The Auto Industry and Its Pioneers in the U. S. and Japan

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Henry Ford and Ford Motor Company

Henry Ford was the greatest pioneer of mass production. Ford was born in 1863 on a farm near Detroit, Michigan, and he was very interested in tools and machines. He went to Detroit when he was 16, and spent several years developing his mechanical skills by working for different machinery companies and by repairing watches and clocks in the evenings. By 1900, Detroit had become the center of the American auto industry because many good mechanics lived there.

In 1891, Ford was hired as an engineer by one of Thomas Edison's companies. Two years later he became the chief engineer. As chief engineer, he earned enough money to pursue his hobby, designing engines and cars. Edison encouraged him to keep trying. Ford built his first car in 1896. Made from simple objects like bicycle wheels, the car could go only 20 miles an hour. Ford then built a more advanced car, and in 1899 he persuaded some Detroit businessmen to invest in a new company. However, the company soon went bankrupt.

At the turn of the century, few people could afford to own cars but many people were excited about car races. Car makers raced cars to show that their machines were fast and durable. Ford also began to race cars in order to get publicity. In 1901, Ford raced Alexander Winton, the most famous driver in the US. Ford drove a car that he had built himself. Winton was a much better driver, but Ford's car was better, and he won the race. In 1902, Ford built a racing car that set the US speed record. The publicity helped Ford to recruit mechanics to work for him, and to persuade businessmen to invest in a new company.

Ford organized a new company in 1903, and recruited many of the best mechanics in Detroit. Most of the money was provided by a Detroit businessman, Alexander Malcolmson. However, Ford and Malcolmson disagreed about the company's strategy. Ford wanted to produce a simple, inexpensive car for ordinary consumers, but Malcolmson wanted to produce an expensive car. At that time, most people believed that only expensive cars made for wealthy people could make money. Since they could not agree, Malcolmson sold his shares to Ford, who became the majority stockholder and company president in 1906. He renamed the company Ford Motor Company.

Ford built only one car, the Model T, so that it could emphasize economies of scale (building as many Model Ts as possible in order to lower the unit price). The Model T, which appeared in 1908, was the first car to combine low cost with high quality. The car cost only $825 (the prices shown in

the table are a little higher). 10,000 Model Ts were sold in the first year. In 1914, Ford Motor built 300,000 Model Ts, and in 1923 more than 2 million. Ford held 60 percent of the American market in the early 1920s, and about half the world market. By 1924, the Model T cost only $290. The real price had dropped about 60 percent.

Table 1 Prices of the Model T Touring Car and Sales of all Model Ts, 1908-1916

Calendar year	Touring car Retail price	Unit sales
1908	$ 850	5,986
1909	950	12,292
1910	780	19,293
1911	690	40,402
1912	600	78,611
1913	550	182,809
1914	490	260,720
1915	440	355,276
1916	360	577,036

The Model T was popular because Ford understood the needs of American consumers, especially farmers. First, the car was inexpensive so average people could afford it. Second, it was sturdy. In the early 1900s, almost all of the roads in the US were dirt roads. Most expensive cars could only drive on paved roads, but the Model T could be driven on either dirt or paved roads. Finally, it was easy to fix. Since Ford had been raised on a farm, he understood that farm families wanted to be able to travel but needed cars that were inexpensive, sturdy, and easy to repair.

In order to make production more efficient, Ford and his mechanics designed many new machines and improved the standardization of parts. Ford introduced the world's first moving assembly line in 1913. The productivity of the workers increased greatly because they did not have to move and because the line forced them to work fast. Before the company set up the assembly line, it took 13 hours to assemble a car. The assembly line made it possible to assemble a car in two and a half hours. The combination of standardization and large volume made it possible to steadily reduce the price of the car. In order to increase sales, Ford Motor also developed a national advertising campaign and a network of sales offices and repairmen to service the cars.

Although the new production system was efficient, it caused labor problems. Workers hated the assembly line because the fast pace of work exhausted them, and they often quit. In 1913, when production was automated, the turnover rate was 380 percent. In 1914, Henry Ford decided to increase the workers' daily wage from $2.34 for a 9-hour workday to $5 for an 8-hour workday. The *Wall Street Journal* called the high wage an economic crime. However, most of the world praised the high wage as a great innovation in business practice.

By 1920, Ford was an international hero. Fordism became a common word (in the late 1920s, it was replaced by the term mass production). Many companies tried to use assembly line methods to

build their products. Some Americans asked Ford to run for president. Some Russians named their babies after him. Lenin and Hitler admired him.

Ford wanted to invest all of the company's profits, so he often argued with stockholders who wanted higher dividends. In 1919, Ford solved the problem by buying all the shares. He then built the Rouge, the first integrated production plant in the world. At its peak, 75,000 men worked at the Rouge. 5,000 of them were cleaners. In order to improve efficiency, the Rouge included its own steel and glass factories. In addition, the Rouge was built on the shore of the Great Lakes so ships could bring iron ore directly to the factories. The Rouge could turn raw materials into completed cars in just four days.

Although Henry Ford was a great engineer, he was a bad manager. The Rouge was a mistake because it was designed only to produce the Model T. The Model T was obsolete by 1928, so Ford had to redesign the Rouge. That was very difficult and expensive. Ford Motor lost much of its market share to General Motors in the 1930s because of Ford's poor management. Nevertheless, Ford's innovations in production started the age of mass production.

Alfred P. Sloan and General Motors

Henry Ford was a great pioneer in organizing production, but he was not a good manager. Alfred P. Sloan, who reorganized General Motors, was one of the greatest pioneers of modern management.

General Motors was founded in 1908 by William Durant. Unlike Ford, who believed that one product, the Model T, was perfect for all consumers, Durant believed that the automobile would change, so he acquired many different auto companies in order to have access to many ideas and technologies. He also acquired a number of suppliers, such as Delco. Both Ford and Durant understood that vertical integration of parts makers and assemblers could help companies to achieve economies of scale. But while Ford built Ford Motor through internal expansion, Durant used mergers and acquisitions to build GM.

Durant was a better creator than a manager. While he was president, General Motors was really a group of independent firms with no common purpose. The parts of the company were not coordinated. Many models competed against each other. In 1920, Pierre du Pont, the main stockholder, forced Durant to quit and made Alfred P. Sloan the new president. Sloan had studied electrical engineering at MIT.

The automobile world changed greatly from the 1910s to the 1920s. The industry became more oligopolistic. There were 274 auto firms in the U.S. in 1909, but only 20 by 1929. Although the number of firms declined, factory capacity more than tripled from 1.4 million units in 1921 to 4.4 million units in 1927. The market also changed. In the early years of the auto industry, most customers were first-time buyers. By the 1920s, many customers already owned a car, and they wanted new and improved models. There were also many used cars.

Henry Ford was too inflexible for the new market. He succeeded in creating the Model T because he ignored criticism, but he continued to ignore advice in the 1920s even though competing companies began to make better cars. Ford believed that the Model T would remain the industry

standard forever, so Ford Motor's only strategy was to compete on price. The River Rouge plant was an expensive mistake because it was designed to produce only Model Ts. By 1927, Ford was forced to admit that a new model was necessary. So Ford Motor converted the Rouge, but redesigned it to make only one car, the Model A.

In contrast to Ford, Sloan understood the importance of good organization. He became one of the main developers of the so-called M-form company, which tries to combine centralized control with decentralized responsibility. The central office makes general plans and coordinates the divisions. It uses economic forecasts to make plans. The forecasts consider business conditions, the company's market share, and other factors. Based on the forecasts, the central office then plans production, investment, and hiring. GM's divisions designed and built the cars according to the central office's general plan.

Sloan also developed a new marketing strategy based on market segmentation. Each division designed cars in different price ranges to appeal to different groups of consumers. Until the mid-1920s, most car companies depended primarily on one model (Ford, of course, depended totally on the Model T). Under Sloan, GM began to produce models in five main price areas. Chevrolets were for customers who wanted good low-priced cars. Oaklands (Pontiacs) were for the "poor but proud." Oldsmobiles were for the middle class, Buicks for people who wanted to spend more for a stylish car, and Cadillacs for rich people who wanted a luxury car.

In the early 1920s, the Model T dominated the low price car market. GM did not attempt to challenge Ford directly in the low-price car range. Instead, it designed the Chevrolet, its cheapest model, to attract customers looking for a low-priced car that was a little better than the Model T.

GM introduced the annual model change in 1923. The company changed styles a little every year to make the cars more appealing. Although the changes were small, the annual model change made production more difficult and greatly increased costs.

In addition, GM provided financing for both dealers and consumers. Most consumers bought their cars on credit in the 1920s. This made Ford's price advantage less important.

Ford largely ignored advertising, but GM became the largest advertiser in the auto industry, and one of the largest advertisers in the country, in the 1920s. In addition, GM began to conduct intensive market research to find out what consumers wanted. The research gathered information on styles, models, and colors that consumers wanted, and what prices they could afford. GM used the information when it designed cars.

GM's innovations allowed it to earn profits even during the Depression, and made it the most successful automobile manufacturer of the 20th century.

Yoshisuke Aikawa, Kiichiro Toyoda, and the Prewar Japanese Auto Industry

Yoshisuke Aikawa and Kiichiro Toyoda were the most important persons in the early development of the Japanese vehicle industry. Aikawa graduated from Tokyo University and then spent two years working for companies in the U.S. to learn about metalworking. Aikawa had good technical and organizational skills, and he used his connections to Inoue Kaoru, the Mitsui family,

and other political and business leaders to build the Nissan-Hitachi Group.

In the 1920s, Ford and General Motors dominated the Japanese car market. Ford established a subsidiary in Japan in 1925, and General Motors established one in 1927. The government asked the three richest zaibatsu, Mitsui, Mitsubishi, and Sumitomo, to start car companies, but they refused because they did not believe that they could make money. The reasons were that a large amount of capital was necessary, American competition was strong, and the domestic market was very small.

However, the army needed trucks for its campaigns in China, and the government wanted it to buy Japanese products. Therefore, the government established policies to encourage Japanese companies to build vehicles. It limited motor vehicle imports and restricted the activities of Japan Ford and Japan GM. It also gave tax breaks to Japanese car makers.

Aikawa used direct technology transfers to develop Nissan. He hired American engineers and bought an assembly line in the US. The first Nissan car was almost completely designed by an American engineer, William Gorham. Nissan made all of its parts in-house in order to improve quality and standardization. It also built subcontracted parts for Japan Ford and Japan General Motors in order to improve its technical capabilities. However, productivity was only about 2 vehicles per worker per year. Further, the company had to redesign its standard truck in 1939 because the first model broke down too often on dirt roads in Manchuria.

Kiichiro Toyoda established Toyota Motor Corporation in 1933. In contrast to Nissan, Toyota used indirect technology transfers to develop its production technology - Toyota engineers copied foreign cars and parts and learned to make them themselves. Instead of hiring foreign engineers, Toyota hired many of the best engineers in Japan. However, productivity was about the same as Nissan's (see table).

Table 2 Toyota production and industry share, 1935-45

Year	Trucks	Cars	Buses	Total	No. employees	Units emp.	Production shares(%)		
							Toyota	Nissan	Other
1935	20	0	0	20	–	–	0.4	74.7	24.9
1936	910	100	132	1,142	–	–	9.4	50.6	40.0
1937	3,023	577	413	4,013	3,000	1.3	22.2	56.5	21.2
1938	3,719	539	357	4,615	4,000	1.2	18.9	68.0	13.1
1939	10,913	107	961	11,981	5,200	2.3	34.7	51.5	13.8
1940	13,574	268	945	14,787	5,200	2.8	32.1	34.6	33.3
1941	14,331	208	72	14,611	5,200	2.8	31.4	42.3	26.3
1942	16,261	41	0	16,302	6,500	2.5	43.8	46.9	9.3
1943	9,774	53	0	9,827	7,500	1.3	38.0	41.6	20.4
1944	12,701	19	0	12,720	6,000	2.1	58.5	32.5	9.0
1945	3,275	0	0	3,275	4,000	0.8	48.7	29.8	21.5
Total	88,501	1,912	2,880	93,293					
%	94.8	2.0	3.1	100.0					

There was little demand for cars in prewar Japan, but the military bought all the trucks that the

companies could produce. As a result, Nissan and Toyota were almost always profitable until 1945. On the other hand, the military sometimes interfered in management. It also forced Nissan and Toyota to stop producing cars in 1939.

Taiichi Ohno, Shotaro Komiya, and Toyota's Postwar Advantage

Until 1945, Toyota and Nissan made mainly trucks. In addition, until the late 1950s, their cars were very simple - they were basically small trucks with car bodies fitted on. During the postwar era, Toyota and Nissan had to learn to make quality cars for consumers.

Economic conditions were difficult in the early postwar era. There were shortages of materials and capital. The unions were strong and did not allow the companies to fire excess workers. However, things soon got better. The unions weakened and the companies were able to reduce the number of workers after 1950. The Ministry of International Trade and Industry (MITI) set high tariffs to make it difficult for foreign companies to enter the market. MITI also helped the car companies to get large loans from banks. Further, since the American Occupation authorities did not allow Japan to have an aircraft industry, Toyota and Nissan were able to recruit top engineers. In the US, the best engineers went to aerospace and other defense-related industries, not to car companies.

Demand grew quickly after 1950. During the Korean War, the US Army ordered many trucks from Toyota and Nissan. After 1955, the domestic demand for cars grew very rapidly. Of all the industrialized countries in the postwar era, Japan has had the lowest rate of increase in population but the highest rate of increase in cars. Thanks to the high demand, Japanese car makers benefited from high capacity utilization.

Table 3 Capacity Utilization (%) in Japanese Manufacturing Industries, 1959-63

Industry	1959	1960	1961	1962	1963	1959-63
Automobiles	98	114	132	115	156	123
Iron and Steel	99	100	100	91	99	98
Rolling Stock	87	89	115	73	90	91
Radio Equipment	90	92	93	83	95	91
Cotton Textiles	94	97	92	71	79	87
Cement	86	87	88	85	74	83
Plate Glass	92	83	83	63	83	81
Rubber	132	160	188	104	120	141
Petroleum Rifining	93	95	73	83	89	86

Supplier networks helped Toyota and Nissan to gain a competitive advantage against Western car makers. Japanese and American auto companies used different forms of vertical integration. American firms made most of their own parts so that they could control supplies and prices. However, Toyota and Nissan managers preferred to build networks of subcontractors. They

bought parts cheaply from subcontractors, but they also helped them to raise quality by sending managers, loaning money, signing long-term contracts, and providing technical assistance. Toyota and Nissan reduced wage costs because the subcontractors used cheaper labor. By using subcontractors, they also reduced the costs of fixed investment in factories and equipment.

During the 1960s and 1970s, Toyota gained a competitive advantage against Nissan even though its basic technology was about the same. One way that Toyota gained a cost advantage was through its production system. The most important person in the development of Toyota's production system was Taiichi Ono. Ono visited the General Motors assembly plant in Nagoya and learned about mass production when he was a child. He was impressed by Ford's idea of "high productivity, high wages." Ono's main goal at Toyota was to eliminate waste, including wasted time. He designed the production system so that each worker did more than one job at the same time. In the 1950s, the average worker at Toyota operated five or ten machines instead of just one. Thus Toyota raised productivity by eliminating idle time.

Toyota gained another competitive advantage through its marketing system. Shotaro Kamiya, who was president of Toyota Motor Sales from 1950 to 1975, developed a sales network that was larger than Nissan's. He set prices lower than competitors' prices, even if the company lost money. Kamiya believed that low prices would increase sales, and therefore increase economies of scale. Thus, low prices would increase profits in the long run. Toyota Motor Sales also established driver education schools to increase the demand for cars.

Toyota Motor Sales also helped Toyota's product development. It conducted frequent customer surveys to find out what consumers wanted. The surveys gathered information on styles, models, and colors that customers wanted, and how much they could afford. Toyota used the information when it designed new cars. Kamiya helped decide new car prices. He first decided what price would outsell competitors and then left it up to production engineers to find ways to cut manufacturing costs. Thanks to Kamiya and Toyota Motor Sales, Toyota coordinated its market strategies and production strategies very effectively.

Various sources were used for Henry Ford and for General Motors, including Thomas K. McCraw and Richard S. Tedlow, "Henry Ford, Alfred Sloan, and the Three Phases of Marketing" in Thomas K. McCraw, ed., *Creating Modern Capitalism* (Harvard University Press, 1997). The sections on Toyota and Nissan were adapted from Michael A. Cusumano, *The Japanese Automobile Indutsry: Technology and Management at Nissan and Toyota* (Council on East Asian Studies, Harvard University, 1985).