# Case 11 Kiichiro Toyoda: From Breakthrough to Incremental Innovations


**Abstract** This chapter introduces Kiichiro Toyoda, the effective founder of Toyota Motor Corporation, who established the basis of the "Toyota Production System" with its Kanban method and Kaizen.

## "The Business History of the Toyoda Family's Spinning and Weaving Business" (Toyoda-ke Boshoku Jigyo no Keiei-shi) by Hiroaki Yamazaki

Kiichiro Toyoda, "the effective founder of Toyota Motor Corporation (formally, of its predecessor, Toyota Motor Co. Ltd),"[1] was born in 1894 (Meiji 27), the eldest son of Sakichi Toyoda, a leading Japanese inventor, in Yoshizu Village, Fuchi County (present-day Kosai City, Shizuoka Prefecture) on the western shore of Lake Hamana in Shizuoka Prefecture.

Hiroaki Yamazaki's book entitled "The Business History of the Toyoda Family's Spinning and Weaving Business: From Spinning and Weaving to Spinning and Weaving Machinery to Automobile" published by Bunshin-do in 2015, provides a detailed account of the Toyoda family business evolution since Sakichi. Following is a book review that I contributed to the "Weekly Economist."[2]

> Numerous books have been written about Sakichi Toyoda's success in inventing the automatic loom and becoming "Japan's loom king." Also, the process by which Sakichi's eldest son, Kiichiro, built on his father's business and boldly entered the automobile industry has recently been the subject of much research.

[1] Wada, K. (2004). "Toyoda Kiichiro" (Kiichiro Toyoda) in Business History Society of Japan eds with Yamazaki, Hiroaki ed. in chief, Nihon keieishi no kisochishiki (*Basic knowledge on Japanese business history*) (p. 290). Tokyo: Yuhikaku Publishing Co., Ltd.

[2] Kikkawa, T. (2015). Shohyo Yamazaki Hiroaki-cho Toyoda-ke boshokujigyo no keieishi, Boshoku kara boshokki soshite jidosha he (*Book review: The business history of the Toyoda family's spinning and weaving business—from spinning and weaving to spinning and weaving machinery to automobile by Hiroaki Yamazaki*). Shukan ekonomisuto (*The Weekly Economist*), 29 September.



T. Kikkawa, *History of Innovative Entrepreneurs in Japan*,
https://doi.org/10.1007/978-981-19-9454-8_17

> However, little has been done to examine how the Toyoda family amassed enormous wealth during the period, and what type of business development enabled it. Hiroaki Yamazaki's "The Business History of the Toyoda Family's Spinning and Weaving Business: From Spinning and Weaving to Spinning and Weaving Machinery to Automobile" (Bunshin-do, 2015) is a daring attempt to fill this gap.
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> The book begins with a careful and detailed estimation of the amount of income tax levied, using as clues the Shoko Shinyoroku [Commercial and Industrial Credit Record], Nihon Shinshiroku [Japan Gentlemen's Register], and other documents. It reveals that Sakichi Toyoda's annual income, which was 300 yen in 1901, rose to 3000 yen 10 years later when he established an automatic loom factory. After a surge during the boom years of World War I, it reached over 120,000 yen in 1928, just before his death in 1930 (Showa 5).
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> The author makes similar estimates for the incomes of Sakichi's immediate and extended family. He successfully recreates the process that led to the Toyoda Family's becoming one of the "three major zaibatsu of Chukyo [central Japan]" by showing dramatic changes in their annual incomes.
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> Although analysis using tax records has recently been attempted in books such as "Capital in the Twenty-First Century" by Thomas Piketty [Le Capital au XXIe siècle, originally published in French in 2013], I do not know of any other work that has examined the income trends of high-income earners in such a thorough manner and over such a long period of time, utilizing publicly available tax data. This book will remain in the annals of research history not only for its richness of content but also for the novelty of its methodology.
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> Yamazaki then goes on to detail the rapid growth of the Toyota Automatic Weaving Factory and the development of Toyota Boshoku, Toyota Boshoku Factory, and Toyota Automatic Loom Works [present-day Toyota Industries], that made it possible for the Toyoda family to increase its income. The writer reveals that the Toyota Boshoku Factory played a major role in the company's expansion into China, and that the dividends and executive compensation paid by the group of companies increased the income of the Toyoda family.
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> The book's final section focuses on the financial conditions that enabled Toyota Automatic Loom Works to enter the automobile industry. In the conclusion, Yamazaki points to three factors: 1) the support of Toyota Boshoku and the Toyota Boshoku Factory; 2) the backing of the Mitsui zaibatsu led by Mitsui Bank; and 3) the co-financing by large banks in line with the national policy.

Yamazaki's "The Business History of the Toyoda Family's Spinning and Weaving Business" tells how Kiichiro Toyoda's entrepreneurial activities, such as those demonstrated in his foray into the automobile industry, were closely intertwined with the Toyoda family's overall business.

## Sakichi, Risaburo, and Kiichiro Toyoda

The definitive biography of Kiichiro Toyoda is Kazuo Wada and Tsunehiko Yui's "A Biografy of Kiichiro Toyoda" (Toyota Motor Corporation, 2001) [English version title: Courage and Change - The Life of Kiichiro Toyoda, 2002]. The following is a review of Kiichiro's life, based on the biography.

Kiichiro attended Meirin Junior High School, a private school in Aichi Prefecture, and then the Second High School in Sendai before entering the Department of Mechanical Engineering at the Tokyo Imperial University Faculty of Engineering.

After graduation, he joined Toyota Boshoku in 1921 (Taisho 10). In the same year, he also became an auditor of the Toyota Boshoku Factory.

In 1909, while Kiichiro was a student at Meirin Junior High School, his father Sakichi applied for a patent for an "automatic shuttle-changing device" which would become the key component of automatic looms. This device "automatically replenishes the weft yarn through the push-up mechanism."[3]

Sakichi Toyoda established the Toyota Automatic Weaving Factory in 1911, and in 1914 (Taisho 3) with the construction of the spinning mill, he renamed it the Toyota Automatic Spinning and Weaving Factory. Then in 1918 he again reorganized the company and established Toyota Boshoku. Sakichi went on to build a spinning and weaving factory in Shanghai, establishing the Toyota Boshoku Factory there in 1921. After graduating from university, Kiichiro began working for these companies established by his father.

When assessing Kiichiro's entrepreneurial activities, it is clear that his relationship with his father Sakichi was significant. However, another person was greatly involved in Kiichiro's activities—Risaburo Toyoda who joined the Toyoda family in 1915 (Taisho 4) as the husband of Kiichiro's younger sister Aiko. When Kiichiro joined Toyota Boshoku, Risaburo was "effectively in charge of the company" [4] as executive managing director.

Tsunehiko Yui describes how Risaburo became Kiichiro's brother-in-law. In 1915, Kiichiro was a student at the Second High School.

> The marriage proposal for Aiko, then a student at a girls' school, came up rather abruptly. Around August of that year [1915] Sakichi Toyoda was visited by Risaburo, the younger brother of Ichizo Kodama, who had been the head of the cotton department at the Osaka branch of Mitsui & Co. and whom Sakichi trusted. At the time, Sakichi had witnessed a dramatic surge in textile exports. So when he met Risaburo who was already well versed in the textile trade and business, brimming with a proactive spirit, Sakichi came to harbor hopes that he would be his right-hand man and even his successor (one wonders whether Kiichiro, still a student at Second High School, was far from being considered successor material). Risaburo, still single, was also eager to have Aiko as his lifetime spouse, and this was when the prospect of marriage to Aiko suddenly became a reality. Aiko, a fourth-year student at Aichi Prefectural First Girls' School, was initially hesitant about the early marriage proposal, but Sakichi persuaded her, and eventually in October of the same year, Risaburo became his son-in-law and joined the Toyoda family. Thus, Risaburo, ten years older, became Kiichiro's brother-in-law. [5]

[3] Wada, K., Yui, T., & Toyota Motor Corporation's History and Culture Department (Eds.) (2001). Toyoda Kiichiro den (*A biography of Kiichiro Toyoda*) (p. 23). Toyota: Toyota Motor Corporation.

[4] *Ibid*., p. 84.

[5] *Ibid*., p. 50.

## Development of the Model G Automatic Loom

In 1921, shortly after joining Toyota Boshoku, Kiichiro Toyoda traveled to Europe and the United States with Risaburo and Aiko. According to Kazuo Wada, "this trip became a major turning point in Kiichiro Toyoda's life." [6]

During the trip, Kiichiro followed a separate itinerary from Risaburo and Aiko and spent several weeks as a factory intern at Platt Bros. & Co. in England, one of the world's leading textile machinery manufacturers at the time. Through this experience, "he deepened his understanding of textile machinery and saw that the high quality of Platt's machines was maintained by a careful finishing touch by humans (i.e., they did not use completely interchangeable parts), but he also had doubts about the management of the workers on the shop floor. He headed home with these thoughts in mind." [7]

After returning to Japan, Kiichiro became involved in designing textile machinery, focusing on the development of an automatic loom equipped with an automatic shuttle changing device. The device had been invented by his father. Kiichiro's efforts bore fruit in 1924 with the completion of the Toyota automatic loom (Model G) featuring nonstop automatic shuttle change, and in 1925 a patent for the invention was registered in Kiichiro Toyoda's name. In 1926, Toyota Automatic Loom Works [present-day Toyota Industries] was established, and Kiichiro became its managing director.

The patent rights for the Model G automatic loom were transferred to Platt in 1929 under the "Toyota-Platt Agreement." With this agreement, Toyota Automatic Loom's technical superiority over Platt gained global recognition. The Model G automatic loom was the culmination of Sakichi's many inventions, but it is undeniable that Kiichiro played an important role in its development. Then how did the rumor that Sakichi alone was responsible for its development take hold? Kazuo Wada, going back to the time of Sakichi's death in 1930, explains the circumstances as follows:

> Many people attended the funeral of Sakichi Toyoda, a world-famous inventor born in Japan. Many newspapers ran major features showcasing various episodes from Sakichi's life, and Sakichi was deified. Many of the episodes about Sakichi written later were based on the newspapers published during this period. In particular, the transfer of his patent rights to Platt Bros & Co. was widely reported as the definitive achievement of his later years. These episodes led to the belief by those lacking technological background that the Model G automatic loom was Sakichi's achievement. In the climate of glorifying Sakichi, similar episodes were repeated without deep consideration, and through repetition, they came to be perceived as facts . . . Even Kiichiro, who knew the truth, would not discuss it until close to his own death. [8]

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[6] *Op. cit.*, Wada, K. (2004), p. 290.

[7] *Ibid.*, p. 290.

[8] *Op. cit.*, Wada, K., & Yui, T. (2001), p. 275.

## Entry into Automobile Manufacturing

Kiichiro returned to Platt Bros. & Co. in England in 1929 (Showa 4) to sign the "Toyota-Platt Agreement," and there he saw firsthand that the textile-related industries were in dire straits. He began to look for alternatives to the textile industry and chose automobile manufacturing.

Kazuo Wada states that "the question of when Kiichiro Toyoda decided to enter the automobile business is the most important point in studying his life." "I would like to determine the timing by tracing Kiichiro's own actions closely," concluding: "The creation of the prototype engine [based on] Smith Motor was the first time Kiichiro gave concrete form to his future vision." This statement refers to Kiichiro's 1930 entry into the automobile business. Wada describes the Smith Motor as "a popular engine at the time, which could be attached to an ordinary two-wheeled or three-wheeled bicycle for transporting goods. Many were imported to Japan in the 1920s for use as a simple means of transportation."[9]

The cooperation of Risaburo Toyoda, then president of Toyota Automatic Loom Works, was crucial to Kiichiro's successful entry into automobile manufacturing. Kazuo Wada explains: "Risaburo Toyoda, who, like Kiichiro, had doubts about the future of the textile industry, cleverly suppressed the opposition of those around him, and Toyota Motor Corporation was born with the concerted financial support of the companies in the Toyota group." [10] Here is Wada's detailed explanation of that financial backing:

> From a financial standpoint, we must not forget the role played by Toyota Automatic Loom Works in the establishment of Toyota Motor. In addition, the roles played by Toyota Boshoku and Toyota Boshoku Factory must also not be forgotten. Toyota Automatic Loom Works had invested as much as approximately 17 million yen in the automobile manufacturing business, which grew out of its Automotive Department. One of the reasons Toyota Automatic Loom Works was able to make such a large investment was due in part to the abundant funds the company had generated from the manufacture and sale of Model G automatic looms and spinning machines. At the same time, however, Toyota Automatic Loom Works issued new shares three times, in January 1934, July 1935, and October 1936, and these were underwritten mainly by Toyota Boshoku and Toyota Boshoku Factory . . . Toyota Motor came into being only thanks to the combined financial support of the textile-related companies that Sakichi, Risaburo, Kiichiro, and others had built over the years . . . Each of the Toyota-affiliated companies took on the role of a venture capitalist, financially backing Kiichiro's efforts to create the new business. [11]

In 1933, ten prototype 60 cc motorcycle motors were built, and the Automotive Department was established within Toyota Automatic Loom Works. 1936 saw the start of production of AA passenger cars and GA trucks, leading to the establishment of Toyota Motor Corporation in 1937. Risaburo was appointed president of the company, and Kiichiro vice president. Kiichiro became president in 1941.

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[9] For discussion so far, see *Ibid*., pp. 272–273.

[10] *Op. cit*., Wada, K. (2004), p. 290.

[11] *Op. cit*., Wada, K., & Yui, T. (2001), pp. 347–348.

## Toyota's Labor Dispute and Kiichiro's Retirement

With the end of World War II, Kiichiro hoped to realize his long-held dream of manufacturing passenger cars in Japan. However, an unexpected predicament awaited him.

In the period immediately following the end of the war, the emphasis of the U.S. Occupation policy toward Japan was to "demilitarize" the country's economy, but as the Cold War intensified, the focus shifted to "economic reconstruction" [of Japan] from around 1947 (Showa 22). To promote Japan's rapid economic recovery, it was necessary to end rampant inflation, prevalent since the end of the war. This task was accomplished by Joseph M. Dodge, who arrived in Japan as a U.S. envoy in February 1949. The series of measures carried out by Dodge, such as balancing the national budget, reducing subsidies, and establishing a single exchange rate of 360 yen to the dollar, were referred to as the "Dodge Line."

Although the Dodge Line succeeded in curbing inflation, its deflationary effect triggered a serious recession. Dubbed the "Stability Depression," it created massive unemployment and provoked serious labor-management conflicts. In the aftermath of the Stability Depression, the "Toyota [Labor] Dispute" broke out at Toyota Motor when deteriorating automobile sales forced the company to lay off employees in order to restructure its operations. In April 1950, in response to the company's streamlining proposal, the labor union went on strike for 2 months, until the outbreak of the Korean War. Kiichiro, the founding president, took responsibility and resigned not only as president but also as a board director in June 1950—a surprise even to the leaders of the union. Kazuo Wada describes the events:

> In June 1950, Kiichiro resigned as president of Toyota Motor, ending the dispute. It came down to Kiichiro leaving the automobile business to which he had devoted his life and soul. The union leaders said they had never been as shocked as they were at the resignation of Kiichiro. Even to them, Kiichiro was an embodiment of Toyota Motor itself. The union, which had stood up to defend their members' livelihood, respected Kiichiro. Otherwise, his statue would not have been later erected in front of the corporate headquarters. [12]

The extraordinary procurement boom brought on by the Korean War that broke out in June 1950 ultimately saved the Japanese economy from the recession brought on by the Dodge Line. The Korean War also prompted the U.S. and Japan to sign a peace treaty. The San Francisco Peace Treaty of April 1952 ended the ongoing Allied occupation of Japan following World War II defeat. Many companies managed to free themselves from financial difficulty thanks to demand arising from the Korean War; Toyota Motor was no exception. The boom restored Toyota Motor and the company soon began its journey to becoming a global company.

In the March 11, 1951 issue of the Japanese business magazine *Diamond*, an article entitled "Toyota Motor Company's Business Turns Around" describes the changes in the company's performance before and after the Korean War as follows:

[12] *Ibid*., pp. 382–383.

> "The first half of last year was a difficult time for the company. It had to reduce the workforce and cut back on production. The general cash shortages had caused a sharp decline in automobile sales." The article went on to say: "However, after the incident, heavy demand came in [from abroad]. Domestic demand also returned gradually and sale prices soared. This was not long after the company had cut back its workforce. This time, the company encountered an almost dizzying business. It was a complete change of situation." The "incident" in the text refers to the Korean War.

Cited in this article, Toyota Motor's production value was 342.5 million yen in January 1950, falling to 114.85 million yen in May of the same year but recovering to 249.52 million yen in June when the Korean War began, and reaching 734.7 million yen in January 1951. On the other hand, the number of employees, 8227 in January 1950, had declined to 5599 in June when the war broke out, not turning upward even in January 1951, with 5486 employees. Thus, the company's per-employee production value had shrunk and then increased significantly—from 42,000 yen/person in January 1950, to 15,000 yen/person in May 1950, to 45,000 yen/person in June 1950, to 134,000 yen/person in January 1951. Toyota Motor was not the only company to emerge from a business crisis thanks to the special procurement boom from Korea. The experience was the same for many others in various industries. We must not forget that the "miraculous recovery" of the Japanese economy was due in large part to the special procurement boom triggered by the Korean War.

Ironically, soon after Kiichiro stepped down as president, Toyota Motor emerged from its financial crisis. Reflecting this comeback, it was "almost certain that he would return to Toyota Motor by the end of 1951." However, in the end, Kiichiro's return never materialized because "the physical and mental strain that had continued during and after the war, combined with his long-standing hypertension, took a toll on Kiichiro's health." [13] Kiichiro Toyoda passed away in March 1952. And, as if to follow him, Risaburo also died in June of the same year.

## The Toyota Production System

The so-called Toyota Production System (TPS) was the source of Toyota Motor's competitive strength as it embarked on the path to becoming a global company. In closing this case study, our attention turns to the Toyota Production System that saw its full-scale development after Kiichiro's death.

During the period of rapid economic growth, Japanese companies gradually began to emphasize high-mix, low-volume production, and eventually developed a production system distinct from their U.S. counterparts, who primarily pursued the benefits of mass production. A representative example was the Toyota Production System that replaced the Ford System, a mass production system based on workflows.

[13] *Ibid*., p. 384.

The fundamental goal of the Toyota Production System is to eliminate excessive intermediate inventory resulting from mass production. According to Taiichi Ōno, the creator of the Toyota Production System and vice president of Toyota Motor, the two pillars of the system are "Just-In-Time" and "Automation."[14] "Creation of flow" throughout the production process supports these foundational pillars.

"Just-In-Time" means ensuring that in the workflow process of assembling an automobile the necessary parts arrive on the production line as needed, when needed, and in the quantity needed.[15] To accomplish this, instead of the conventional "earlier processes supplying later processes [the push system]," one lets "later processes pick up necessary items from earlier processes when and as needed [the pull system]." The "kanban" [signboard], synonymous with the Toyota Production System, was devised as a means of linking different stages of production when implementing the "later process pick up" [i.e., pull], indicating what and how much is needed by later processes.

Meanwhile, "Automation" with a human touch ["jidoka" in TPS terminology] meant automation incorporating human discretion, and in terms of machines, it meant enabling workers to immediately halt production whenever an abnormality was detected. As a result of such automation, a single worker would be able to supervise multiple processes, allowing "multi-process handling," an important prerequisite for "creating flow" in production.

However, even if "multi-process handling" is accomplished in earlier stages, if there is a large variance in production in the final stage, earlier stages will necessitate extra people and equipment. Therefore, to "create flow" in the entire production process, the lot size of the final process must be kept as small as possible to ensure smooth production. To accomplish this, swift "setup changes," such as changing the mold in the press department, would be essential. While the average press setup time in Toyota Motor's main plant ranged from 2 to 3 hours in the early 1950s, this timing was shortened to 15 minutes in 1962, and to 3 minutes in 1971. By speeding up the time involved in "setup changes," Toyota Motor was able to smooth out the production process.

Toyota Motor began developing the Toyota Production System immediately after the end of the war. It partially introduced the "later process pick up" [the pull system] as early as 1948, and nearly perfected it in the early 1960s. It fully adopted "Kanban" in 1962 and established "multi-process handling" in 1963. After the oil crisis, the Toyota Production System spread to many Japanese companies, beyond the boundaries of one company (Toyota) and one industry (automobile). The spread of a production system able to produce a wide variety of products in small quantities at low cost contributed greatly to the competitiveness of Japanese products in the

[14] Description of the "Toyota production system" based on Ōno, T. (1978). Toyota seisan hoshiki: Datsukibo no keiei wo mezashite (*Toyota production system: Aiming for management without scale*). Tokyo: Diamond, Inc. See especially pp. 5–22; 229.

[15] Wada points out that Kiichiro Toyota conceived of "Just in Time" by 1938–1939. For this discussion, see *op. cit*., Wada, K., & Yui, T. (2001), pp. 352–353; 362–363.

global market. After a period of rapid growth, the global market was entering a period of low growth around that time.

The Toyota Production System spread around the world with "Kaizen" becoming a part of English vocabulary. The very meaning of the word "Kaizen," or improvement, epitomizes incremental innovations.

Kiichiro Toyoda's entrepreneurial activities, starting with the breakthrough innovation of the Model G automatic loom with his father Sakichi, were passed down in the form of the "Toyota Production System," a representative example of incremental innovation in postwar Japan.