MMRC
DISCUSSION PAPER SERIES

No. 390

Global Knowledge Transfer Network: The Case of Global Production Support System of Toyota

Youngkyo Suh
Graduate School of Economics, the University of Tokyo

March 2012

東京大学ものづくり経営研究センター
Manufacturing Management Research Center (MMRC)

http://merc.e.u-tokyo.ac.jp/mmrc/dp/index.html

Global Knowledge transfer Network: the Case of Global Production Support System of Toyota

Youngkyo Suh

Department of Management,Graduate school of Economics, the University of Tokyo, Japan

Keyword: Knowledge transfer, Overseas production, Mother factory

Summary: In this paper we discuss global knowledge transfer networks by examining Toyota`s global production support system. We focus on three parts of Toyota`s system, the mother plant, Operations Management Consulting Division(seisan chosa shitsu) and Global Production Center(GPC). This paper argues that these systems work as knowledge transfer network.

Global Knowledge transfer Network: the Case of Global Production Support System of Toyota

Youngkyo Suh

Department of Management,Graduate school of Economics, the University of Tokyo, Japan

1. Introduction

Japan has a very strong manufacturing industry. And many Japanese firms go abroad and utilize their manufacturing abilities. But it is not easy to transfer Japanese production system in foreign countries. Because foreign countries have different language, cultural background and market environment, Japanese production system might not work well at there. In order to solve these kinds of problems, mother plant system used for transferring Japanese production system. Mother plant supports production of foreign plants. But mother plant system is not the only systems that support foreign productions and foreign factories.

In this paper we examine production system`s transfer through the case of Toyota. In this case we will discuss transferring Toyota`s production knowledge from Japan (a home country) to overseas production bases. We assume that one of Toyota`s ownership advantages is Toyota`s knowledge about mass production. We lay emphasis on three parts of Toyota`s knowledge transfer system, the mother plant, Operations Management Consulting Division (seisan chosa shitsu) and Global Production Center.

Yamaguchi(2006) indicates that the mother plant is a key factor of Japanese production system. When a Japanese firm tries to manufacture its own products in foreign countries, it has to transfer its own knowledge to its foreign factories. In this situation, the mother plant functions as a part of tacit knowledge transfer system. Tacit knowledge is much harder to be transfered than explicit knowledge. The mother plant transfers tacit knowledge by sending its skilled workers and teaching foreign workers in the mother plant. And the mother plant also has a role in creating new organizational routines. It supports foreign factories by creating and teaching new organizational routines.

Operation Management Consulting Division (OMCD), as known as seisan chosa shitsu, was made by the former Toyota`s CEO, Oono Taiichi. The task of OMCD is, firstly education and diffusion of Toyota Production System(TPS), secondly human resource development for TPS, thirdly helping factories and suppliers solve problems, fourthly participating in “voluntary problem-solving studies(jishu ken)”, and finally local support and expansion of

TPS in foreign production(Satake1998, Fujimoto1999). TPS is not a simple production system, but a kind of organizational norm and philosophy. In foreign countries TPS is hard to be accepted because they have different cultural backgrounds from Japanese ones. Because of this kind of difficulty, OMCD has very important role in global production. Despite of importance, there is not much research on OMCD.

Global Production Center (GPC) was founded in July, 2003. It was made for human resource development and localization of model changes. Recently, Toyota`s foreign production is increasing rapidly. With increase in production, it is getting harder to transfer best practices. To overcome the problems of human resource development, GPC trains foreign factory`s trainers and supervisors. Also it is responsible for training of Japanese staff members who will be sent to overseas. Localization of model change is also important role of GPC. Manufacturing new model is time consuming process. Especially in foreign factories, introduction of new model is followed by mother factory`s model change and supported by mother factory`s staff. Now foreign and Home country staff members develop their production methods of new models together in GPC. It is for localization and time saving in overseas plants.

These three parts of global production support system have very important roles. It transfer s home country`s advantages and knowledge to foreign countries. But there is not much research on these systems. In this paper, we discuss global knowledge transfer network by examining Toyota`s global production support system. The relationship and link between these systems will be explained.

2. Transfer of Production as Knowledge Transfer

In this paper, we assume that transferring of production function from home country to foreign countries as knowledge transfer process. It means that home country`s factories and organizations have knowledge about mass production. And this knowledge forms a production system. Transferring production system to foreign countries means that transferring knowledge about production from home country to foreign countries.

Transfer of Production system to Foreign Country

Why multinational Companies(MNCs) expand overseas? This is because MNC transfer their competitive advantages based on the home country`s headquarters to overseas (Hymer1960). Foreign subsidiaries, compared to local businesses have disadvantages such as languages, local economy information, laws and regulations, and distribution networks. So MNC has to have some advantages over local businesses in order to succeed in overseas markets. Dunning(1979) developed eclectic theory by combining ownership advantages,

location advantages and internalization incentive advantages.

In research on Japanese MNCs, transferring ownership advantage are considered important factors of their overseas business. Japanese management system and Japanese production system are treated as competitive advantages. Especially in Japanese MNC`s production system, foreign factories heavily depend on home country`s advantages (Yamaguchi2006, Abo2007). But Japanese management and production system might not work well at foreign country, because foreign country has different language, cultural backgrounds, and market environments. Abo(2007) explains Japanese foreign plant by 'application-adaptation(hybrid) evaluation model'. By this model, Japanese foreign plant has two sides. One side is 'application'. It means Japanese management and production system are introduced and transplanted without modification. On the other side is 'adaptation'. It means Japanese systems are modified by foreign environments. Any Japanese firm`s foreign plant have characteristics of both sides. Similar discussions are claimed by Jeffrey et al(1999). It insist that Japanese firm`s factories in America has Japanese production system as its ownership advantage. But it has been modified because of American environments. These researchs assume that Japanese production system as ownership advantage, and Japanese firms want to transplant it to foreign countries.

Yamaguchi(2006) indicates that the mother plant is a key factor of Japanese production system. When a Japanese firm tries to manufacture its own products in foreign countries, it has to transfer its own knowledge to its foreign factories. In this situation, the mother plant functions as a part of tacit knowledge transfer system. Tacit knowledge is much harder to be transfered than explicit knowledge. The mother plant transfers tacit knowledge by sending its skilled workers and teaching foreign workers in the mother plant. And the mother plant also has a role in creating new organizational routines. It supports foreign factories by creating and teaching new organizational routines.

Knowledge Transfer and Organizations

Knowledge is created by organizations. By daily operations, knowledge has been created in organizations. Not only in organizations, knowledge could be acquired from outside of organizations. Knowledge can both be created inside and acquired from outside. And these knowledge can be a source of firm`s competitive advantages (Kogut&Zander 1993, Darr,Argote,Epple1995, Zander&Kogut1995, Szulanski1995, 1996, 2000, Almeida&Kogut1998, Argote&Ingram2000, Tsai2001, Schlegelmilch&Chini2002)

To utilize knowledge, knowledge has to be transferred from its original source to other organizational units. But knowledge transfer is far from easy. There are many barriers to knowledge transfer. Szulanski(1995, 1996, 2000) indicates that there is stickiness in knowledge transfer processes. Stickiness defines as the difficulty of transferring knowledge

within the organization.

Kogut&Zander(1993) and Zander&Kogut(1995) explain transfer of knowledge by knowledge`s characteristics. They analyzed characteristics of knowledge by codifiability, teachability, and complexity. If the knowledge is much codifiable, easy to teach, and not complex, that knowledge is less hard to transfer and its transferring speed has to be fast.

Many researches pointed out that efficiency of knowledge transfer and organizational relationship are related. Darr,Argote,Epple(1995) examine transfer of knowledge acquired through learning by doing in service organizations. Knowledge is found to transfer across pizza stores owned by same franchisee. Almeida&Kogut(1998) found that interfirm mobility of engineers and communications influences the local transfer of knowledge. Tsai(2001) focuses on intraorganizational network. It emphasizes that the network of interunit links provides channels for distributing information and knowledge. If A unit positions central network position, it has opportunities to access other unit`s knowledge and knowledge transfer will be more activated than others. Schlegelilch&Chini(2002) also emphasizes the link between knowledge transfer and organizational distance.

These researches focus on characteristics of knowledge and organizational relationship. But when knowledge transfers occurring how organizational units are interrelated each others were not discussed. Knowledge are saved in more than one organizational units (Argote&Ingram2000). Because knowledge is distributed in organization, its transfer needs organizational unit`s interrelationship and cooperation.

Research Question and Methods

In this paper, we assume transfer of production system as transfer of knowledge. And we discuss about the case of Toyota`s foreign factory. Supports from home country to foreign countries are regarded as knowledge transfer.

How multiple organizational units interact and cooperate when they transfer home country`s knowledge to foreign countries? Former researches did not discuss about these problems. How firm can management their units to transfer knowledge to overseas?

To explain this we discuss about the case of Toyota. The case is based on 4 times of factory visiting (Japan and foreign factories) and 7 times of interviews. With this case we can find how Toyota`s organizational units interact and cooperate in knowledge transferring processes.

3. The Case of Toyota: Phase 1

We divide Toyota`s knowledge transfer system in 2 phases. First phase mainly analyzes about Toyota`s knowledge transfer system before 2000. There are two important organizational units in phase1, mother plant and Operation Management Consulting Division

(OMCD). Second phase analyzes about Toyota`s knowledge transfer after 2000 and there was change in the system because of rapid growth of foreign production. In phase2 we will discuss about Global Production Center (GPC), mother plant and OMCD.

Phase1 - Mother Plant

Toyota`s first foreign plant was NUMMI (New United Motor Manufacturing, INC.). Its factory located in Fremont, California and it was joint venture with General Motors. NUMMI was the first experience of transfer Toyota Production System (TPS). Takaoka plant supported NUMMI`s factory. Engineers are sent to NUMMI for its ramp up from Takaoka.

After NUMMI, Toyota built its own foreign plant in America alone. It was Toyota`s Kentucky plant. Japanese Tsutsumi plant supported to launch Kentucky plant. Kentucky plant was planned as a mirror factory of Tsutsumi plant. It means that Kentucky plant was a copy version of Tsutsumi plant.

When Toyota build foreign factory, they choose Japanese plant to support it. Not only supporting for launching foreign plant, but also supporting for daily manufacturing. Supporting Japanese factory is called ‘mother factory’ of ‘parent plant’. In this paper we call this system as ‘mother plant system’. Mother plant is a key factor of Toyota`s knowledge transfer system.

Mother plant has 5 roles for supporting foreign plant. First launching support, second new model manufacturing support, third skill training, fourth kaizen, and finally problem solving support.

Launching support is the first step of foreign plant supporting process. Mother plant is a base of foreign plant. Basically foreign plant is reproduction of mother plant. Because of different market environments and local situation, it has to be modified. But Toyota want to keep TPS in foreign plants and reproduction of mother plant is the best way to do that. To launch foreign plant, mother plant sends its engineers.

New model manufacturing support is important role of mother plant. Toyota`s new model was basically developed by development department in Japan. After development, mother plant put new model producing to trial. In trial producing, problems about manufacturing and producing line lay outs are determined. Home county`s mother plant decide the way to produce new model, and it is transferred to foreign plants. Mother plant manufacture new model before foreign plant and its experiences and knowledge are transferred to foreign plants.

Skill traning, kaizen, and problem solving are daily support in production site. Skill training is teaching skills for producing cars to workers. Japanese workers or engineers from mother plant teach producing skills or foreign workers can be trained in Japanese mother plant. This trainings include not only producing skills but also management skill at production site (e.g.

role of group leader, team leader). Kaizen means improvement in Japanese. At production site kaizen means pursuit of better manufacturing way and continuous improvements Fujimoto(1999). Mother plant support foreign plant`s kaizen by transfer its kaizen outcome. Kaizen that already been done in mother plant is transferred to foreign plant. Finally, if foreign plant has problems or trouble in production sites mother plant support to solve the problems.

These kinds of mother plant`s support are done by humane transfer. Supports are done by sending mother plant`s engineers and workers to foreign plant or by accept foreign plant`s engineers and workers at mother plant.

Phase1 - Operation Management Consulting Division

Operation Management Consulting Division(OMCD) is an organizational unit unique to Toyota. It established in 1970 by Taiichi Ohno as a staff office in the Production Control Division. It has been in change of maintaining, diffusing and educating employees about the Toyota Production System (TPS) both inside Toyota and at Toyota Group parts suppliers(Fujimoto1999).

Its current mission can be broken down as follows: educating employees about TPS, implementing TPS principles on the shop floor in collaboration with TPS instructors (shusa) who belongs to each plant, participating in “voluntary problem solving studies (jishu-ken)” by the plants or by the suppliers, diffusing and educating employees about TPS to foreign subsidiaries and plants.

To educate about TPS, OMCD supplies contents about TPS class. TPS class is included in Toyota`s human resource development courses. Each plant has a employee called TPS instructor(shusa). OMCD works with TPS instructor to improve production sites (kaizen). With kaizen they can teach TPS concepts to employees. Also OMCD participates in voluntary problem solving studies (jishu-ken). Toyota`s plants can solve problems of production in studies. Toyota Group parts suppliers have their own voluntary problem solving studies too.

And OMCD also has a role for foreign subsidiaries and plants. OMCD diffuses and educates about TPS to foreign employees. Foreign plant is mainly supported by its mother factory, but in some cases OMCD can supports it. When OMCD is requested help or support by mother plant, it can support foreign factories.

In foreign sites, OMCD`s roles are little different from domestic roles. About TPS class, OMCD provides the contents of TPS to foreign plants or subsidiaries. Sometimes foreign employees are sent to OMCD and be educated in there. OMCD also do the kaizen in foreign plant to diffuse and educate TPS. Finally, there is voluntary problem solving studies by foreign plants and OMCD participate it. But there is no voluntary problem solving studies by foreign parts suppliers. OMCD supports foreign parts suppliers when they are requested.

OMCD has a role for maintaining, diffusing and educating TPS not only in domestic sites, but also foreign sites.

Phase 1 - Summary

Toyota`s knowledge transfer system in phase 1 is consisted with mother plant and Operation Management Consulting Division (OMCD).

Phase 1`s knowledge transfer system is largely dependent on people`s transfer. In this phase knowledge transfer is done by moving people. Mother plant sends engineers or workers to foreign plants to transfer its knowledge. Foreign plant sends its employees to Japan for education in mother plant. Yamaguchi(2003) indicate that this kind of knowledge transfer by moving people is efficient for transferring tacit knowledge. Mother plant is a system for transfer tacit knowledge to foreign plants without knowledge conversion (tacit knowledge to explicit knowledge). OMCD`s supporting was also based on sending its people to foreign sites.

Another characteristic of Phase1`s knowledge transfer system is its knowledge creation sources. In this phase, creation of knowledge is highly dependent on home country. Of course knowledge mainly flows from home country to foreign countries. Mother plant supports foreign plants in many ways, but it only transfer knowledge that be created in Japan. For launch a new model, mother plant produce new model before foreign plant did. And mother plant`s experiences and knowledge about new model are transferred. In case of kaizen, mother plant adapts kaizen that already occurred in mother plant to foreign plants. OMCD also transfers its knowledge about TPS that is created and maintained in Japan.

Mother plant and OMCD has a complementary role in knowledge transfer system. Mother plant supports problems of production sites and substantive manufacturing such as launching support, new model manufacturing support, skill training, kaizen, and problem solving support. In contrast, OMCD supports in philosophy and attitude about TPS. This is because the characteristics of TPS. TPS is not only production methods, but also philosophy and thoughts of production. To transfer knowledge about Toyota`s manufacturing and TPS, they have to transfer different kinds of knowledge. Because of these differences, two organizational units of Toyota transfer different kinds of knowledge to foreign plants. And it works as complementary system.

4. The Case of Toyota: Phase 2

Phase 2 is about Toyota`s knowledge transfer after 2000 and there was change in the system because of rapid growth of foreign production.

After 2000`s, production in overseas grew rapidly. With growth of production in overseas,

numbers of foreign factories grew too. And with growth of numbers of foreign factories, Toyota`s knowledge transfer system has been changed.

Phase 2 – Mother Plant

Mother plant was the core of Toyota`s knowledge transfer system. TPS includes much tacit knowledge in it. As stated before, mother plant system was effective system for transfer Toyota`s tacit knowledge to foreign plants.

Mother plant system also changed with rapid growth of foreign production volume. Mother plant mainly supports foreign plants by sending its people. But numbers of foreign plants are increased and mother plant lacks of its human resources.

With shortage of human resources, lack of consistency in the support of foreign plant is also the problem. People sent from mother plant transfers tacit knowledge embedded in them. But tacit knowledge of individuals highly depends on its personal characters. If supporter from mother plant are changed, the knowledge from supporter might change with it. And there is differences between home country`s plants. Toyota has multiple plants in Japan. All the plants are run by TPS, but details are different. Mother plants transfer knowledge from their experiences. It means each mother plant transfers different knowledge to its supported foreign plants.

Mother plant was decided by models. If foreign plant A are planned to produce model B, domestic plant that produced model B is decided foreign plant A`s mother plant. Production of same model was required for knowledge transfer from mother plant to foreign plants.

But foreign market has a different condition with domestic market. To fulfill those needs foreign plant has to produce models that are not produced in its mother plant. For production of those models, one foreign plant has to be supported more than one mother plants. Also with domestic market`s change, mother plant`s production model might be changed. These situations make mismatches in production models of mother plant and foreign plant. Mother plant system`s knowledge transfer decreased its efficiency.

Toyota changes its mother plant`s support for its consistency. In this paper, we see this change with Toyota`s plants in china.

Tianjin FAW Toyota Motor (TFTM) is a joint venture of Toyota and FAW motor. It established in 2000, and started its manufacturing at 2002. Plant 2 was built in 2005, and plant 3 was built in 2007. All three plants produce different models.

Plant 1 and plant 2`s mother plant was mainly Motomachi plant. But Tahara plant supported TFTM`s plants. These mother plants were decided by production models. And plant 3 is supported by Takaoka plant. These 3 mother plants are similar production system but little different in details. There were 3 teams from each mother plants in TFTM. These team members cannot be mixed or moved. And communication between teams were not activate.

After 2008, TFTM unifies its mother plant to Takaoka Plant. Supporters from Motomachi and Tahara plant are decreased and supporters from Takaoka plant are increased. By unifying mother plant TFTM can solve common production problems its plants and communications between supporters are improved.

Phase 2 - Operation Management Consulting Division

The role of OMCD is not changed basically from Phase 1. OMCD`s role for foreign sites is diffusing and educating TPS. But there is change in its systems.

OMCD`s role for foreign sites were done by sending people to foreign plants. Similar to mother plants, with rapid growth of foreign production volume, OMCD has shortage of human resources. Therefore, OMCD decided to set up sub unit of OMCD in regional headquarters. It is called operation management development division. America, Europe (England), Asia (Thai) have operation management development division in there. It is consisted with OMCD`s officers from Japan and officers hired by regional.

Operation management development division cooperate with TPS trainer in each foreign plants. TPS trainer is similar with TPS instructors (shusa) in domestic plants. TPS trainers have roles to do kaizen in production sites and educate TPS. TPS trainer alternate the roles formerly done by supporters from Japan.

Phase 2 – GPC

Global Production Center (GPC) is established in 2003. Establishment of GPC is deeply related to growth of foreign production. Toyota`s production volume in 2003 was 6millions. Toyota planned to increase its volume to 10million till 2010. It means Toyota has to increase 4millions in 8 years. And it depends mainly on foreign production. When Toyota increases its production volume in overseas, many problems have been occurred.

What were the problems? As mentioned before, Toyota`s knowledge transfer system was highly dependent on people. Transfer of knowledge is mainly done by moving people. When foreign production is increased, Toyota needs to send large numbers of people to foreign plants. But numbers of human resources in home country have limitation. Another problem is launch speed of foreign plant. To grow foreign production rapidly, foreign plant have to be launched fast. Toyota`s knowledge transfer emphasize on transfer of tacit knowledge and transferring by people. It was very powerful way to diffuse and utilize TPS but relatively time consuming way.

To solve these problems, Toyota has to change its way of knowledge transfer. GPC has established to solve these problems. GPC has 2 roles. First, it develops tool for training of human resources of domestics and foreign. Second, it reduces the time of switching new model. We focus on GPC`s role in Toyota`s global knowledge transfer system.

GPC develops tool for train workers at production sites. To speed up of training, it sets fundamental skills of manufacturing and develops tools for teach fundamental skills. Workers produce cars by following standard tasks. Standard tasks are consisted by elemental tasks. In period of time, numbers of elemental tasks have to be done by fixed order. That is the standard task of Toyota. Fundamental skills are skills that be needed to perform elemental tasks. By mastering these fundamental skills workers can produce cars successfully and repeatedly.

To teach fundamental skills, GPC developed Visual Manuals. Visual Manuals explains fundamental skills to workers by videos, animations, and textual description. Workers can master fundamental skills easily and fast with visual manuals. After training with visual manual, workers can practice it in training facilities. These kinds of trainings for workers were mainly done implicitly at production sites. GPC develops manuals about these trainings. GPC develops visual manuals about 18 sections of production.

Each plant trains its workers with visual manuals. And each plant has its trainer. These trainers are trained by master trainer in GPC. Master trainer trains trainers and send them to each plants.

Not only fundamental skills, but also leader`s roles at production sites are turned into manuals. In Toyota`s production sites team leader, and group leader are responsible for management for workers and productions. To be a leader, rich experiences and tacit knowledge about production are needed. But with rapid growth of foreign production, it becomes hard to train leaders in foreign plants. Traditional ways to train leaders was time consuming. To solve this problem, GPC develops manuals about leader`s roles. It is called floor management development system. GPC tries to utilize this for human resource development.

Another role of GPC is to make new model change fast. Former way of model change was leaded by mother plant. Mother plant has to produce new model before foreign plants and foreign plants are transferred its experiences and knowledge about new model production. In this way, new model production of foreign plant always be followed by mother plant. And mother plant has to send large number of supporter to foreign plant.

To solve this problem, GPC built facilities for trial production of new model. GPC has pilot line facilities for welding, painting and assembly line for production. When a new model is planned to be produced not only domestic plants, but also foreign plants, all the people from plants that be expected to produce a model, gathered in GPC and prepare for its production. By doing so, people of foreign plants can participate in the preparation process of new model production. This can reduce the support from mother plant and possibly reduce the time for model change.

GPC is located in Japan, but there are sub unit of GPC in Toyota`s regional headquarters.

Toyota has 3 regional headquarters, America, Europe (England), Asia (Thai). Each regional head quarter has its own sub unit of GPC. Master trainers in regional GPC train trainers and send them to regional foreign plants. But these Master trainers of regional GPC are trained in GPC of Japan. Also regional GPC has its own pilot line for preparing new model`s production, but it only be used for regional models.

Phase 2 – Summary

In phase 2, Toyota`s knowledge transfer system is changed because of rapid growth of foreign production volume. What was different in systems between phase 1 and phase 2?

Characteristic of Toyota`s knowledge transfer system in phase 1 is knowledge transfers mainly by people. Sending people or being sent people was important way to transfer knowledge. But with rapid growth of foreign production, Toyota lacks of human resources. And management of mother plants had problems too. Phase 2 of Toyota`s knowledge transfer system is a result of these problems and correspondences.

GPC is a organizational unit established for solve these problems. GPC trains master trainer and master trainers train trainers. Trainers are sent to foreign plants and train workers at production sites. By doing this, mother plants role for skill training can be reduced. And visual manuals reduce time for training and numbers of trainers. GPC`s pilot line also reduces mother plant`s support for new model change.

Another change occurs in knowledge flows. In phase 1, knowledge only flows from home country to foreign countries. But in phase 2, knowledge can flow in regional. GPC and OMCD have its sub unit in regional head quarters. Knowledge can flow from these sub units to foreign plants. Home country is not the only source of knowledge. Regional headquarters are now one of the source of knowledge.

So in phase 2, how these three organizational units cooperate for knowledge transfer? Mother factory and OMCD basically cooperate similar to phase 1. They transfer different type of knowledge about TPS. But their roles are relatively decreased. GPC supports mother plant and OMCD. Mother plant and OMCD mainly concentrated on transfer of tacit knowledge. GPC tries to turn tacit knowledge into explicit knowledge. Explicit knowledge can be transferred fast and easily. Visual manuals and floor management development system are examples of explicit knowledge. But explicit knowledge is made for faster transfer tacit knowledge. This will be described in discussion.

5. Discussion

In Toyota`s knowledge transfer system, mother plant and OMCD cooperate and work complementary. Mother plant and OMCD transfer different type of knowledge to foreign sites.

Mother plant support and transfer knowledge about daily production, OMCD support and transfer knowledge about attitude and philosophy of production. This can be explained with organizational routines and organizational norm. Mother plant transfers knowledge about organizational routines and OMCD transfers knowledge about organizational norm.

Organization forms a organizational routine through daily operation. Behaviors are done repeatedly and form a pattern (Nelson&Winter1982).Organizational routine makes firm`s operation efficient. At production sites, hundreds of vehicles are produced per day. Workers have to do their work repeatedly and keep stable quality. These production activities form organizational routines. To transfer knowledge about routines mother plant system was used.

Organizational norm is shared by all organizational members. It is a philosophy, attitude and value that all members share. Argyris&Schon(1978) indicate that, when organization accept new information or knowledge, organizational norm is the most hard part to change. OMCD`s roles for foreign sites are transfer knowledge about organizational norm that is hard to transferred and settled.

GPC`s role is turning tacit knowledge into explicit knowledge. For example, visual manual is turned tacit skills of production into videos and texts. Floor management development system is also turned tacit skill of management at production sites into manuals. Explicit knowledge is easier and faster to transfer than tacit knowledge (Kogut&Zander1993, Zander&Kogut1995). But these explicit knowledge works as base for tacit knowledge. Fundamental skills are base for learn elemental tasks, and standard tasks. If workers do not master fundamental skills, learning elemental tasks and standard tasks will be delayed. FMDS is a manual for leaders, but it is positioned a base for leader`s training at production sites. Explicit knowledge made by GPC works as support tools and bases for mother plant and OMCD`s knowledge transfer.

Toyota wants to transfer their implicit production system to foreign plant as possible as they can. Mother plant and OMCD works complementary. They transfer different types of knowledge. And GPC supported it by developing tools and converting knowledge.

Also the source of knowledge has been multiplied. GPC and OMCD have its own in regional headquarters. Knowledge can flow in regionally. But original knowledge creation in regional is still rare. The majority of regional knowledge transfers to plants are created in Japan.

Tsai (2000) inidicates that the network of interunit links provides channels for distributing information and knowledge. The closer network of two organization unit is, the more knowledge transfer occurs. Distance of network is defined as frequency of communication between organizational units. In Toyota`s knowledge transfer system, regional knowledge source can interpret as closer network position. Home country and foreign plants are harder to communicate than regional headquarter and foreign plants. Regional office could

communicate better than home country`s units and organizational network distance can be reduced. And knowledge transfer can be effective and frequent.

6. Conclusion

This paper explains about Toyota`s global knowledge transfer network. Support for foreign plants can be explained by knowledge transfer. Home county`s knowledge can be transferred to foreign countries and it can support and work as competitive advantage. Toyota`s knowledge transfer system analyzed by dividing in 2 phases. We indicate that multiple organizational units can cooperate for effective knowledge transfer.

More than one organizational units work as a knowledge transfer network. Different types of knowledge can be transferred by different units. Tacit and explicit knowledge also can be transferred by different units. And different network position can activate knowledge transfer. Organizational units can work complementary and configure knowledge transfer network.

However this paper`s case deals with only one firm. Other firms can have different organizational structure and environments. More cases about multiple organizational units knowledge transfer system need to be investigated. Empirical methods also be needed. An empirical approach has to be tested for further researches.

References

Abo.T.(Eds.).(2007) *Japanese Hybrid Factories: A comparison of Global Production Starategies*, Palgrave macmillan

Dunning.J.H.(1979) Explaining Changing Patterns of International Production: In Defense of the Ecletic Theory, *oxford Bulletin of Economics and Statistics*, vol.41, pp.269-295

Fujimoto.T.(1999) *The Evolution of a Manufacturing System at Toyota*, New York : Oxford University Press

Hymer.S.(1960) *The International Operations of National Firms*. Doctoral dissertation, MIT. Publsished in 1976, Cambridge,MA; MIT Press

Satake.H.(1998) *Generation, Development, Transformation of Toyota Production System*, toyokeizaisinposya

Yamaguchi.T.(2006) *Organizational Capabilities of Multinational Enterpreses: Mother Plant System of Japanese Firms*, hakutoshobo

Almeida.P&Kogut.B(1998) Localization of Knowledge and the Mobility of Engineers in Regional Networks, Management Science, Vol.45 No.7 pp.905-917

Kogut Bruce & Udo Zander (1993)、KNOWLEDGE OF THE FIRM AND THE EVOLUTIONARY THEORY OF THE MULTINATIONAL CORPORATION, *Journal Of International Business Studies*; Fourth Quarter 1993; 24, 4 pp625- 645

Darr E.D, Argote. L, Epple.D(1995) The Acquisition, and depreciation of Knowledge in Service Organizations: Prodctivity in Franchises, *Management Science*, Vol.41 No.11 pp 1750-1762

Szulanski.G(1995) UNPACKING STICKINESS: AN EMPIRICAL INVESTIGATION OF THE BARRIERS TO TRANSFER BEST PRACTICE INSIDE THE FIRM, *INSEAD working paper series*

Szulanski.G(1996) Exploring internal stickiness : Impediments to the transfer of best practice within the firms, *Strategic Management Journal*, Vol.17 27-43

Szulanski.G(2000) The Process of Knowledge Transfer: A diachronic analysis of stickness, *Organizational Behavior and Human Decision Processes*, 82(1), 9-27

Schlegelmilch.B.B, Chini.T.C(2003) Knowledge transfer between marketing function in multinational companies: a conceptual model, International Business Review, Vol.12 pp215-232

Tsai.W(2001) Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance, Academy of Management Journal, Vol.44 No.5 pp996-1004

Zander.U&Kogut.B(1995) Knowledge and the Speed of the Imitation of Organizational Capabilities: An Empirical Test, *Organizational Science*, Vol.6, No.1 76-92

知識移転のネットワーク：トヨタ自動車における海外生産支援を事例に

徐寧教(ソヨンキョ)
東京大学大学院経済学研究科経営専攻博士課程

キーワード：知識移転、海外生産、マザー工場

要約：本論文では、トヨタ自動車において、本国のマザー工場が海外生産拠点をどのように支援していて、それがどのような意味を持っているかを分析する。更にマザー工場システムだけではなく、生産調査室、GPC という組織ユニットも知識移転に関与していることを説明する。そして、これらの組織ユニットが知識移転のネットワークとして本国から海外への知識移転に寄与してことを明らかにする。