. Due to World War II, cars were not produced from 1942 to 1946. However, the 1940s were the years when luxury cars came off the production line for the first time, companies turned to producing military vehicles, and jeeps, which are four-wheeled military vehicles, were started to be produced for the first time. In the 1940s, cars with automatic transmission and semi-automatic operating systems were also produced for the first time. Cars of the 1940s were capable of going 15-20 miles on a gallon of fuel. Mini vans, which were used in towns and villages in the 1940s, had a capacity of 9 passengers. The trend that started in the 1940s continued, with cars from the 1950s getting lower, longer and wider. In these years, there was a great increase in automobile sales, the rear wheel shaft and chrome automobiles took a new form, and the automobile design and the shape of the automobiles became very beautiful and strange. The trend in the 1930s and 1940s continued in the 1950s, as automobiles became more sophisticated and accelerated. In the 1950s, characterized as the jet age, speed increased a lot despite the complex curved components and shapes in the production of automobiles. As US brands began to enter the US market, they started to change. In the cars of the 1960s, economy came to the fore. Since the mid-1950s, foreign automobile brands such as Volkswagen, Fiat, Renault, Datsun (Nissan) and Hillman began to enter the US market and this trend continued in the 1960s. In the early 1960s, GM (General Motors) started producing new, smaller and more economical cars; these were the Buick Special, Oldsmobile F85 and Pontiack Tempest. Chevrolet produced the 6-cylinder Corvair. Chrysler also released Vallant. Rambler, which was released in 1958, brought a strengthening innovation and seat belt application in the chassis. The most popular cars of the 1960s were ponies. Sports style cars are very popular with their long front and short rear. The most famous of the pony cars was the Ford Mustang Classic, which was produced between 1964 and 1973. In the 1960s, we can say that public cars such as Volkswagen Beetle, Renault's small car, Fiat 124 and

[9] https://www.britannica.com.
[10] https://www.britannica.com.
[11] https://www.britannica.com.

sports cars dominated the European market. In-car and road safety became important in classic US cars in the 1960s. For example, the use of seat belts in cars has become standard. With the population explosion that started in 1946, those born in those years were old enough to own a car in the 1960s, which led to a 30% increase in sales in the USA by 1969. Chevrolet, on the other hand, started production of the Corvette Sting Ray in 1963 and production continued until 1967[12] (Dolanay & Oğuztürk, 2019).

The flexible production system was developed in the years after the Second World War. We can say that in these years, Ford and GM companies were still producing with the mass production technique, taking advantage of the economies of scale which has been possible. However, after the war, the market in Japan was too small for Toyota to produce with mass production technique. Toyota also had to manufacture many different motor vehicles on the same production line in order to meet customer demands. It has achieved this by keeping the time for the production of each vehicle short and using the production line flexible. Toyota has achieved this success by achieving higher quality, being more customer focused, delivering higher productivity and better use of machinery and space[13] (Goswami, 2018, p. 11; Dolanay & Oğuztürk, 2019).

The purpose of Toyota's just-in-time production system was to be able to work without holding stock and to minimize the cost of holding stock (Goswami, 2018, pp. 11-12; Dolanay & Oğuztürk, 2019).

We can say that the cars of the 1970s were the result of the logic of the industries in the USA. We can say that the reason why automotive companies diversify their products is that they can produce products such as TV sets and washing machines other than automobiles. We can say that the USA has become the largest, richest and most militarily widest country in the world, and no other country has been able to compete with it. However, with the 1973 oil crisis, the cars of Honda, Toyota and Nissan companies, which were smaller and used more efficient fuel, were imported from Japan, and started to be popular in the US market since the second half of the 1970s. Thus, in the 1970s, it began to change in US-style cars. Due to the energy crisis, diesel-powered cars have become popular. Since the half of the 1970s, vans have also started to become popular. In these years, the production of mini vans has not yet been discussed, and SUVs (Sport Utility Vehicles) have not yet appeared. Yet the public has been the smaller and more fuel-efficient model of the Maverick type and station wagons have been in production. However, the three big automobile companies in the USA continued to produce large and very fuel-consuming models. Among them, Chevrolet's new Chevette was the most economical model. Ford's new Granada model has become the smaller and more fuel-efficient model of the Ford Maverick. In these years, customers in England started to prefer Ford Capri instead of Austin[14] (Dolanay & Oğuztürk, 2019).

In the 1980s, the US automobile industry was shaken by the competition of Japanese cars. Even the three big US companies lost huge sums. In the early 1950s, Japanese automakers visited their US facilities and learned what to do and how. They took the technology and adapted it to their own society, and applied the teamwork method in the mass production facilities they established. The Japanese used existing technologies in a disciplined manner while producing their cars in the 1980s. The reason for the slow sales of US cars in the 1980s was the oil embargo on Iran in 1979. Americans do not like small cars, and they want to see big old cars everywhere. They were unhappy that they could not drive their own big cars due to the lack of gasoline. However, they had to buy smaller cars. Seeing this, the Japanese sent their 1980-made small cars to the US

[12] https://www.anythingaboutcars.com.
[13] https://www.anythingaboutcars.com.
[14] https://www.anythingaboutcars.com.

market. In the face of Japanese competition, US automakers had to increase the quality and productivity of their cars and meet production standards. Because otherwise, they have come to a situation where they cannot continue production. Chrysler, on the other hand, had worse resources than Ford and GM[15] (Dolanay & Oğuztürk, 2019). In the 1990s, the three big US companies worked harder than before to improve quality. In 1991, GM lost more than ever before and decided to close 21 of its factories. In order to overcome the problem, a friendly approach was started to be made to the customer in the European market, thus the European unit was tried to be strengthened. GM began producing the first new J-cars for Japan in 1994, while the German company Opel entered into a partnership with the Japanese company Toyota. GM could not save its realtors, and announced that it had made a profit for the first time since 1989 with the transformation of the automobile company. At the same time, Chrysler has had problems since the 1987 disaster. The decision to diversify has also led to a shortage of money. It was closed with a loss in 1989. Production of Iaccoca was terminated in 1992 and it was replaced by Bob Eaton. We can say that after a short time, the sales of mini vans and jeeps started to go well, and it protected the company in difficult times. The new lines of LH cars, Dodge, Interpid, Chrysler Concorde and Eagle Vision have all received good returns. The aerodynamic design realized at LH, the advanced styles realized in cabs in the automotive market have increased the profits inside, and the lessons learned from the Honda automobile example have provided the opportunity to produce with world-class products. For example, although the Neon was produced at a much lower cost than the Toyota Corolla, it was noted for its good engine and softer design, became better, cheaper and faster, and became the best seller of the 1990s. We can say that Mustang saved Ford from the 1991 recession and loss of profit. We can say that Mustangs, which are more effective and cheaper than their competitors in the past, quickly dominated the market in the 1990s. *MotorTrend* named it car of the year in 1994. The Honda Accord, which was produced between 1989 and 1992, could easily be pushed out of the market by Ford Taurus, and the devaluation of the yen could not save Japanese automobile companies. As a result, Honda and Toyota had to close their US plants. Detroit, on the other hand, produced the best cars in its history in the 1990s[16] (Dolanay & Oğuztürk, 2019). The 2000s started with trouble for the three big companies of the USA. Ford and Firestone companies were able to get away from the problem area thanks to the discovery tire. However, the embattled Chrysler continued on its way alone and tried to enter into partnership with Daimler and Mitsubishi before going bankrupt, and it was also affected by the great recession in 2008 and went bankrupt after a decade. General Motors followed in Chrysler's footsteps and declared bankruptcy a month later. The three big US companies are not content with just producing exploration tires like the Sebring, and they continue to produce cars like the Dodge Viper, Ford GT and Pontiac G8 GXP. These cars are fast enough and they look good. We can say that the reason why the three big automobile companies of the USA put cars on the market for sale despite the situation they fell into was their very successful designs and products in the past[17] (Dolanay & Oğuztürk, 2019).

In the 2000s, automobiles began to have complex technologies in terms of electronics and software. The Japanese Honda company has been in the market since 1999 with the S2000. The S2000 was produced between 1999-2009. The German BMW company has launched the second generation version of the M1, which started to produce in the 1970s, as of 2011. Although the M1 series has the same performance as the M3 or M5, it can be preferred because it is cheaper. When the US company Chrysler announced that it would not produce the

[15] https://www.anythingaboutcars.com.
[16] https://www.anythingaboutcars.com.
[17] https://www.thedrive.com.

next generation version of the Dodge Viper cars that have been produced since 1992, no one could believe it. We can say that the second generation version of Dodge, which was produced three generations before, has the best performance. For the US roads, the production of the Dodge Challenger SRT Hellcat continued. The Japanese Mazda company continued to produce sports cars by developing the Mazda RX-8. The US Ford company continued production with the Mustang Shelby GT350. The German BMW company continued the production of the BMW X6 M. The Japanese Mitsubishi company continued the production of the Mitsubishi Lancer Evolution X[18] (Dolanay & Oğuztürk, 2019).

Another model that came to the fore in the 2000s is the SUV (Dolanay & Oğuztürk, 2019).

Popular SUVs of the 2000s are as follows: Toyota RAV4, 2000 Lexus RX, 2000 INFINITI QX, 2000 Honda CRV and 2000 GMC Yukon XL 2500[19] (Dolanay & Oğuztürk, 2019).

Other cars that came to the fore in the 2000s are as follows: BMW M3 produced between 2000-2006, Honda S2000 produced between 1999-2009, Audi TT produced between 1998-2006, Dodge Viper produced between 1996-2002, Ford Mustang produced between 2005-2014, Jaguar XX manufactured between 2007-2014, Volkswagen Golf R32 produced for the USA market in 2004, Saab 9-5 Aero produced between 2000-2009, Mercedes Benz E55 AMG produced between 2003-2006, and Pontiac Solstice GXP produced between 2007-2009[20] (Dolanay & Oğuztürk, 2019).

The most popular vehicles of the 2010s are as follows: Dodge Challenger Hellcat, 2012 Tesla Model S, 2011 Chevrolet Volt, 2010 Ford F-150 Raptor, 2014 Ferrari LaFerrari, Porsche 918 Spyder, McLaren P1, 2015 Ford F-150, 2013 Toyota Rav4, 2014 Mercedes F1 W05 Hybrid, 2014 Porsche 914 Hybrid, and 2014 Mitsubishi Mirage[21] (Dolanay & Oğuztürk, 2019).

Concept of Path Dependency

When David first introduced the concept of trail adherence in 1985, he brought the concept to the agenda with its technological developments, but later the concept could be applied in other fields. For example, Seda Unsar, in her study titled "A Path-Dependent Analysis of the Ottoman Empire and Its Influence on the Foundation of the Turkish Republic", examined the collapse of the Ottoman Empire and the establishment of the Republic of Turkey in terms of its political, sociological and administrative aspects, within the framework of the concept of adherence to the path. In this study, the historical development in the automotive industry will be examined with its sociological and technological aspects within the framework of the concept of path adherence (Dolanay & Oğuztürk, 2019).

According to David (2001), we find that many intriguing empirical problems cannot be solved simply by analytical tools applicable to every situation. For the solution, alternative analytical, statistical and even econometric analyses that take into account the historical development of the numbers are needed. However, events that took place in history may have much more value in the formation of today than the value given to historical development in these analyses. Based on the fact that the technological and economic development did not occur as expected today, it can be thought that one or a few historical events in the past may have led to path dependency (cited by Dolanay & Oğuzturk, 2018, p. 105; David, 2001).

[18] https://www.hotcars.com.
[19] https://www.kbb.com.
[20] https://gearpatrol.com.
[21] https://www.caranddriver.com.

Path dependence is the approach stating that the choices made in certain periods of history put the person, company or country on one of many possible paths, and that the choice made creates a lock on a certain technology level, and that all future structures are shaped around this technology axis. While examining today's events and phenomena, it is necessary to look at the details by going back to the past. Because after a choice is made, the structure shaped on it reaches an enormous size; it becomes difficult to return and its cost increases[22] (Dolanay & Oğuztürk, 2018, p. 105; Dolanay & Oğuztürk, 2019).

It is seen that the concept of trail adherence can explain many problematic issues today. However, in this study, the Turkish automotive industry is discussed. For this reason, it is necessary to examine the history of the automotive industry (Dolanay & Oğuztürk, 2019).

Developments in the Turkish Automotive Industry Between 1923 and 1960

Although the Turkish automotive industry was formed and started to develop from a very early date, we see that today's technology development capability has not been gained yet (Dolanay & Oğuztürk, 2019).

Developments in our country at the end of the 18th century, which was the establishment and expansion period of the world automotive industry, caused the late structuring of this industry. The meeting of Turkish people with automobiles coincides with the last period of the Ottoman Empire. Therefore, the declaration of the Constitutional Monarchy in 1876, which constituted the breaking point of this period, was planned by preparing an independent industrial organization of Anatolia, and by preparing seaway, railway and road maps aimed at structuring the city-town-village transportation in the country. Considering the geographical spread of the Ottomans in three continents in this period, it can be concluded that these similar plans or studies included the fiction of a large part of the world transportation network. At the end of the 18th century, the Ottoman Empire showed an industrial development on the spread of rail and seaways rather than highways in the transportation of these vast lands. During this period, the production of horse carriages, which were considered as personal transportation vehicles, was carried out by small enterprises producing furniture, textiles and metal products in Bursa, Istanbul, Konya, Kayseri and similar industrial zones. These small enterprises, which were divided into specialties within themselves, carried out the different parts and assembly stages of the horse carriages or sea and land vehicles to be produced, with the guidance of the guild organizations. Therefore, motor vehicles, tram wagons, boats and ships, omnibuses, phaetons and railway wagons in the last period of the Ottoman Empire were produced by small businesses in these regions (Paker et al., 2018; Küçükerman, 1999; Bedir, 2002).

When the Republic was founded, the incentive for industry law of 1913 was still in effect. However, those who participated in the Izmir Economy Congress convened in 1923 suggested a more comprehensive program to encourage the industry. In the report prepared by the industrialists, the state was insistently requested to provide the necessary conditions for the establishment of large-scale industry in order for Turkey to walk on the path of progress, and the principle of undertaking by the state was adopted in some jobs that private investors could not do. In the report, which was approved upon the completion of the congress, the government was asked to amend the 1913 law in line with the needs of the industrialists. The proposed amendments in the law were that the privileges granted by the law were applied to foreign companies, the industrialists decided which raw materials would be freely imported, and the government preferred domestically produced goods to foreign goods, even if they were 20% more expensive than imported goods. However, the new law, which envisaged changes in the law

[22] https://eksisozluk.com.

of 1913, was passed by the Parliament in May 1927. The new law brought about tax exemption, land donation, duty-free import permit of investment goods, reduction in transportation fees, and government agencies' preference for the products of the promoted company even if there is a price difference of up to 10%. The law also details the workplaces that can benefit from the privileges granted (Keyder, 1993, p. 77; Dolanay & Oğuztürk, 2019).

Within the framework of the principle of rapid industrialization taken at the 1st Izmir Economics Congress, an automobile assembly facility was established by Ford Motor Company in Istanbul in 1929 with great incentives provided by the state, and the facility had both production and export targets for the domestic market. However, with this initiative, the Istanbul facility continued production for a short time, then stopped production and ceased operations (Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 227-251; Dolanay & Oğuztürk, 2019).

Although there was some foreign direct investment in the period between 1920 and 1930, about one-third of these were in the services sector, while the remaining two-thirds were in the mining and manufacturing industry. While these investments were made in partnership with domestic capital, the Istanbul automobile factory, which was established as a unit of multinational companies, obtained free zone rights and started production in 1929. The factory had the production capacity to assemble 80 cars per day and acted as a distribution center for the ports in the Black Sea and the northeast. The factory was planned to assemble both automobiles and tractors, but when the world economic depression broke out, the factory ceased to operate. In addition, in these years, *The Economist* magazine reported that the Baladour automobile agency and repair station in Izmir could not assemble the cars fast enough. From here, it will be possible to deduce that automobile assembly was carried out in an automobile workshop in Izmir (Keyder, 1993, pp. 80-84; Dolanay & Oğuztürk, 2019).

After the facility established by Ford company in Istanbul, production facilities were established in different automotive products fields through license agreement (Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 227-251; Dolanay & Oğuztürk, 2019).

Developments in the Turkish Automotive Industry Between 1960 and 1980

By the 1960s, while the production of different motor vehicles in the automotive industry could be carried out by assembly, the automobile production facility had not been established yet. However, in 1961, Turkey's first domestic automobile prototype could be manufactured in a short period of four months. Although the project was successful, mass production could not be started (Şimşek, 2006; Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 251-275; Dolanay & Oğuztürk, 2019).

In many respects, the Devrim car prototype was criticized, and it was said that the prototypes produced did not look aesthetic, and that the machinery and equipment required for automobile production were not found in the facility where the production was made (Dolanay & Oğuztürk, 2018; Şimşek, 2006). In short, an obstacle emerged in order not to start mass production of Devrim cars and mass production could not be started by overcoming this obstacle. Therefore, the adherence to the path could not be broken and automotive industry production continued through technology transfer and assembly (Dolanay & Oğuztürk, 2019).

With the Assembly Industry Instruction published in 1963, in a sense, import substitution industrialization strategy and industry incentive policies of the development model were established. With this arrangement, the aim was to produce similar parts of imported automotive products under local conditions. We can say that with

the non-selective incentive system, the way to produce poor-quality copies of foreign products has been opened (Azcanlı, 1995; Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 251-275; Dolanay & Oğuztürk, 2019).

In 1967, the production of the Anadol automobile, which can be considered Turkey's second domestic automobile, started. The body of Anadol, which can be said to have been produced through the multi-technology transfer, was composed of an unusual fiber glass material. Production of Anadol continued until the 1980s (Demirer & Aydoğan, 2008; Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 251-275; Dolanay & Oğuztürk, 2019).

Since the export of Anadol was not considered and production could not be started with a sheet metal body instead of fiber glass material, the production in the project could come to an end. We can say that the competition of Renault and TOFAŞ cars which were established with a license agreement in 1971, was added to the mistakes we mentioned above, and this was one of the factors that prepared the end of Anadol (Dolanay & Oğuztürk, 2018; Dolanay & Oğuztürk, 2019).

With the commercial failure of Anadol, the hopes for developing technology were once again extinguished, the chance to switch to the path of technology development by producing domestic automobiles was once again missed, and its commitment to the path could not be broken. Commitment to the path of sustaining automotive industry production through assembly based on technology transfer continued (Dolanay & Oğuztürk, 2019).

In 1971, Renault automobile production facility in France was established by OYAK with a license agreement, and Fiat brand automobile production facility in Italy was established by TOFAŞ (Azcanlı, 1995; Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 276-283; Dolanay & Oğuztürk, 2019).

With the newly established factories, the production volume of the automotive industry has increased. The increase in the production volume was largely due to the newly established automobile production facility, but "automobile production is a luxury for Turkey, it is necessary to focus on truck production" was given by the DPT (State Planning Organization) to prevent mass production of the Devrim automobile prototype, which was successfully manufactured in 1961. It can be said that the report containing the result as follows was not done (Şimşek, 2006; Dolanay & Oğuztürk, 2019).

As the automotive industry production started to decline in the second half of the 1970s, we can say that the import substitution industrialization strategy prepared the formation of a major economic crisis at the end of the 1970s due to the foreign exchange bottleneck (Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 276-283; Dolanay & Oğuztürk, 2019).

With the economic stability program announced on January 24, 1980, we can say that the first foundations of a great economic transformation were laid, while the value of the Turkish lira was lowered against foreign currencies with the large-scale devaluation made to ensure stability in the economy. Because, while emphasizing the necessity of exporting for the first time, it has been understood that it is possible to switch to an export-based growth model at the same time (Azcanlı, 1995; Dolanay, 2017; Dolanay & Oğuztürk, 2018, pp. 284-301; Dolanay & Oğuztürk, 2019).

Developments in the Turkish Automotive Industry Between 1980 and 2000

As an industrial policy preference, the export-based growth model started to be implemented after 1983, and accordingly, a change was made in the incentive system and export incentives came to the fore (Dolanay & Oğuztürk, 2018, pp. 284-301; Dolanay & Oğuztürk, 2019).

The Manufacturing Industry Regulation, which was adopted in 1984, highlighted the quality development, unlike the Assembly Industry Instruction (Azcanlı, 1995). In a sense, it was determined that the automotive industry, which had developed with the technology imported from abroad until that time, should ensure technological development, and in addition, the necessity of technological development was emphasized at the national level with the first Science and Technology Report published in 1983 (Dolanay & Oğuztürk, 2018, pp. 284-301; Dolanay & Oğuztürk, 2019).

With the liberalization practice in the economy that started in 1983, foreign trade started to be liberalized, the protective customs tariffs that protect the automotive industry from foreign competition were also abolished, but a fund application was introduced because the automotive industry was not yet ready to open up to foreign competition (Dolanay & Oğuztürk, 2018, pp. 284-301; Dolanay & Oğuztürk, 2019).

Turkey became a member of the World Trade Organization (WTO) in 1994 and a Customs Union (CU) agreement was signed between the European Union (EU) and Turkey in 1996. Thus, in line with the agreements, direct monetary incentives were abolished and state aids for exports came into effect in a way that would not contradict international commitments[23] (Dolanay & Oğuztürk, 2019).

The 1990s were the years when reports and books on science and technology increased, and institutions for technology development were established. The second Science and Technology Report was published in 1993 and after the establishment of TÜBİTAK (Turkish Scientific and Technical Research Council) in 1963, institutions such as TUBA (Turkish Academy of Sciences) and TTGV (Turkish Technology Development Foundation) were established in the 1990s. However, despite these efforts to create a national innovation system, the approach of ensuring development in the automotive industry by acquiring technology from abroad continued (Dolanay & Oğuztürk, 2018; Göker, 2013; Dolanay & Oğuztürk, 2019).

Post 2000 Process at Turkish Automotive Industry

In the 2000s, the trend of the 1990s continued and the national innovation system gained a more developed institutional structure, and the laws forming the legal framework of the national innovation system were published (Dolanay & Oğuztürk, 2018, pp. 310-333, 368-385; Dolanay & Oğuztürk, 2019).

Despite the vitality and development brought by three automobile production facilities opened in the 1990s in the automotive industry, a new automobile production facility was not established in the 2000s, and Hyundai's request to establish the second factory in Turkey in 2006 was rejected when the desired incentives could not be given[24] (Dolanay & Oğuztürk, 2018, pp. 310-333, 368-385; Dolanay & Oğuztürk, 2019).

After this investment opportunity missed in 2006, domestic automobile production was focused on in the 2010s, and it was announced that the domestic automobile prototype was manufactured in 2015. However, after the reactions from the public, the domestic automobile production business was tendered. Turkey's Automobile Enterprise Group, which won the tender, announced that the first prototype will be manufactured in 2020 and mass production can be started in 2022[25] (Dolanay & Oğuztürk, 2019).

However, the fact that the year 2022 was determined for the transition to mass production after the first domestic automobile prototype emerged in 2015 has shown how difficult it is to break the adherence to the path in this area. Moreover, this situation led the government to make an agreement with Volkswagen to establish an

[23] http://iibfdergisi.ksu.edu.tr/tr/.
[24] https://www.hurriyet.com.tr/.
[25] https://www.togg.com.tr; https://www.haberturk.com.

automobile factory in Turkey, and we can say that the government was caught between producing domestic automobiles by developing its own technology and providing the necessary incentives for foreign automobile brands to establish factories in Turkey (Dolanay & Oğuztürk, 2019).

This dilemma of the government, on the other hand, reminded the dilemma of stopping the transfer of information and technology in the Ottoman period and turning to introversion and starting the transfer of knowledge and technology again and trying to develop its own technology. The Ottoman Empire, firstly, executed a scientist such as Molla Lütfi, who tried to contribute to the production of local knowledge by benefiting from foreign scientific developments, and then, when scientists with the same talents did not grow, they brought scientists from advanced countries and tried to establish the institutions of advanced countries in their countries (Uludoğan, 2015, pp. 3-5; Ültanır, 2017; İhsanoğlu, 1992; Müller-Wiener, 1992; Dolanay & Oğuztürk, 2019).

The Historical Origins of Path Dependency

There are many features that distinguish social phenomena from natural phenomena which are available. The main ones can be summarized as follows (Erol, 2002, p. 9):

(1) Social phenomena, as a result of organization between parts. Since they are formed, the relationships between the parts are discrete and follow the law of probability. Therefore, social events are irreversible, that is, irreversible are events. This situation shows that determinism is not valid in social events. In other words, even if a result is reached for a reason, the same result cannot be reached from the same result by reversing the event. For example, industrialization creates its own unique worldview and way of life. However, an agricultural society cannot be industrialized by adopting this worldview and way of life peculiar to industrial societies. Or, the consumption habits of a group or society can be changed by increasing incomes. However, this situation cannot be reversed. In other words, an increase in income cannot be achieved by changing consumption habits. This feature of social phenomena is reflected in bureaucracy-driven changes. It also explains the reason for the failure (Erol, 2002, pp. 9-10).

However, reversible events in biological systems are available. For example, a living organism (say, a human). When body temperature is increased by external influence, metabolism accelerates and heart rate increases. This cause-effect relationship can also be reversed. In other words, when the metabolism is slowed down and the heart rate is reduced, body temperature decreases (Erol, 2002, p. 10).

(2) Waiting for every social demand, directing people in certain directions leads to behavior. However, if this orientation does not turn into useful work, social tension increases. Every social phenomenon has to convert a certain amount of social energy into useful work in order to maintain its existence. Therefore, there is a relationship between social expectations and the amount of energy that cannot be converted into work. Social tensions arise when the amount of energy that cannot be converted into work due to the lack of appropriate social mechanisms increases. The most important reason for the revolution and social turmoil is the inability of the social system to respond to the increasing expectations. As a matter of fact, Maslow writes that during the Second World War, the prisoners in German collection containers were left half-starved and their expectations were kept at a low level (Erol, 2002, p. 10).

(3) Any sub-system, whether in the economic or managerial field, unless it can provide additional energy (a new idea, technology, capital, etc.) begins to repeat itself. This means that the system is in dynamic equilibrium. Systems in dynamic equilibrium have a much slower and weaker reflex to changes in the environment. For this

reason, Habermas thinks that "communicative action (interaction) rather than purpose-rational action is effective and decisive in modern societies and its spheres" (Habermas, 2002, p. 98; Erol, 2002, p. 11).

Since the last period of the Ottoman Empire and the Republic of Turkey, there has been continuous technology transfer and the country's technology level has been tried to be increased (Murphy, 1992; İhsanoğlu, 1992; Dolanay & Oğuztürk, 2018). When we look at the automotive industry specifically, it has been seen that automobiles could be imported, albeit limited, in the last period of the Ottoman Empire (Dolanay & Oğuztürk, 2018). This is technology transfer, albeit at a limited level. This shows that technology transfer has been made, albeit at a limited level. Technology transfer continued after the establishment of the Republic of Turkey. However, despite all the efforts made with technology transfers, the success of technology development could not be achieved (Dolanay & Oğuztürk, 2019).

As it is known, the emergence of technological developments and innovations depends on the existence of sufficient knowledge. It is very important to obtain information specific to the country and company (Coombs & Hull, 1998; Dolanay & Oğuztürk, 2019).

When information is received from abroad and transferred to students through educational institutions in the country, we can say that information transfer is made. We can say that this transfer was made by the mudarris in the Ottoman Empire (Dolanay & Oğuztürk, 2019).

In the Ottoman system, educational institutions are basically consisted of Subyan Schools, Madrasahs and Enderun School. Madrasahs also differed according to the subjects they taught (Cihan, 2014, pp. 27-132; Dolanay & Oğuztürk, 2019).

The first madrasah in the Ottoman Empire was established by Orhan Gazi in 1331 in Iznik and the famous ulema Davud-ı Kayseri was brought as a professor (Cihan, 2014, p. 39; Dolanay & Oğuztürk, 2019). After this first transfer of knowledge, we can say that the madrasah system developed in the Ottoman Empire, and professors who were able to transfer knowledge with the ability to adapt to their own systems began to grow (Dolanay & Oğuztürk, 2019).

After the first madrasah was established in Iznik, many madrasahs were established in Bursa and Edirne, and professors were brought from cities such as Konya, Kayseri and Aksaray, as well as from places such as Turkistan, Iran, Syria and Egypt (Cihan, 2014, pp. 39-40; Dolanay & Oğuztürk, 2019).

Perhaps the most important of the incoming professors was Ali Kuşçu, the famous mathematician and astronomy ulema who came during the reign of Mehmed the Conqueror. Molla Lütfi, who was one of Ali Kuşçu's students, increased his knowledge in mathematics and astronomy with the information he received from him (Pala, 2019; Dolanay & Oğuztürk, 2019).

Then, in the 16th century, Hezarfen Ahmed Çelebi, who made the first glider flight in the world in 1632, was exiled and removed from the scientific circle of the time, and Lagari Hasan Çelebi, who had shown the success of vertical flight for the first time in the world with a kind of missile, was exiled, thus leading to the emergence of further inventions. Let's say it's blocked (Dolanay & Oğuztürk, 2018, p. 377; Dolanay & Oğuztürk, 2019).

Another event that took place in the Ottoman Empire is that the observatory of the famous astronomy and mathematics scholar Takiyuddin Efendi, which was established by the order of the Sultan, was destroyed by the order of the Sultan (Dolanay & Oğuztürk, 2019).

In the 19th century, positive sciences were taught in the Süleymaniye Complex and there was also a Darülhendese (geometry school). We can say that at the end of the century, together with other positive sciences, geometry and arithmetic education in madrasahs was terminated and thus the knowledge accumulated in these

institutions was lost. A comet was observed in 1577 with the observatory established by Takiyuddin Efendi in 1575 by the order of the Sultan in 1578, and then a plague epidemic began in 1578. When it was stated that observing was an arrogance to learn the secrets of Allah, the order for the destruction of the observatory was given by Sultan Murad III. In the book *Ceridet el-Dürer ve Haridet el-Fiker* (*The Pearl of Pearls and Opinions*), which Takiyuddin Efendi completed in Istanbul in 1584, invaluable trigonometry tables and geometry information were found. It is thought that the destruction of Takiyuddin Efendi's observatory by Sultan Murad III also had an effect on the interruption of the use of trigonometry and geometry in the Ottoman Empire after the 16th century (Özilgen, 2009, pp. 37-38; Kongar, 2016, pp. 62-65; Dolanay & Oğuztürk, 2018; Dolanay & Oğuztürk, 2019).

The fact that the transfer of knowledge and technology, which was thought to have been interrupted by the events we discussed above, and the knowledge that was thought to have disappeared, was actually very important, was only half understood after the defeats in the wars and at a time when the Western world started to switch from knowledge transfer to knowledge production and from technology transfer to technology development. The Ottoman Empire again opened its doors to information transfer, but limited the transfer of information to the military field (İhsanoğlu, 1992; İhsanoğlu, 2003; Özilgen, 2009; Dolanay & Oğuztürk, 2019).

We can say that this delay delayed the transition to knowledge production, and even events in the past prevented the production of knowledge and led to path dependency (Dolanay & Oğuztürk, 2018; Dolanay & Oğuztürk, 2019).

A domestic automobile prototype launched by TOGG (Turkey's Automobile Initiative Group) on December 27, 2019 has been added to the attempt to produce domestic automobiles (Dolanay & Oğuztürk, 2018), which failed despite efforts made twice in the past[26] (Dolanay & Oğuztürk, 2018; Dolanay & Oğuztürk, 2019).

We can say that whether the project will be successful will depend on its ability to go into mass production and market its products. However, it is clear that turning to electric vehicle production instead of hybrid vehicles in the project, not producing in the smart factory, starting the prototype production too late in the project, and a commercial success that can be achieved can make these deficiencies invisible (Dolanay & Oğuztürk, 2019).

General Evaluation

It is sufficient to look at the automotive industry production figures of the last decade in order to determine whether there is a path dependency in the Turkey automotive industry (Dolanay, 2021, p. 83).

According to David (2000), if there is a path dependency somewhere, the numbers do not show an ergodic change from year to year. We can say that ergodic change figures show a continuous linear increase from year to year and sectoral figures are high for one or two years and then decline for one or two years[27] (Dolanay, 2021, p. 83).

In the period between 2010 and 2020, Turkey automotive industry's total production was as follows: There were 1,094,557 in 2010, 1,189,131 in 2011, 1,072,978 in 2012, 1,125,534 in 2013, 1,170,445 in 2014, 1,368,796 in 2015, 1,485,927 in 2016, 1,695,731 in 2017, 1,550,150 in 2018, 1,461,244 in 2019, and 1,297,878 in 2020.

Although there has been an increase in numbers for several years in a 10-year period, for example, a decrease is observed in total production values in 2012, compared to 2011, and in 2018 compared to 2017.

[26] https://www.togg.com.tr.
[27] https://qastack.info.tr/signals/1167/what-is-the-distinction-between-ergodic-and-stationary.

Again, a decrease was observed in 2020 compared to 2019. It can be said that there may be an increase in production values with the transition of TOGG to mass production in 2022.

As can be clearly seen, there has not been an ergodic increase in the figures from year to year, as David (2000) stated, in the 10-year period, which has shown the existence of path dependency in the automotive industry.

Total production figure of 2012 is lower compared to 2010 and 2011. The total production figures increased in 2013, 2014, 2015, 2016, and 2017; there was a decrease in 2018 compared to 2017, a decrease in 2019 compared to 2018, and a decrease in 2020 compared to 2019. Turkey's automotive industry total production figures did not show any change on an annual basis in ergodic decade. This is a clear indication that Turkey has become a path dependence in the automotive industry. Since 2011, there has been an effort to produce domestic electric cars in order to get rid of the path loyalty and create a new path in the automotive industry (Şimşek, 2020). The process that has taken place since 2011 has shown how difficult it is to get rid of the path dependency and create a new path (Dolanay, 2021, p. 83).

In the automotive industry, first of all, it should be decided whether a path-dependent development line will be continued or a new path will be created by concentrating on breaking the path.

If a path following is to be followed, the foreign investment incentive system should be established accordingly. Concentrating on breaking the path dependency is a more costly and difficult process. We can say that it requires the change of socio-cultural structure and active learning (Dolanay, 2022; Dolanay & Oğuztürk, 2018; Viotti, 2002).

However, when technology development ability (social ability) is gained, it will be possible to create a new path both by developing technology and transferring technology (Dolanay, 2022).

It is understood that the Turkish automotive industry tried to continue its development by following the technology development path of the USA automotive industry before 2000, but after the year 2000, South Korea tried to adapt its technology development path, which is even a leapfrog. Because, just as South Korea skipped the carburetor vehicle phase by switching to injectable domestic automobile production instead of producing domestic carbureted automobiles in the 1980s, Turkey skipped the gasoline domestic automobile production phase and turned to producing electric domestic automobiles. However, while South Korea has entered into this effort after gaining technological ability through methods such as reverse engineering and effective learning, we can say that this situation is not enough for Turkey (Dolanay & Oğuztürk, 2018).

Conclusions

Turkey has tried to establish a unique automotive industry since the 1960s, but it has not been able to create a unique path and has agreed to a path-dependent development. This path, on the other hand, could involve transferring technology from abroad and adapting it to the conditions of its own country. With the point reached by following the same path followed by the countries that have completed their economic development before, a competitive brand has not emerged in the world, and an innovative company has not been formed yet.

Let's hope that a domestic automobile competitive brand, launched on December 27, 2019, can become Turkey's first innovative company at TOGG, which created it.

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