

International Horizontal Transfer of Production Technology Systems

—Toward Realization of Transnational Management—

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【Abstract】This book focuses on international horizontal transfer of production technology systems in Japanese multinational corporations (MNCs) and clarifies the effects of such transfers by MNCs' overseas subsidiaries. It defines a production technology system as “a system that refers to the combination or totality of various production technology elements,” and it considers the transfer of a production technology system from one overseas factory to a fellow overseas factory in another country within the same multinational corporation group as an “international horizontal transfer.”

This volume consists of two major parts. The first, consisting of Chapters 1 through 4, is theoretical and constructs an analytical framework by critiquing the results of previous studies. The second part, Chapters 5 and 6, is empirical and conducts quantitative and qualitative analyses based on that analytical framework. The specific contents of each chapter are described below.

Firstly, the Introduction points out that the research trend on MNCs has come to focus on knowledge transfer among business locations, and that international horizontal transfer of production technology systems encourages “learning from overseas factories through teaching,” an effect that has been overlooked by previous studies.

Chapter 1 in the theoretical section explains the contribution of this book to the multinational enterprise (MNE) theory by describing the achievements and limitations of five classics on MNEs that are considered to be relevant to the topic of this research. Chapter 2 further clarifies the contribution of this book by discussing previous studies on technology transfer and demonstrating the achievements and limitations of technology transfer research. Chapter 3 confirms the structure of knowledge transfer as “cause - process - effect,” through an examination of previous studies on knowledge transfer. Based on the results of the above studies, Chapter 4 establishes “factor - process - effect” as the basic analytical framework for this exploration, and it also identifies the basic constructs that are incorporated into this analytical framework.

Next, Chapter 5 in the empirical section explains how data was collected through a questionnaire survey of 391 manufacturing subsidiaries of Japanese multinationals located in six countries and regions (the U.S., Thailand, Indonesia, Vietnam, Malaysia, and Taiwan) that have been in operation for at least five years. Using correlation, multiple regression, and covariance structure analyses, this chapter details the discovery of the existence of the following causal chain (a causal mechanism): technology transfer (technical guidance) - explicitness of the production technology system (ease of teaching) - development of conceptual skills. Chapter 6 describes a comparative case study of two Japanese multinational manufacturing companies, in which the presence of the aforementioned causal chain is confirmed, proving that “learning on the teaching side” does in fact occur.

Finally, the last chapter presents two conclusions based on the results of the above analyses. First, by

making production technology systems explicit, the international horizontal transfer of such systems indirectly enhances the conceptual skills of engineers and workers on the teaching side. Second, MNEs can encourage further growth and self-reliance in their overseas subsidiaries (factories) by transferring production technology systems to them through international horizontal transfers, in addition to ordinal transfers from the parent factory in the home country. The findings of this book reveal a new aspect of human resource development and therefore contribute to the development of management study.

【 Keywords 】 multinational companies, production technology systems, international horizontal transfer, teachability, conceptual skills

1. Introduction

My book *International Horizontal Transfer of Production Technology Systems: Toward Realization Transnational Management* (Yuhikaku Publishing, February 2021) won the 2021 Japan Academy of Business Administration Award (Book Category). I had the honor of presenting an overview of the book at the 96th Annual Meeting of the Japan Academy of Business Administration. I would like to express my sincere gratitude to everyone who provided their guidance and cooperation as I was writing this book, to everyone who recommended it, to everyone who reviewed it, and to everyone who organized the conference.

The research theme of the book is the international horizontal transfer of production technology systems at Japanese multinational companies. It seeks to clarify the effects source overseas subsidiary factories gain in the processes of horizontal transfer of production technology systems to other overseas subsidiary factories. This book defines a production technology system as one “that combines or is the sum of various production technology elements” (Kambayashi, 2001). Furthermore, it considers an “international horizontal transfer” as occurring when an overseas subsidiary factory in a multinational company transfers production technology systems to another overseas subsidiary factory in the same group.

To achieve the stated aim, the discussion is divided into two main sections. Part 1, which is theoretical, comprises Chapters 1 to 4 and constructs an analytical framework while criticizing the research findings of previous studies. Part 2, which is empirical, comprises Chapters 5 and 6 and conducts quantitative and qualitative analyses based on the analytical framework. The following sections briefly summarize the contents of each chapter, give an overview of the book, and conclude by mentioning its potential theoretical and practical contributions.

2. Book Overview

2-1. Exploring Learning by Teaching

In the introductory chapter, I first reviewed the trends in research on multinational companies. Research on multinational companies initially tackled the question of why companies become multinational, explaining the creation of overseas subsidiaries as a way to exclusively utilize the

advantages of the parent company in the home country in overseas locations¹. Eventually, as companies became more multinational, it became popular to research how subsidiaries established overseas could be utilized to improve the competitiveness of multinational companies. In particular, an increasing number of studies investigate how to effectively and efficiently utilize innovations generated by overseas subsidiaries in multinational companies. This book confirms that the core of research on multinational companies is shifting from parent companies in home countries to overseas subsidiaries.

This book elucidates the international horizontal transfer of production technology systems within this trend in multinational company research. International horizontal transfer of production technology systems is a management phenomenon where overseas subsidiary factories transfer production technology systems to or receive such systems from overseas subsidiary factories in other countries. Previous studies on technology and knowledge transfer showed that production technology systems are transferred by mother factories in the home country (i.e., ordinal transfer), rather than by overseas subsidiary factories. However, in recent years, a management phenomenon is emerging wherein production technology systems are transferred horizontally from overseas subsidiary factories to overseas subsidiary factories in other countries.

I wrote this book because I suspected that the source of the new competitiveness of multinational companies is entrenched in this phenomenon. This is an effect of overseas subsidiary factories developing engineer and worker skills at their own factories through the international horizontal transfer of production technology systems, which improves production and development capacity, and enhances the competitiveness of multinational companies as a whole. This effect can be referred to as “overseas subsidiary factories learning by teaching.” Focusing on this, the book advances the discussion by asking whether the effect of overseas subsidiary factories learning by teaching actually exists.

2-2. Benefits of Overseas Subsidiaries

Chapter 1 examines five classical theories on multinational companies and their relevance to this book. The following is a brief review of that discussion.

Multinational companies have the intrinsic property of transferring the advantages of their home country through direct investment (Hymer, 1976). If a production technology system has the characteristics of a public good, it will be advantageous to transfer it to an on-site overseas subsidiary factory (Buckley and Casson, 1991). Moreover, since trade and investment patterns change in response to shifts in product demand, it is not necessary for the mother factory in the home country to continue to be the transferor of production technology systems. In some cases, overseas subsidiary factories may become the transfer sources instead of domestic factories (Vernon, 1966; Wells, 1972). In other words, it is possible for multinational companies to transfer production technology systems horizontally and internationally.

The transfer by a multinational company of a production technology system is essentially one of management resources. Such management behavior is company-wide and unified to increase these companies' competitive advantage (Fayerweather, 1969). In recent years, transnational management has been proposed as a way for multinational companies to achieve competitive advantage (Bartlett

¹ In international management studies, parent companies are referred to as "parent companies" and parent factories as "mother factories." In this paper, I will adhere to this convention.

and Ghoshal, 1989). A characteristic of transnational management is specialization of overseas business bases and mutual interchange of management resources. In particular, it emphasizes the importance of mutual transfers among overseas subsidiaries. Here, the international horizontal transfer of production technology systems is part of transnational management and can be a useful means of gaining a competitive advantage.

In this way, the classical theory of multinational companies has proposed that the international horizontal transfer of production technology systems enables multinational companies to obtain monopoly profits and brings about a “scope economy” based on the sharing of resources. Classical theory contends that management promote the international horizontal transfer of production technology systems to maximize economic benefits. However, these classical theories focus on the benefits of the multinational company as a whole (the parent company in the home country) and largely ignore the benefits of overseas subsidiaries. According to these theories, overseas subsidiaries transfer production technology systems internationally to maximize the benefits of the parent company in their home country, not the benefits of the overseas subsidiary itself.

Certainly, the international horizontal transfer of production technology systems may benefit the parent company. However, these classical theories do not answer the question regarding what benefits they directly bring to overseas subsidiaries, except for indirect enjoyment. Thus, this book focuses on the benefits of overseas subsidiaries, which are largely overlooked. The aim is to elucidate the effects of the international horizontal transfer of production technology systems, demonstrate its inevitability from a learning and teaching perspective, and derive new theoretical and practical implications for the management of multinational companies.

2–3. Effects of Supplying Technology

Chapter 2 is based on Saito’s (1979) classic of technology transfer research. First, it analyzes the production and development capabilities of overseas sub-factories at company and individual levels, focusing on the mental interaction between engineers and workers involved in technology transfer. Second, it analyzes the “production technology system” consisting of machines and humans.

Next, based on Abo et al. (1991), we confirmed the technical universality of the production system in Japan and analyzed the international transfer thereof, which has the characteristics of both partial and international transfer by industry. The book clarified the importance of analyzing the situation in each industry.

As a new trend in research on the international transfer of production systems in Japan, we studied the mother factory system. Research on the international transfer of production systems in Japan has focused on the overseas subsidiary factories that are the recipients of technology, while that on mother factories deals with home factories that supply the technology. Since the 2000s, the number of overseas subsidiary factories of Japanese companies has increased rapidly, and the pressure on these to provide technical support to them is higher than ever. As a result, multinational companies have formulated two methods to deal with the problem. One is to reduce the transfer of production technology systems by narrowing the area of responsibility of mother factories in the home country and to encourage the self-reliance of overseas subsidiary factories. The other is to transfer production technology systems horizontally from other overseas subsidiary factories without reducing the transfer of these systems. The significance of studying the international horizontal transfer of production technology systems has increased in examinations of the mother factory system.

In recent years, research on mother factory systems has started to include studies on the international horizontal transfer of production technology systems. However, the majority of these

studies still focus on ordinal transfers of production technology systems, while few examine mother factory systems from a “learning on the part of the supplier (teacher) of technology” perspective. Research has been accumulating based on the premise that the learner of technology in a technology transfer is the technology recipient and not its supplier. As such, conventional technology transfer research does not really address the question of what fruits overseas subsidiaries reap from the international horizontal transfer of production technology systems. Thus, this book contributes to the technology transfer research by focusing on the novel aspect of “learning on the part of the supplier (teacher) of technology,” which has been overlooked in conventional technology transfer research.

2-4. Effect of Supplying Knowledge

However, research on technology transfer has not received much attention in recent years. One reason is because knowledge management theory rapidly emerged in the field of business administration in the 1990s, and the number of studies on technology as knowledge increased. Chapter 3 focuses on knowledge transfer research, which has seen remarkable development in recent years, and confirms the relevance of previous findings to the research topics addressed this book.

To summarize the findings in Chapter 3, knowledge transfer can be explained in terms of a “factors→ processes→ effects” structure. Since technology and knowledge transfer have aspects in common, I thought the analytical framework for this book could be constructed with reference to a knowledge transfer structure. However, regarding the effects of knowledge transfer, it became clear that most previous studies focused on the effects on the knowledge recipient, not those on the supplier. Knowledge transfer research, like that on multinational companies and technology transfer, rarely answers the question of the benefits of providing knowledge for the knowledge provider, especially when this also involves creation. Although Nonaka and Takeuchi’s (1995) theory of systematic knowledge creation advocates systematic knowledge creation, it does not explain that those who supply (teach) knowledge create new knowledge by supplying (teaching) it.

In this sense, conventional knowledge transfer research overlooks the aspect of “learning on the part of the supplier (teacher) of knowledge.” Thus, this book, which attempts to demonstrate the effects of “learning on the part of the supplier (teacher) of technology,” may provide a new theoretical basis for this area. Furthermore, this book attempts to contribute to the knowledge transfer research by demonstrating the “creative benefits for knowledge providers.”

2-5. Relationship between Technology Transfer and Skill Development

In Chapter 4, based on the above discussion, I attempted to construct an analytical framework for the international transfer of production technology systems in multinational companies. In particular, I used the “factors→ processes→ effects” knowledge transfer structure to create the analytical framework “factors→ processes→ effects” for the transfer of production technology systems. Specifically, I discuss and define “the explicitness (non-implicitness) of production technology systems” (Kogut and Zander, 1993; Zander and Kogut, 1995) and “autonomy of overseas subsidiary factories” (Birkinshaw and Hood, 1998) as two factors that contribute to the transfer of these systems.

Regarding the processes for this transfer, I proposed that technology transfer is a “collaborative learning system” (Yoshihara, 1992), and presented four types: technological absorption (secondment and acceptance types) and technological guidance (secondment and acceptance types). This enabled distinguishing between the effects of learning on the part of both the recipient (student) and supplier (teacher) of technology.

Two effects of technology transfer were discussed, namely the skill development of engineers and workers at overseas subsidiary factories and improvement of the production and development capacity of overseas subsidiary factories (Shintaku et al., 2014). The former is a construct that captures the learning and growth of engineers and workers, while the latter captures the self-reliance of overseas subsidiary factories. Furthermore, the skills of engineers and workers were identified as (1) technical, (2) human, and (3) conceptual skills, with reference to previous research (Katz, 1974).

The development of technical skills is thought to have a high affinity with technology absorption, and the development of human and conceptual skills with technological guidance. Thus, this book formulates five propositions as follows:

- Proposition 1: The explicitness (non-implicitness) of production technology systems in overseas subsidiary factories affects the technology transfers of overseas subsidiary factories.
- Proposition 2: The autonomy of overseas subsidiary factories contributes to the technology transfers of overseas subsidiary factories.
- Proposition 3: Technology transfers of overseas factories contribute to the development of skills of engineers and workers at overseas subsidiary factories that supply the technology.
- Proposition 4: The development of the skills of engineers and workers at overseas subsidiary factories contributes to the improvement of the production capacity of overseas subsidiary factories that supply the technology.
- Proposition 5: The development of the skills of engineers and workers at overseas subsidiary factories contributes to the improvement of the development capacity of overseas subsidiary factories that supply the technology.

In particular, as per Proposition 3, “learning” and “teaching” technology transfers have different effects. This is the most important proposition, as it forms the backbone of this book, which examines these five propositions to answer the research questions.

2-6. Discovering the Indirect Effects of International Horizontal Transfer

In Chapter 5, I quantitatively verify the propositions defined in Chapter 4 and attempt to answer the research questions guiding this book.

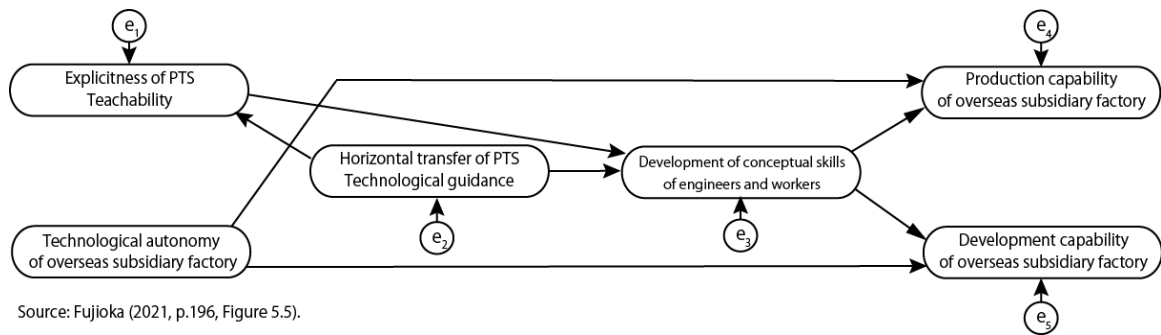
First, using Toyo Keizai’s “Data and Text Edition of Companies Expanding Overseas 2019,” I identified 3,025 manufacturing subsidiaries of Japanese multinational companies that have been in operation for at least 5 years in 6 countries, namely the United States, Thailand, Indonesia, Vietnam, Malaysia, and Taiwan, and conducted a questionnaire survey of them. As a result, 391 valid responses were obtained out of the 2,914 valid requests, achieving valid response rate of 13.4%.

Next, I performed correlation analysis, ordinal logistic regression analysis, and linear multiple regression to verify the propositions. The results showed that Propositions 1, 4, and 5 are mostly supported, but not Proposition 2. Regarding Proposition 3, which is used to verify the effects of “learning on the part of the supplier (teacher) of technology,” the results of the correlation and multiple linear regression analyses differed. Specifically, for international horizontal transfer, although the correlation analysis showed a positive correlation between technology transfer (technological guidance) and the development of conceptual skills, the partial correlation disappeared in the multiple linear regression. In contrast, technology transfer (technological guidance) was positively correlated with the explicitness of production technology systems (especially ease of teaching), and the partial correlation did not disappear in the linear multiple regression analysis.

This suggests that technological guidance is possibly related to the development of conceptual skills via the explicitness (ease of teaching) of production technology systems.

As such, in this book, I constructed a new analytical model that includes causal mechanisms (Figure 1) and conducted a covariance structure analysis to verify it. The results showed that for technological guidance (secondment and acceptance types) of international horizontal transfer, the paths for both “technology transfer (technological guidance)→ explicitness (ease of teaching) of production technology systems→ development of conceptual skills” and “technology transfer (technological guidance)→ development of conceptual skills” were both statistically significant. This implies that the international horizontal transfer of production technology systems may indirectly contribute to the development of the conceptual skills of engineers and workers at overseas subsidiary factories that supply the technology via the explicitness (ease of teaching) of production technology systems. However, the degree of fit of the model is not high; thus, to demonstrate its effectiveness, the results were supplemented with a case study to enable us to infer the causal mechanisms.

Figure 1: New Analysis Model



2-7. Reconfirming the Indirect Effects of International Horizontal Transfers

In Chapter 6, based on the results of the quantitative analysis in Chapter 5, I conducted a case study to demonstrate the existence of the causal chain (causal mechanism) “technology transfer (technological guidance)→ explicitness (ease of teaching) of production technology systems→ development of conceptual skills.” To select the companies to include in the case study, I requested the cooperation of eight Japanese multinational manufacturing companies listed in *Factory Management* (Vol. 63, No. 4, March 2017), of which two agreed to participate (Company A, a major home appliance company, and Company B, a major consumer goods and chemical company). I then conducted a case study on the international horizontal transfer of production technology systems at Company AW, a Chinese subsidiary of Company A, and BM, a Malaysian subsidiary of Company B. To collect information, I performed interviews with 21 people from Companies A and AW and 9 from Companies B and BM. The results are as follows.

First, Company AW instructed the Mexican factory of its subsidiary in the United States, Company AA, on its production technology system. S, a Chinese engineer at Company AW, collaborated with Mexican engineers to support the conceptual design of production equipment. Through this process, they learned about elements of Company AW’s production equipment and their interrelationships. Moreover, Company A has a manufacturing-related index within the group called the “Monozukuri Assessment.” Using the assessment criteria enabled Company AW to objectively understand the differences between its production technology systems and those of Company AA and

communicate effectively with the other party.

Next, to perform regular repairs, Company BM in Malaysia and Company BF in the Philippines shut down their high-grade alcohol production factories at different times, dispatching engineers, maintenance personnel, and workers from the running factory to the stopped factory to support each other's regular maintenance. While performing regular maintenance at Company BF, BM workers learned about the differences between the two companies' high-grade alcohol production technology systems, deepening their understanding thereof. Furthermore, they learned more about leadership, teamwork, cross-cultural management, and other aspects of business management. Moreover, the common production technology standards and technological basis provided by Factory W, the mother factory in Japan, facilitated mutual technical support between the two companies.

The case study revealed that both Companies AW and BM developed especially conceptual skills related to the elements of production technology systems and their interrelationships while making their production technology systems explicit through international horizontal transfer. The causal mechanism "technology transfer (technological guidance)→ explicitness (ease of teaching) of production technology systems→ development of conceptual skills" indicated by the quantitative analysis in Chapter 5 was thus also confirmed in the qualitative analysis in Chapter 6.

The research question addressed in this book pertained to the effects of the international horizontal transfer of production technology systems on learning and growth in overseas subsidiary factories that supply the technology. In this regard, the book synthesizes the results of the analyses in Chapters 5 and 6 as follows. Essentially, engineers and workers at the overseas subsidiary factories of multinational companies make easier to teach (formalize) the production technology systems of their own factories by teaching it to engineers and workers at overseas subsidiary factories in other countries. In the process of making the production technology system explicit, they develop conceptual skills with regard to their own production technology system, which deepens their understanding of the elements of that system and their interrelationships. If engineers and workers at overseas subsidiary factories improve their conceptual skills, the overall production and development capacity of these factories also increase. This boosts both the competitiveness and self-reliance of overseas subsidiary factories and the competitiveness of the multinational company. Thus, the book concludes that the international horizontal transfer of production technology systems facilitates learning and growth at overseas subsidiary factories that supply the technology.

3. Contributions of This Book

3-1. Theoretical Contributions of This Book

Based on the above discussions, I believe this book has made several theoretical and practical contributions. I first outline its theoretical contributions.

3-1-1. Economy of Learning in International Management

First, the book contributes theoretically to the theory of multinational companies. One argument in multinational corporate theory is that of Bartlett and Ghoshal's (1989) transnational management. An element of transnational management is sharing the innovations developed by an overseas subsidiary with the parent company and other overseas subsidiaries to realize various economies of scope, which gives the multinational company a competitive advantage.

However, the logic of achieving the competitive advantage of multinational companies demonstrated in this book differs from the economy of scope advocated by transnational management.

Rather, competitive advantage in multinational companies, based on the findings reported in this book, is activated by teaching the production technology system to overseas subsidiary factories in other countries. This increases the production and development capacity at both overseas and their own factories by developing the conceptual skills of engineers and workers. Their growth and independence generates a competitive advantage for multinational companies. This is the logic of the “economy of learning” in the sense that learning through the international horizontal transfer of production technology systems can lead to economic benefits for multinational companies.

From the viewpoint of realizing an “economy of learning,” it may be desirable from an international management perspective for the parent company to develop an overseas subsidiary factory by providing an opportunity to “teach” it the production technology system, and in the long term, to raise the production and development capacity of the entire multinational company to achieve a competitive advantage, even if inefficient in the short term. By demonstrating the existence of a causal mechanism of “technological guidance→ explicitness of the production technology system→ development of conceptual skills of engineers and workers in overseas subsidiary factories that supply the technology→ and improvement of the production capacity and development capacity of overseas subsidiary factories that supply the technology,” this book makes a theoretical contribution by arguing that international management be based on the “economy of learning” for the first time.

3-1-2. Technology Transfer as a Collaborative Learning System

I also see this book as contributing to technology transfer theory. Its first contribution to this theory is the presentation of a new type of technology transfer, which this book considers an interaction between the side that receives (learns) the technology and the side that supplies (teaches) it. Thus, the view of technology transfer as a “collaborative learning system” wherein both sides learn is presented. To distinguish between learning and teaching technology transfer, I developed the concepts of “technological absorption” and “technological guidance” as well as “secondment type,” which means heading over to another base, and “acceptance type,” referring to receiving the other side at your base. By combining the two, I presented four types of technology transfer: “technological absorption (secondment type),” “technological absorption (acceptance type),” “technological guidance (secondment type),” and “technological guidance (acceptance type).”

By measuring the effects of technology transfer in each of these four categories, this book advances a new conceptual framework to demonstrate the differences between the effects of learning and teaching technology. By considering technology transfer a collaborative learning system and using the typology to distinguish between the sides that learn and teach technology, the learning effects on both sides can be measured.

3-1-3. Possibility of a Mutual Mother Factory System

The book’s second contribution to technology transfer theory is its rationale for a mutual mother factory system. In recent years, the technology transfer research has argued how a mother factory system can effectively counter increases in the ratio of overseas production by multinational companies. Here, the mother factory should be in the home country.

However, as demonstrated in this book, if we assume that the international horizontal transfer of production technology systems by overseas subsidiary factories increases production and development capacity by developing the conceptual skills of their engineers and workers, there is less need to restrict the mother factory to be in the home country. If teaching production technology systems leads to learning and growth at the factory, then restricting the role of the mother factory to the one in the home country may suppress learning and growth at overseas subsidiary factories. This may hinder

improvements in production and development capacity for the multinational company as a whole.

For the multinational company, this may be less efficient in the short term due to duplication of management resources, but more efficient in the long term if the mother factory is not restricted to the one in the home country. In this case, several influential overseas subsidiary factories can be identified as mother factories that mutually teach each other their production technology systems. By presenting the concept of a “mutual mother factory system,” this book contributes to the recent technology transfer debate on this factory system.

3–1–4. Knowledge Updates by Knowledge Suppliers

I believe this book also contributes to knowledge management theory, which deals with the transfer and creation of knowledge. Conventional knowledge transfer is conducted to update the knowledge base on the receiving side. That is, research clarifies the methods and effects of updating the knowledge base on the receiving (learning) side through knowledge transfer.

However, as this book clarifies, with the international horizontal transfer of production technology systems, supplying (teaching) knowledge is accompanied by updating it on the side supplying knowledge on production technology systems as well. That is, with this technology transfer, a phenomenon was observed in which the knowledge bases of both the recipient and supplier were simultaneously updated. However, the knowledge base updates on both sides are not necessarily identical.

The fact that knowledge transfer updates the knowledge base in this way for both the recipient and supplier of knowledge is not advanced in conventional knowledge transfer theories. Similarly, knowledge creation theory does not involve a situation where the knowledge supplier creates new knowledge by supplying it. However, if the knowledge supplier can update their knowledge base through the knowledge transfer and become a leader in organizational knowledge creation, the choice of “whom” in the organization to entrust with knowledge supply becomes an important focus for both researchers and practitioners.

Knowledge management theory explains knowledge as an important source of competitive advantage for companies. This book demonstrates that knowledge suppliers in knowledge transfer processes can also play an important role in organizational knowledge creation. Thus, research on what attributes and relationships of knowledge suppliers in knowledge transfer will lead to the most effective updates and creation of knowledge may become popular in knowledge management theory in the future. This opening up of new research possibilities for knowledge management theory is another theoretical contribution of this book.

3–1–5. Causal Mechanisms of the Effects of Teaching

Last, I believe this book contributes to business administration. Conventional research has not focused on teaching effects in the field of business administration, including in multinational companies, technology transfer, and knowledge transfer. Strangely, although organization members are involved with each other (Suzuki, 2013), coordinate with each other (Barnard, 1938; Niwamoto, 2015), and demonstrate leadership (Kanai, 1991; Niwamoto, 2015)—consciously or unconsciously—the research focuses only on learning effects. Although research that argues for the effectiveness of on-the-job training and self-learning, it still focuses on the effectiveness of learning—not teaching—based on previous practices.

Nonetheless, in the field of management, as introduced in the AW case study in Chapter 6, there are several cases of employees growing by having them teach. This book clarifies the causal mechanisms by which teaching promotes the explicitness of the material taught, so that the teacher improves conceptual skills in the process of making the material easy to teach. I believe this book is

the first in the field of business administration to present the logic of teaching effects in terms of how teaching helps people grow.

Thus, in addition to the usual perspective of how to teach and develop human resources in companies, this book proposes a new perspective on “who” should teach and train, and what kind of relationship should be created between teachers and teaching materials to effectively develop those who teach. If research is advanced from this perspective, we may be able to develop new measures for human resource development in companies.

Therefore, I believe that a theoretical contribution of this book to business administration is clarifying the causal mechanisms of teaching effects and a new perspective on human resource development in companies.

3-2. Practical Contributions of This Book

I believe this book makes various contributions to practitioners as well.

3-2-1. Autonomy and Heteronomy of Overseas Subsidiary Factories

A practical contribution of this book is that it presented an adjustment model of autonomy and heteronomy for overseas subsidiary factories. This advances a logic for the autonomy of overseas subsidiary factories as they make their production technology system easier to teach through its international horizontal transfer. Through this process, the conceptual skills of engineers and workers are developed and linked to the production and development capacity of overseas subsidiary factories. Moreover, I pointed to the urgent situation that technical support from the mother factory in the home country is not sufficient due to rapid increases in overseas production.

Considering this, it is better for multinational companies to actively seek management measures that make them autonomous and increase their competitiveness through the horizontal transfer of production technology systems to overseas factories in other countries. While the mother factory in the home country specializes in developing the core production technology system and fulfills the role of ordinal transfer, it should also promote the development of peripheral production technology systems and international horizontal transfer by supporting overseas subsidiary factories in becoming autonomous.

However, this does not mean that international horizontal transfer by overseas factories should go unchecked. Just as the direction of development of production technology systems should accord with the intentions of the multinational company as a whole, it is also necessary to impose restrictions on overseas subsidiary factories. One way to do this is to prepare evaluation criteria for production technology systems. Here, preparing a common evaluation standard for the formalization of production technology systems will enable multinational companies to indirectly control the direction of development of the production technology systems in accordance with their intentions. It will also facilitate international horizontal transfer by overseas subsidiary factories. As such, it would be a beneficial management measure for multinational companies to apply common evaluation criteria to formalize production technology systems and achieve both autonomy and heteronomy for overseas subsidiary factories.

In this way, to resolve the contradiction between the autonomy and heteronomy of overseas subsidiary factories, the first practical contribution of this book is to propose a management policy to develop a common standard for evaluating the formalization of production technology systems.

3–2–2. Handling the Shift to Bloc Economics

The second practical contribution of this book is that it provided a prescription for how Japanese multinational companies can deal with the changing international business environment. On October 4, 2018, Vice President of the United States Mike Pence delivered a speech lasting more than 40 minutes at the Hudson Institute in Washington on the Trump administration's policy toward China. He identified China as a country that could challenge the United States and declared that they would confront it (Suzuoki, 2018). With Vice President Pence's speech, globalization, which has been on the rise since the late 1980s, may have come to an end due to the confrontation between the United States and China. Thus, the formation of an economic bloc centered on the United States and another on China may have begun in the latter half of the 2010s.

With this shift in the international strategy of the United States, Japanese multinational companies may not be able to transfer their production technology systems to their factories as freely as in the past. Furthermore, to avoid trade friction between the United States and Japan, it will likely be difficult to further increase exports from Japan to the United States. This would force many Japanese multinational companies that produced their products in China and exported them from there to the United States either to increase their production investment in the United States or in Southeast Asia as an alternative. As a result, they may face the international management challenges of cultivating subsidiary factories in the United States and Southeast Asia as well as managing the production technology systems of their remaining factories in China.

Here, the international horizontal transfer of production technology systems will play an important role. Japanese multinational companies will first have to accelerate their investment in production in their economic bloc, especially in the United States and Southeast Asia. The transfer of production technology systems is indispensable in accelerating production investment. However, ordinal transfer among subsidiaries through the mother factory system alone will not be enough to cultivate subsidiary factories in the United States and Southeast Asia. It is therefore necessary that the development of overseas subsidiary factories be hastened while simultaneously engaging in international horizontal transfer by overseas subsidiary factories located in the economic bloc of the United States.

China, which has already received considerable production investment, may continue to be an important place for some Japanese multinational companies. One solution in this case for international management could be for subsidiary factories in China's economic bloc to increase production and development capacity through the horizontal transfer of production technology systems among each other.

Accordingly, the second practical contribution of this book is to show that in the coming era, when we are likely to see the emergence of two major economic blocs centered on the United States and China, the international horizontal transfer of production technology systems may become an important management measure for Japanese multinational companies.

4. Conclusion

Finally, I conclude this paper by describing the research topics not addressed in this book.

First, the book relies on Katz (1974) to develop an analytical model that links technology (knowledge) transfer with skill development to elucidate the learning effects of overseas subsidiary factories engaged in teaching. However, the theoretical considerations that connect the two are not

always sufficient. Learning through teaching is also studied in the field of pedagogy. In the future, it will be necessary to deepen theoretical considerations between technology (knowledge) transfer and skill development by drawing on theories from pedagogy and other related fields.

Next, this book examines the learning effects of overseas subsidiary factories engaged in teaching using quantitative and qualitative methods. However, some issues regarding these methods should be acknowledged. For example, issues pertaining to quantitative methods include the (1) failure to distinguish between engineers and workers, (2) operationalization of the development of three skills—technical, human, and conceptual skills—with the help of a scale for managers, and (3) respondents' subjective measurement of key constructs and the independent and dependent variables. Regarding qualitative methods, a key challenge is that it cannot adequately analyze the interactions between recipients (learners) and suppliers (teachers) of technology. Future research should seek to tackle these issues.

In business administration, especially in the field of international management, there is an inherent difficulty in how research subjects are internationally dispersed. However, I will not be daunted by this and will steadily continue my work as a researcher.

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