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Introduction

The world's automobile industry was on the verge of significant change at the start of the twenty-first century. Automobile industries, typically in developed nations, accounted for 10 percent or more of each nation's gross national product (GNP), and the industry as a whole marked its 100th anniversary in 1985.[1] Over the years, the global automobile industry has experienced perpetual change.

Although the automobile was invented in Europe, mass production as the basis for mass marketing was developed and established in the United States. Everyone would agree that the Ford System of mass production was the influence behind the beginning of mass marketing. The Ford System, initiated by the emergence of the Ford Model T in 1908, was established by 1913. It later became the fundamental paradigm for production systems in the US automobile industry and was then transferred to advanced countries, including those in Europe, Japan, and other Asian nations, and adapted into its current state. In the US, mass production inherited from the Ford System was followed by a more marketing-oriented paradigm shift, from the simple mass production system limited to manufacturing a single model like the Model T to the full-line mass production system created by A. P. Sloan of GM, which responds better to a mature market. Some regard it as the "coexistence of Fordism and Sloanism."[2] The US automobile industry developed under these two paradigms. Europe, meanwhile, was influenced by the Ford style of mass production, yet maintained a tradition of craftsman-like automobile manufacturing to a certain extent, which today remains in the manufacture of luxury models and sports cars. While accepting Ford-style mass production, European automobile manufacturing mainly concentrated on compact vehicles with monocoque bodies.

In contrast to the mass production models that were developed in Western countries, the automobile industry in Japan, which was the last to join the developed nations, gathered mass production manufacturing

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techniques from both the European and US systems, but generated a production system different from both. This is called the Japanese production system or just-in-time (JIT) manufacturing. A further development based on this system is lean manufacturing, which took shape by absorbing automotive product development systems and supplier systems of *keiretsu* companies. In this book, lean manufacturing and just-in-time are treated as synonyms to describe the Japanese production system. Similarly, although Toyota refined this system to a higher level, we also regard production systems by Nissan, Honda, and other Japanese automobile manufacturers as practiced systems, though achievements and activities vary. It is well known that the Japanese production system had a huge impact and created a paradigm shift in the world's automotive manufacturing in the last quarter of the twentieth century.

The significance of the Japanese production system is its antithesis, which exposed the ill effects of mass production with high-volume manufacturing focusing only on economy of scale, rather than the elimination of wasted resources through streamlined production. How the Japanese production system came to overtake the prevailing Ford-style mass production system is described later in this book. The Japanese system, which began by committing to just-in-time production and synchronized manufacturing that manufactured what, when, and how much was necessary and eliminated wasteful processes and stock, brought a new paradigm. This ended the vicious cycle of stockpiles and forecast-based production characterized by the chain reactions of mass production and mass sales, and dissolved the rigidity of production where only existing products continued to be manufactured with existing technology. The Japanese production system also came to greatly influence parts manufacturers, trading systems, and even lean product development.

When taking a bird's-eye view of the global automobile industry in the last quarter of the twentieth century, the impact of lean production on international competition should be highlighted, emphasizing that the system itself was faced with internationalization/globalization, challenged in its international universality, and had to evolve and transform as it was transferred across national boundaries. Looking back on the past twenty-five years, history reveals the US automotive industry's critical phase in the early 1980s, triggered by the second oil crisis, the Japan–US inversion, the internationalization period among Japanese

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automobile manufacturers as they built plants in other countries in response to the automobile trade conflict between Japan and the US, and the strong yen appreciation following the Group of Five agreement in September 1985. In the 1990s, we can see that globalization of the world's automobile industry had become inevitable, and the revival of automobile manufacturers in Western nations, especially those in the US, is noteworthy. The key elements of their successful revival were their adoption and adaptation of the lean production system, their prompt adoption of Information Technology (IT) innovations, and their development of global strategy-building capabilities. Japanese auto makers that seemed to have reached the top of the world experienced a relative decline in international competitiveness in the first half of the 1990s due to a second period of strong yen, the collapse of the "bubble economy," and paralyzed financial systems. Although the level of decline varied from one Japanese manufacturer to another, in general what made a difference was the lack of strategy-building capabilities, which was due to ignoring changes in the global environment and the IT revolution.

When global restructuring of the world's automobile industry arrived as an extension to the revival of European and US automobile manufacturers in the 1990s and their new global strategies, two points of view emerged among journalists and academics, both within and outside Japan. One was that the world's automobile manufacturers would be aggregated into four or five manufacturers, and the accompanying economies of scale beyond national borders would have absolute meaning. This evolved into a "4 million unit scale club" theory that concluded that only those manufacturers with an annual production capacity of 4 million vehicles could survive. This theory spread on its own, without a clear source or authenticity.[3] The other view was that lean manufacturing would became a thing of the past as new business models emerged due to the IT revolution.[4]

However, the recent status of the world's automobile industry seems to display the flimsiness and the fallacy of these arguments. For example, how did Ford and GM, which individually acquired so many overseas brands, dip so far into the red? Why was it necessary for the two companies to implement corporate downsizing of their North US businesses in order to extricate themselves from the red, despite the fact that the North US market did not show the expected considerable decline in the aftermath of the terrorist attacks of 9/11? Why are we not seeing any

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discernible results coming out of the Daimler–Chrysler merger, which was a major focus of global restructuring? More specifically, why is the North American Chrysler division in the red? On the other side, how have the Japanese automobile manufacturers as a whole (not just the top companies like Toyota and Honda), which only recently caught up with the IT revolution and are rebuilding lean manufacturing, increased profits and gained their largest share ever in North America?

Looking at these very recent trends, these phenomena are not simply incidental or temporary – no one could deny that at the depth of the phenomena, the paradigm proposed by lean production still exists.

In this book, the author examines the generation and the progress of lean production in the last quarter of the twentieth century and attempts to demonstrate the process of its globalization, incorporating the competitive relationships and strategies among the automotive industries in Japan, Europe, and the US. The author also aims to explore the most desirable evolutional direction of lean production as the world's automobile industry faces a turning point in the twenty-first century. The author humbly admits that it is beyond his ability to write a complete treatise on a theme of such magnitude in one attempt, yet wishes to approach it by reflecting as much as possible on the knowledge gained through research, studies, and numerous international conferences, both within and outside Japan over the past twenty-five years.

The automobile industry in the twenty-first century faces challenges that extend beyond the framework of automotive technology, such as the prevention of global warming by committing to zero emissions as part of a concerted effort toward issues concerning the global environment, eradication of wasted resources and environmental degradation through mass production, sales, and disposal, and the realization of a fail-safe transportation system. It is necessary to cooperate in establishing the automobile industry in developing countries in areas such as Asia, while at the same time preventing environmental destruction and damage. A new evolution is required, where lean production can be implemented beyond the realm of technological innovation to contribute to reforming distribution, logistics, recycling, and even social systems. As a new paradigm develops with global universality, the automobile industry can establish a new industrial system and paradigm that adds social responsibility to its automobile civilization.

Under such a vision, Chapter 1 examines how Japan gained a competitive edge at the beginning of the 1980s by comparing productivity

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between Japanese and US automotive industries and by exploring the factors that drove improvements in Japanese productivity and quality.

Chapter 2 focusses on the second half of the 1980s and analyzes the real status of internationalization of the Japanese automobile industry and offshore production, including the transfer of Japanese production systems to overseas plants, with case studies based on field surveys. In the analysis, the author provides a generalized view on the beginnings of overseas production, the localization of management, the expansion of local parts-procurement ratios, and the localization of product development, based on many field surveys and interviews conducted between the second half of the 1980s and the first half of the 1990s. In Chapter 3, the author analyzes the impact of local production and lean production on the production, supplier, and development systems of the Big Three plants.

Chapters 4 and 5 reveal the background behind the birth of lean production, which drew the world's attention while the Japanese automotive industry was internationalizing. The international penetration of this system and its evolutionary process are also discussed, relating these issues to current problems such as automation of manufacturing processes.

The remainder of the book deals with the changes the automotive industry went through during the acceleration in global competition during the 1990s, and reveals how the automobile manufacturers of the West regained their strength and how the Japanese production system played a role in the recovery of Western automobile manufacturers. It also reveals the global restructuring of the automobile industry and the reality of the structural transformation in the automotive parts industry. Changes in supplier systems and, in relation to those changes, how businesses among *keiretsu* companies that used to be regarded as the strength of Japan are changing are analyzed. Based on the author's field surveys, the real condition of the European automobile industry, which is rebuilding its strategy after entering the globalization era, is examined, and the current situations, problems, and outlook for the Chinese and Asian automobile industries, which are considered to have the largest potential for growth, are explored.

Having examined the very dynamic developments in the world's automotive industry during the quarter century from the second half of the 1970s, the book concludes by examining the twenty-first century outlook for the world's automobile industry in a time of complete

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globalization and problems for the Japanese automobile industry. The author admits that the research subject of this book is too broad; however, there are a few key words that appear frequently, namely "production system" and "supplier system," which are aspects of the Japanese automobile industry that support its competitiveness even today. "Distribution and sales system" can be added to the list, as there are many associated unsolved/untapped issues with the advent of the information age. The author asks the reader to consider that a consistent theme of competitive strategy analysis – the impact of globalization/internationalization on Japanese as well as the world's automobile manufacturers – exists throughout this book, and invites the reader to join in considering what changes and evolutions the automobile industry of Japan, a latecomer to the industry, has been going through, what these changes mean, and what problems the industry will face in the future.

Notes

1. Although there are several stories concerning the birth of the automobile, Europe leads the invention efforts. Among the European inventors, Karl Benz and Gottlieb Daimler of Germany were the first to present to the world a car powered by an internal combustion gasoline engine. In 1885 a prototype was built, hence the basis for claiming it is the year the car was invented (K. Shimokawa, *The Business History of the U.S. Automobile Industry*, Toyo Keizai Shinpo Sha, 1977, p. 12). In 1985, Daimler-Benz held a sizable ceremony in Germany in commemoration of the one hundredth anniversary of the invention and invited individuals involved in the automotive industry from all over the world.
2. The first person to use these terminologies was Emma Rothschild. See her only work concerning the US automotive industry, *Paradise Lost – The Decline of the Auto Industrial Age*, Random House, 1973, pp. 33–51. Her book is mentioned in detail in Chapter 7 of the author's own book introduced above, where the author quotes her. Emma Rothschild's terminologies were also quoted by Robert Boyer, the leading member of the French Regulation School and a leading figure of GERPISA.
3. Jack Nasser, the former chief executive officer (CEO) of Ford Motors, reportedly said in a press conference at the Detroit Motor Show that the automobile industry of the world would be aggregated into four or five companies. Undoubtedly, at some point many other leaders of the industry as well were influenced by this thought. For arguments concerning this point, see T. Fujimoto, "Economics class column, Automobile industry: quality first," *Nihon Keizai Shimbun*, April 19, 1999; K. Shimokawa,

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"Global amalgamation and flexible production system," *Daily Automotive Newspaper*, May 15, 1999.

4. Martin Kenney, in a book he coauthored (M. Kenny and M. Florida, *Beyond Mass Production*, Oxford University Press, 1993), presents his excellent study on production systems and supplier systems of overseas factories of Japanese companies. However, he expresses his lack of interest in the Japanese-style production system, as it was a thing of the past, in a return email to the author's invitation to a symposium sponsored by the Industrial Information Center of Hosei University in 1999.

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1 *Comparing productivity of the Japanese and US automobile industries*

This chapter was first published in 1982. Though more than twenty years have passed since its publication, there is still significant meaning in the author's analysis and the indications made by W. J. Abernathy and others about the reversion of competitiveness in the Japan–US automobile industry and the factors caused by the reverse in the view of Japan–US comparisons in productivities. The history of international competitiveness in the Japan–US automobile industry since then, and the contemporary lessons from the theory put forward by Abernathy, are briefly described in the addendum.

1. Introduction

The US automobile industry deteriorated markedly in the early 1980s due to the effects of the first oil shock of 1973, fuel regulations introduced under the 1975 energy conservation law, and the second oil shock in 1979. During 1980 and 1981, the Japanese automobile industry reached production levels of 100 million units per year and became a strong international competitor, resulting in increased protectionism in the US and Europe.

While struggling to protect themselves against Japanese competition, US and European auto manufacturers began to search for the reasons behind Japan's success. Even though the deterioration in the competitive power of the US automobile industry could be directly attributed to the energy crisis, government policies, and changes in the US market environment, it was widely agreed in business and industrial circles and amongst scholars that the resulting fall in productivity was clearly due to structural causes.[1] Furthermore, this was not limited to the automobile industry but also included iron and steel, textile, electric, and other industries. The need to learn from Japan was recognized, and this led to the subsequent influence of lean production revolution systems in US business circles.

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How did the productivity gap between the two countries emerge? What new features of the competition between the US and Japan made this gap so conspicuous? To investigate and compare all aspects of automobile production in both countries, it is important to analyze the characteristics of the automobile industry overall as well as to study how each country addressed productivity problems during that period. But while the automobile industry overall can be used to represent the productivity of each country, there are numerous, inextricably linked factors that underlie that productivity. At the root of the productivity gap between Japan and the US in the early 1980s lay differences in production methods and in industrial behavior. We also have to consider these issues in the light of abrupt changes in automobile technology and technological innovations, and the fact that, in response to the oil shock, intensifying worldwide competition was centered on inexpensive small cars.

This chapter begins with the analysis of a set of indices that is thought to relate to productivity in the US and Japan, and goes on to discuss the reasons why the gap in productivity occurred. The significance of the new technological competition is explored by relating these indices to investment behavior and innovations in process technology. The conditions under which the Japanese auto industry might sustain its relative comparative advantage, and those under which it might break down, are examined. International adoption of the Japanese production and supplier systems, including localized manufacturing by Japanese industries in the US and US–Japan joint ventures, is discussed from the perspective of its impact on the recovery of US manufacturing industries.

2. Japanese automobile production from the viewpoint of economic indices

When discussing automobile production in the US and Japan, the indices most often used are sales volume, investment capital, or profit. The indices of sales volume and worldwide profit rankings have always been an issue, and it is only recently that the investment capital and scale of business have started to be considered as symbolic of international competitiveness. However, if we equate the marked fall in business performance with the fall in competitiveness of the US automobile industry in the early 1980s, it becomes quite clear why we cannot

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depend on nominal quantitative indices to predict the competitiveness of a business or industry.

In 1981, the true state of affairs was that GM, with a world ranking of number one, faced losses of $800 million; Ford, the second largest automobile maker in the world and ranked fifth in sales, faced a deficit of $2 billion; and Chrysler, which had been in the best ten in the world for the previous three years, had a cumulative deficit of $4 billion. Until 1978, three years earlier, it was widely thought that the high-profit financial structure of the US automobile industry was associated with a high level of technological achievement and high productivity. However, looking at the very serious deficits accumulating in Detroit at this time, one cannot help but think that the reality was radically different. Even if one accepts that the industry was affected by strict government policies regarding fuel efficiency and the rapid shift toward small cars in the US market, the question is then whether, if the standards of technology and productivity had been higher to start with, the situation would not have been so grave.

So what drove the high-profit financial structure of the US automobile industry until that period? In short, it was the oligopolistic structure in Detroit, which supported the production of large vehicles for the US market.[2] The high profit margin on large cars, of at least 18–24%, and the absolute profit figures of over three times, were guaranteed because the three car makers had a monopoly on large-car production.[3] Automobile production, under the umbrella of the Detroit monopoly, was protected from international competition, so poor technological standards and falls in productivity were hidden behind the high-profit structure.

In comparison with the situation in the US, the Japanese automobile industry was showing remarkable growth and international competitiveness, and was establishing a reputation for high productivity and high quality. Mass production of passenger cars in Japan had started after the Second World War, strengthening from the latter half of the 1950s. Although car production in Japan started to develop much later than in Europe and the United States, the Japanese domestic market grew rapidly from the late 1960s until the first oil shock of 1973, and the late 1970s saw a rapid increase in exports, especially to the US, growing to about 1 million vehicles per year. The Japanese automobile industry thus became the strongest automobile industry in terms of international competitiveness.

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