Mother Factory vs. Model Factory: Comparative Study of International Knowledge Transfer

Youngkyo SUH^{a)}

Abstract: The production systems of Japanese companies are considered to be firm-specific advantages, which lead to superior productivity. The mother factory system, exemplified by Toyota Motor Corporation, has been used as a primary method for transferring Japanese production systems overseas. However in recent years, some companies, such as Hyundai Motor Company of Korea, have begun using a different way to transfer production methods overseas. This paper terms this method the “model factory system” and compares it with the mother factory system within the framework of knowledge transfer theory. In this framework, production systems are regarded as knowledge held by the home country. In this analytical framework, members, tools, and manuals represent knowledge that is directly moved; skills, organizations, and layouts represent knowledge that can be reproduced by the recipient. This framework was used to analyze cases of production system transfer overseas by Toyota Motor

^{a)} Manufacturing Management Research Center, Graduate School of Economics, the University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan, ruiberd@gmail.com

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Corporation and Hyundai Motor Company. It was shown that the mother factory system primarily transfers knowledge from the home country's factories, whereas the model factory system transfers knowledge from the corporate headquarters.

Keywords: mother factory system, model factory system, global knowledge transfer, production system, overseas production

Introduction

The mother factory system is considered to be an organizational capability for transferring Japan's superior production systems overseas (Yamaguchi, 2006). Toyota Motor Corporation (Toyota) is one good example of this system although recently the functions of the system are exhibiting various changes. Conversely, there have been recent examples of Korean companies such as Hyundai Motor Company (Hyundai) that do not use the mother factory system. Rather, they use a different system for knowledge transfer (Jo, 2016; Suh, 2012a). This paper terms this the "model factory system." The main purpose of this study is to compare the mother factory system and the model factory system, as well as to identify their differences. To do so, this paper compares cases of knowledge transfer by Toyota and Hyundai because these two companies are representative in their use of the mother factory system and the model factory system, respectively. When comparing these companies in this analysis, production systems that each company has in the home country are regarded as knowledge.

This paper discusses previous research regarding the transfer of production systems. An analytical framework is derived on the basis of knowledge transfer theory. Using the cases of Toyota and Hyundai, the mother factory system and the model factory system are

compared, and their differences are identified. Further, changes to the mother factory system are explained using this same framework.

Transferring the Production System

Multinational corporations (MNCs) have firm-specific advantages in their home countries. MNCs are believed to gain competitiveness overseas by transferring their advantages (Dunning, 1979; Hymer, 1976). Particularly in Japan, the unique management and production systems of Japanese companies are regarded as advantages. How those systems are transferred overseas is broadly discussed (Abo, Itagaki, Kamiyama, Kawamura, & Kumon, 1991; Liker, Fruin, & Adler, 1999; Yamaguchi, 2006). The Japanese production system has been researched for its high performance and productivity (Fukuzawa, 2015; Mukai, 2015), and the mother factory system has been used to transfer production systems overseas (Nakayama, 2003; Oki, 2011, 2015, 2016; Yamaguchi, 2006).

Nakayama (2003) defines the mother factory system (or mother plant system) as a technical support method. Engineers or workers of the mother factory in the home country are sent to overseas manufacturing subsidiaries. They support the technical aspects of manufacturing, including shop floor management.

Yamaguchi (2006) interpreted the mother factory as a system of transferring tacit knowledge from a domestic factory to foreign factory without codifying them. This transfer of tacit knowledge regarding mass production at the mother factory occurs when personnel from the mother factory are sent to overseas factories or when overseas factory workers or managers are sent to the mother factory in the home country for training. In addition, the mother factory coordinates with current organizational routines so that they can be matched to overseas factory environments and are employed effectively.

Oki (2011) focused on the phenomenon of the mother factory competing with overseas factories and its effect on the improvement of competitiveness of the mother factory. Here as well, the mother factory plays a guiding role in the process of improving the productivity of both domestic and overseas factories. In addition, even in a mother factory that does not have a mass-producing function in the home country, it could support overseas production (Oki, 2015).

In contrast, Suh (2012a) analyzed the case of the overseas factory in Hyundai Motor Company of Korea and its Chinese manufacturing subsidiary and identified the existence of a method of transferring production systems to the overseas factory that is different from the mother factory system. The purpose of this system is to transfer Korea's unique production systems overseas (Jo, 2016). This unique overseas production system transfer method has not been discussed much. In this paper, it is called the model factory system. This paper analyzes how the mother factory system and the model factory system differ when transferring production systems overseas.

Framework

In this paper, the knowledge transfer framework of six types of knowledge is derived from theories in Walsh and Ungson (1991) and Argote and Ingram (2000). Argote and Ingram (2000) emphasized that knowledge is composed of three fundamental elements (members, tools, and tasks) and networks that are combinations of these elements. Members are individuals that make up an organization. Tools are technical elements that include both hardware and software. Tasks reflect organization goals, intents, objectives, and routines. Knowledge is stored not only independently but also complementarily. Knowledge that exists as a system of combinations and linkages, is argued to be knowledge stored in a

network.

There has been similar discussion within organizational theory. Walsh and Ungson (1991) analyzed the storage of information and knowledge by organizations, calling it “organizational memory.” They divide the places where organizations store memory into the following five locations: individual members of an organization, organizational culture, organizational structure, the transformation process within an organization, and the physical environment of an organization.

In combining these two arguments, members, tasks, and tools and their combinations (skill, organization and layout) constitute the knowledge that is transferred. In this paper, combinations of members and tasks are the organization, combinations of members and tools are the skills, and combinations of tasks and tools are the physical environments of organizations, or their layout.

How are these six types of knowledge related to the knowledge transfer structure? Members, tasks, and tools can be directly moved from senders to recipients. Members have knowledge and can transfer that knowledge within an organization or between organizations. Tasks can be codified in the form of manuals and can be directly moved. Tools can be directly transferred in the form of equipment or facilities. Members, tasks, and tools function as knowledge storage mediums and can all be directly transferred. However, members have different characteristics than the others. Members are knowledge storage mediums and are also simultaneously agents of knowledge transfer. Individuals from the sender’s side can move to the recipient’s site and exchange knowledge with individuals there. Skills, organizations, and layouts cannot be directly moved. These knowledge systems can be reproduced by the recipient. Skills can be learned as knowledge by members of the recipient organization and be mastered using tools. An organization must be reproduced by members and their

tasks. Layouts at the recipient's site can be reproduced by setting up facilities and equipment with arrangements made for tasks.

Case Analysis of Toyota and Hyundai

This section explains the cases of Toyota Motor Corporation and Hyundai Motor Company by using the analytical framework. The organizational units responsible for Toyota's overseas knowledge transfer are the mother factory and the Operation Management Consulting Division (OMCD). Among them, the role of the mother factory was particularly large. In a knowledge transfer process, the mother factory would basically send line workers to teach overseas workers, as well as to work directly on the overseas factory line. In addition, engineers were sent for ramping up manufacturing, kaizen (improvement) of the line, and problem-solving in manufacturing. The mother factory sent machine tools—even some of those that it used. Standard tasks at the mother factory were also codified and moved overseas. Organizations, skills, and layouts at overseas factories were reproductions of those of the mother factory in the home country. OMCD had the role of managing the domestic Japanese suppliers and of unifying the Toyota production system. In the overseas knowledge transfer process, OMCD sent engineers to support the resolution of issues in overseas factories and to diffuse the fundamental philosophy regarding the Toyota production system and its roots (Suh, 2015). Figure 1 summarizes the mother factory system of Toyota.

In contrast, Hyundai Motor Corporation has its own overseas knowledge transfer system. In this system, the home country factory (model factory) has a different role from the mother factory (Suh, 2012a). Hyundai, despite being heavily influenced by Japanese production systems, has a unique production system and method of transferring knowledge overseas (Jo, 2016). In their case, the

Figure 1. Knowledge transfer of mother plant system

function of the home country factory is limited. Engineers from the model factory are sent to overseas factories although workers on the shop floor are not sent overseas. Even when workers have to be sent, their role is strictly limited. The role of the company headquarters is major in the model factory system. The headquarters' engineers move overseas and continually support overseas factories. Most of the company's production equipment is made as directed by the headquarters and then moved to overseas factories. Standard tasks are documented at headquarters and then moved to overseas factories. Skills are reproduced by foreign workers with headquarters' standard tasks.

In the model factory system, the model factory's layouts and organizational structure are reproduced in overseas factories. However, reproduction of organizational culture is strictly avoided. This is due to the work organization and labor union at Hyundai. Hyundai has a highly rigid domestic work organization and work culture and thus does not want to replicate these overseas (Suh,

Figure 2. Knowledge transfer of model plant system

2012a). Although their home country factory acts as a model factory that provides the basics of production concepts, knowledge transfer and manufacturing support are mainly done by the headquarters. Figure 2 summarizes the model factory system of Hyundai.

In contrast, in the mother factory system of Toyota, the homegrown mother factory provides full support to overseas factories, and the headquarters has the role of supporting the mother factory. In other words, the mother factory has the central role in knowledge transfer to overseas factories. Another fundamental difference between the mother factory system and the model factory system involves the different roles played by the home country factories and the headquarters in the knowledge transfer process. As can be seen by the comparisons shown in Figures 1 and 2, in the mother factory system, most of the knowledge transfer is done by the mother factory, whereas in the model factory system, knowledge transfer is mainly done by the corporate headquarters. In other words, the difference

lies in which organizational unit leads the transfer of knowledge—the home country factory or the headquarters.

Changes in the Mother Factory System

Nonetheless, Toyota's mother factory system has changed as the company expands its global production. These changes can also be explained using the same framework.

Toyota has continued to increase its overseas production. At the turn of the century, overseas production rose dramatically in conjunction with the increase in demand from developing countries. Overseas production exceeded domestic production in 2007 (Suh, 2012b). As overseas production increased, so did overseas support. This support became the responsibility of the mother factory, particularly with respect to the need to send many human resources overseas. The Global Production Center (GPC) was created to reduce the overseas support load and to resystemize overseas knowledge transfer.

Toyota's GPC codified and documented shop floor best practices at Toyota and further provided tools to teach these best practices to workers. They moved these manuals and tools for best practices education overseas and helped to develop human resources in overseas factories. This role of the GPC lessened the overseas support load carried by the mother factory in the home country. The development of manuals and skill development tools by the GPC can be interpreted as codifying implicit knowledge of the mother factory. Codifying knowledge makes the knowledge transfer process efficient and swift. The need for sending human resources from the home country is lessened. Currently, OMCD is responsible for sending engineers for problem-solving and diffusion of the Toyota production system in overseas factories (Suh, 2015).

Another aspect that should be explained here is the

relationship between overseas factories and the mother factory. The mother factory–overseas factory relationship is basically dependent on what car model the factory produces. Fundamentally, if an overseas factory produces a certain car model, it receives support from the mother factory in the home country that produces the same model. With the growth of foreign markets, an overseas factory has to produce car models that multiple factories in Japan produce. In such a case, one overseas factory would have multiple mother factories. This structure is inefficient, and thus the relationship between overseas factories and mother factories was reviewed. The mother factory–foreign factory relationship is no longer determined on the basis of car model but by region. In this changed relationship, one mother factory in Japan is responsible for a particular region, and one foreign factory is connected to only one mother factory. Even though car models between the mother factory and the foreign factory are not fully matched, the mother factory can support the foreign factory without problems because transferred knowledge is accumulated over time and the capabilities of the foreign factory are nurtured. Mother factories only need to provide support for the knowledge transfer required.

Figure 3 summarizes the changed mother factory system. Home country factories and corporate headquarters mobilize members, tasks, and tools. In other words, organizations and skills are no longer a reproduction of the mother factory. Simultaneously, knowledge transfer from corporate headquarters' organizations increase in order to lighten the load of the mother factory. However, even in the changed system, the mother factory takes the lead in supporting overseas factories, just as they have always done before. The GPC and OMCD support these activities although the scope of their support has expanded.

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