

Global Innovation and R&D for Knowledge Creation

- The Case of P&G, Unilever and Kao -

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Abstract

Many multinational enterprises (MNEs) have launched new products in overseas market places while conducting their R&D activities mainly at home. However, in these past 10 to 20 years, as a result of the geographical dispersion of scientific and technological knowledge creation, and in the emerging market, these companies now conduct their R&D activities, in collaboration with other institutions at home and abroad.

Traditional knowledge creation theories, however, including strategic management theories, have hardly highlighted the impact of cross-border collaborative R&D activities on knowledge creation processes and the dynamic interconnectedness between R&D facilities from the perspective of the source of global competitiveness and dynamic capabilities. This study has analyzed the case of Kao, P&G, and Unilever to examine how far these MNEs leverage overseas human R&D resources that can be regarded as knowledge creation processes. The authors examined three companies' papers published in the US, UK, and Netherlands.

As a result of the analysis, the authors find that there is an increasingly dynamic knowledge creation mechanism as one of the global open innovation systems. This mechanism was promoted by the cross-border and inter-institutional collaborative R&D activities by these MNEs. These tendencies would enhance the theoretical importance of the management of the new knowledge creation process as the main resource of dynamic capabilities of MNEs.

Key Words:

Knowledge Creation, Globalization of R&D, Collaborative R&D Activities, Dynamic Capabilities

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Introduction

The objective of this research is to identify the directional shift toward the decentralization of scientific technological knowledge creation by Multinational Enterprises (MNEs) in the global market and to determine the extent that MNEs leverage local knowledge. Therefore we try to analyze how firms can retain competitive advantages from the view point of the global knowledge creation. In doing so, we try to overcome intrinsic static views in the resource based view and clarify sources of contemporary MNEs' dynamic capabilities.¹ We also try to examine dynamic capabilities of contemporary MNEs group which can be seen as MNEs-specific from the analysis of the overseas subsidiaries' R&D capabilities. In particular, we are going to clarify the relationship between mechanism of global knowledge transfer and knowledge creation process by MNE groups and source of global competitive advantages through targeting MNEs who have been successfully introducing new products in the global marketplace.

Scholars have recently focused on the role of knowledge in explaining the existence MNEs. Large MNEs exist not as a response to market failure in the buying and selling of knowledge, but as a consequence of their ability to organize the generation and transfer of this knowledge worldwide. These firms are described as repositories of knowledge that are able to create unique capabilities. Since these capabilities are fostered through firm-specific social learning processes, they are easier to transfer within the MNE group than across organizations, and constitute the true ownership advantages of the MNE as a group (Cantwell, 1989, 1991, 1994; Kogut and Zander, 1993, 1995). As many existing literatures on globalization and decentralization of R&D have suggested, MNEs have been trying to innovate through knowledge creation through utilizing subsidiaries' R&D resources, R&D facilities in a host country. In this fast changing competitive environment, business organizations such as MNEs have been under considerable pressure to respond to competitor firms not only in the MNE's home country but also its host countries. MNEs have been trying to

¹ In our research we refer points of argument by Barney(2002), Wernerfelt(1984), Dunning(1996), Casson(1991), Cantwell(1995), in particular, how existing theories of MNEs are reexamined as bodies possessing dynamic capabilities (Teece: 2009; pp.136-175).

develop differentiated new products on enhancing global scale. Therefore, generating new technological knowledge and new concepts that are in high demand in order for companies to develop new products has become a necessity more than ever before. In order to raise the probability of success in new product development, the general R&D strategy which had been used until 1990s was to invest further in R&D facilities and human resources and in so doing to raise the R&D capability within the organization. However, due to changes in the global competitive environment and the shortening trend of the product lifecycle, strengthening R&D activities in many organizations merely led to the further lowering of R&D investment efficiency.

Although R&D has been considered as the least globalized functions of MNE group (UNCTAD; 2005), the more global the company, the more it was pressured to employ R&D human resources in a strategic manner regardless of nationality. Traditional decentralization of R&D was found from developed home country to developed host countries. Within the context of a capabilities-creating subsidiary, Birkinshaw and Hood (1998) introduce the concept of a subsidiary's charter in terms of markets served, products manufactured, technologies possessed, functional areas covered, or any combination thereof. The charter is typically a shared understanding between the subsidiary and the parent TNC regarding the subsidiary's scope of responsibilities. A subsidiary needs a certain level of decision making autonomy to be able to pursue charter-enhancing and reinforcement initiatives. When we consider the level of decision making autonomy, the autonomy level of a subsidiary is affected and controlled by the strategy of the parent TNC. This strategy affects the subsidiary's charter changes and its capacity to evolve towards competence-creating status. If MNE undertake R&D in developing countries, their R&D functions are for adapting products and processes to local conditions. The production process is no longer driven only by the need for local adaptation; R&D by MNE is required to respond to increased competition, access foreign pools of research talents, reduce R&D costs and speed up the process of technology development (UNCTAD; 2005). As a result, these global companies were able to retain their multicultural knowledge resources as part of their institutional capability. As such, theoretical arguments on globalization of R&D have evolved over time (Hayashi: 2004). In 1970s and 1980s, theoretical arguments on globalization of R&D were centered on MNEs from U.S.A and European countries. However, the more the production of scientific technological knowledge has decentralized globally against the backdrop of even the most global companies having

difficulty in forming a competitive global edge, based on the closed national innovation system, it is evident that the focus has shifted to centering on the principle of “metanational innovation” (Doz, Santos and Williamson: 2001, Doz: 2006, Asakawa: 2006). We also try to investigate to what extent national origin of human resources in the R&D facilities has been diversified and to what extent MNEs in the culture-specific industry leverage local R&D human resources and construct R&D networking within the region in developing new products for enlarging regional markets. In order to develop our research focusing on these issues, we assume that analyzing the subsidiary-specific R&D capabilities on the mechanism of knowledge transfer and knowledge creation through global R&D networking by MNEs is necessary.

We look at the cases of three MNEs in the culture-specific industry in which sensitivity to meet locally bounded consumers’ demand is necessary. Three companies are selected according to the high market share in the global market, but from different national origins. Therefore, we selected one from Europe, one from USA and one from Japan. We configure subsidiary evolution in a host country, where our attention will be specifically given to the R&D activities in subsidiaries in host countries. We are aiming at analyzing MNE-specific global knowledge creation mechanism as one of MNEs innovation system within the MNE group through analyzing the R&D activities by subsidiaries in not only host developed countries but also host developing countries. In order to clarify how MNEs create knowledge strategically during the process of new product development for global markets or regional markets, we employ methods which analyze the research papers as outcomes of R&D activities and knowledge creating activities by MNEs group. We have collected 2893 technical and scientific research papers in which the names of authors (researchers and engineers) belonging to Kao, P&G and Unilever which are competitive in developing new products in the culture-specific industries.² Using the analytical methods, we categorize the papers into departments within the targeted three MNEs which authors belong to, national origin of affiliated organization, and the same information of co-authors for joint research. Categorized information was used to investigate evolution of global mechanisms of creating knowledge by targeted MNEs. The periods studied are selected as 1981-1983,

² From previous research which focused on the Culture-free industry (e.g. MNEs in electrical and electronics industries), evidences suggested that that globalization of R&D activities have evolved over time (Serapio and Hayashi:2004, Hayashi and Serapio:2006, Hayashi:2007c、Iguchi:2006, 2008). This research paper focused on the cases of MNEs in the Culture-specific industry such as toiletry, food and beverages in order to clarify if MNEs in this type of industry have similar results or not.

1991-1993, 2001-2003, and 2006-2008. Technical and scientific research papers are limited to those published in the UK, US, and Netherlands where major scientific journals are published.

Arguments on Innovation Systems by MNEs

The geographical decentralization of scientific and technological knowledge production (Tidd, Bessant and Pavitt, 1997; Hayashi, 2004), the increasing risks associated with R&D, as well as the rapidly shortening trend of product development lead time have staggeringly increased the strategic importance of the leverage of external knowledge (Badaracco, 1991; Rosenbloom and Spencer, 1996; Robert, 2001; Chesbrough, 2003, 2006). In this regard, while the development of internationally renowned new technology needs constant intersections or boundaries between multiple technological fields, this trend has at the same time led to the necessity for collaborative research with other internationally distinguished organizations in related fields. As a result, the globalization of R&D activities and networking has become an inevitable trend (e.g., Pearce and Papanastassiou, 1996; Nakahara, 2000; Takahashi, 2000; Serapio and Hayashi, 2004; Medcof, 2001, 2004; Hayashi and Serapio, 2006; Iwata, 2007).³ Argument on National Innovation Systems (NIS)⁴ also supports the view. “Innovation” is traditionally divided into product innovation and process innovation (Schumpeter, 1926). When we consider technological innovation, we have to realize that firms do not normally innovate in isolation, but in collaboration with and interdependence on other organizations (Fagerberg and Godinho, 2004). Through innovation activities, the successful introduction of a new or improved product to the global marketplace is crucial for MNE groups (Dorfman, 1987; SPRU, 1972; Kamien

³ Gross domestic expenditure on R&D in 2002 was 676,514 million US dollars, corresponding to an average annual growth rate of 2.8% since 1996 (UNCTAD, 2005). Significant feature of R&D spending is that more than 86% of the world total R&D spending was dominated by the ten largest spenders. In host developing countries, R&D expenditure by MNE subsidiaries accounted for 17.7% of total R&D expenditure in 2001 increased from 2.3% in 1993 (UNCTAD, 2005).

⁴ NIS is defined by Freeman as “the network of institutions in the public and private sectors whose activities and interactions initiate, import, and diffuse new technologies” (Freeman, 1987: 1). Two major studies on NIS are Lundvall (1992) and Nelson (1993), which take different approaches to NIS. Nelson (1993) emphasizes empirical case studies and narrowly focuses on nations’ R&D systems. By contrast, Lundvall (1992) is theoretically oriented and seeks to develop an alternative to the neo-classical tradition in economics by placing interactive learning, user-producer interaction and innovation at the centre of the analysis (Lundvall, 1992: 1). Similar to Lundvall’s “innovation at the centre of the analysis” is the idea that the main sources of innovation are promoting the creation and dissemination of knowledge (Nelson and Rosenberg, 1993) by the activities of organizations such as firms, industrial research laboratories, research universities, and government laboratories. Edquist (1997b) uses a more general definition emphasizing both organizations and determinants, defined as “all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of innovations” (14).

and Schwartz, 1982). Organizations and institutions are components of systems for the creation and commercialization of knowledge. Organizations are defined as entities within the system such as firms, universities or public agencies responsible for innovation policy and competition policy, and are formal structures that are consciously created and have an explicit purpose (Edquist and Johnson, 1997: 46-47). Institutions are defined as “sets of common habits, norms, routines, established practices, rules, or laws that regulate the relations and interaction between individuals, groups, and organizations” (Edquist and Johnson, 1997: 46). Innovations by firms always emerge in such systems of innovation. Edquist (2004) argues that systems of innovation have a function to pursue innovation processes, i.e. to develop, diffuse and use innovations. The activities of the principle protagonists in systems of innovation are those which determine the main function of the system, and thus exert influence on the innovation processes. The relevant activities which can be expected to be important examples of this in most systems of innovation (Edquist, 2004: 190-191) include: 1) the provision of R&D, 2) the creation of new knowledge, 3) competence building, 4) networking through markets and other mechanisms, including interactive learning between different organizations involved in the innovation processes, and 5) the provision of consultancy services of relevance to the innovation process. Functions and activities were not addressed in the original literature; however, as Liu and White (2001) focus on “activities” being related to “the creation, diffusion and exploitation of technological innovation within a system” (1093), we stressed activities and functions within innovation systems as important factors affecting innovation activities by MNEs group.

An analysis of the innovation system must examine the effectiveness of these actors and their interactions along the trajectory of innovation activities. The literature on innovation system emphasizes the importance of diversified linkages among the various components of the institutional environment, as well as between organizations, in improving competitive performance, and this emphasis particularly applies to the relationships between firms, universities and government agencies within the innovation system. For knowledge-based or learning economics, such interactions among different actors within innovation systems are crucial to the production, accumulation and diffusion of knowledge in promoting competitiveness through technological change and innovation (Lundvall and Johnson, 1994; Archibugi and Lundval, 2001). Collaborative innovation always involves external interactions among customers, local suppliers, regulators

and knowledge providers (Edquist, 1992; David and Foray, 1994; Freeman, 1991, 2001; Guinet and Polt, 1998; Byrant and Wells, 1998; Raymond, 1996). Such co-operation is essential not only at the national level, but also at regional and global levels.

Dynamic capabilities of MNE

Issues related to inter-organizational linkages between capabilities of subsidiaries and MNEs headquarter in the home country have been discussed through subsidiary evolution (Birkinshaw & Hood:1998) from dynamic capabilities point of view, Home-base-augmenting or Home-base-exploiting R&D (Kuemmerle, 1997) from globalization of R&D point of view. Literatures also suggested “supply-side factors such as obtaining R&D human resources and access to new technology” (Florida, 1997), competence-creating subsidiaries and competence-exploiting subsidiaries (Cantwell and Mudambi, 2005) for the linkages, and dynamism of enhancement of R&D capabilities of overseas subsidiaries and MNEs headquarters (Asakawa, 2001a, 2001b, 2004). Although focus of the previous scholars was based on the issues of MNEs in general or subsidiaries in U.S.A. and European countries, recent researches on subsidiary evolution of contemporary MNEs have shifted to focus on subsidiaries in host developing countries such as ASEAN countries (Iguchi, 2006, 2008).

Large MNEs such as Kao, P&G and Unilever exist not as a response to market failure in the buying and selling of knowledge, but as a consequence of their ability to organize the generation and transfer of this knowledge worldwide. These firms are described as repositories of knowledge that are able to create unique capabilities. Since these capabilities are fostered through firm-specific social learning processes, they are easier to transfer within the MNE group than across organizations, and constitute the true ownership advantages of the MNE as a group (Cantwell, 1989, 1991, 1994; Kogut and Zander, 1993, 1995). Responsibilities and roles of subsidiaries and the functional scope that a subsidiary has in a host country will vary depending on the nature of inputs available in the host country. However, due to changes in subsidiaries and their history of operations in host countries, subsidiaries became aware that the parent organization was not the sole source of competitive advantage for the MNE group.

In recent years, some subsidiaries have gained a more creative role linked to the closer integration of subsidiaries into global networks within the MNE group. These subsidiaries within internationally integrated strategies in the MNE group are characterized as having a competence creating role, while others continue to be competence-exploiting subsidiaries (Cantwell and Mudambi, 2005). Therefore, increasing research attention was given to subsidiaries which reflected recent phenomena, specifically competence-creating subsidiaries. The competence creating subsidiaries use local knowledge and creative inputs, to develop new products aimed at expanding the global marketing scope of their MNE group (Burgelman, 1983a, b; White and Poynter, 1984; D'cruz, 1986; Cantwell, 1987; Pearce, 1992, 2001; Rugman and Verbeke, 1992; Dunning, 1996). The competence creating subsidiaries have supportive autonomy and creative scope, allowing some element of asset-seeking or knowledge seeking behavior based on their ability to affect MNE group's competitiveness and the creative assets of the host or regional economy. In order to function effectively, the MNE must rely on the area in which it is located to obtain existing local technology and unique elements of research capacity in the local science base and sufficiency in human capital. Therefore, the emergence of competence creating subsidiaries is a crucial manifestation of an increasingly decentralized approach to the generation and application of knowledge in contemporary MNEs. This approach attaches importance to the role of the capabilities of the subsidiary and emphasizes that the subsidiary is part of a network (Birkinshaw and Hood, 1998).

As theoretical argument suggests, conducting global collaborative R&D is necessary for new product development and for creating novel substance which is required for developing new products to the market to meet global consumers' demands. We examine whether an inherently different knowledge creation mechanism of MNEs can be discovered through analyzing the outcome of R&D activities of Kao, P&G and Unilever. Firstly, we identify the directional shift toward the decentralization of scientific technological knowledge creation on a global scale leads to tendencies toward cross-border knowledge creation strategies in order for MNEs to leverage globally dispersed excellent knowledge. Secondly we also clarify to what extent MNEs in culture-specific industries decentralize R&D and construct R&D network to leverage locally specific knowledge in the target region so as to develop products which fit regional market needs. Finally we try to

analyze the global knowledge creation mechanism by MNE groups, hence innovation system of particular MNEs.

Definitions and Evolution of R&D laboratories

When we discuss R&D facilities, R&D laboratories, and R&D functions, there are several levels of R&D. According to international guidelines⁵, R&D comprises creative work “undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications” (OECD 2002b, p. 30). The research activities of the firms start with basic research⁶, representing fundamental investigation in the broad area of science that is of interest to the firm. Such basic research is not implemented to solve a specifically defined problem, or to meet a currently perceived commercial objective of the company. We may therefore say that the basic research phase ends when a particular piece of scientific output is perceived to be providing an idea that might underlie an important commercial possibility. The next stage of the activities is called applied research⁷ in which the basic research output is picked up and moves it forward in the light of what should become an increasingly clear commercial possibility. In our research typology the applied research phase then ends with the definition of the broad outlines of the new product concept. In its conventional application this typology then concludes with a development stage⁸, in which the product concept derived from applied research is refined into a commercially innovated product (along with its associated production process). However, in the context of an approach to innovation in a TNC two alternative paths could occur at the development stage. In the first possibility the innovation process is essentially centralized, with the definitive product derived and implemented in the home country through the efforts of centralized R&D, marketing, engineering and management personnel. This sequence, in the context of the contemporary MNE, would add on an

⁵ We use guidelines of OECD, National Science Foundation Network (NFS), and Ministry of Internal Affairs and Communications of Japan (MIC).

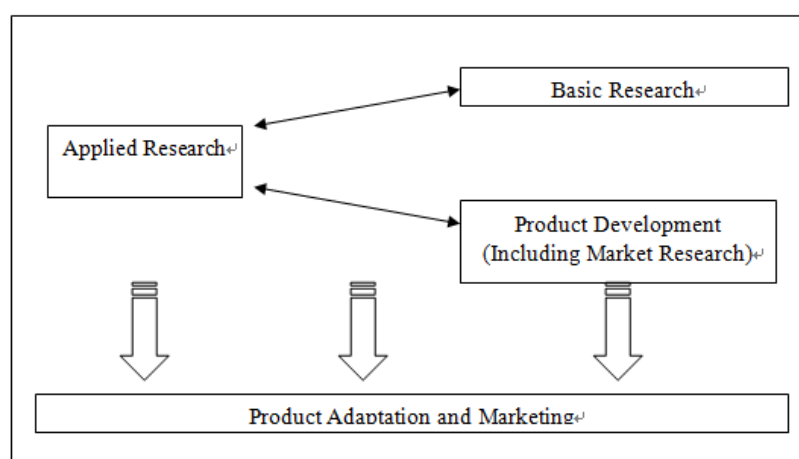
⁶ The objective of basic research is to gain a more comprehensive knowledge or understanding of the subject under study without specific applications in mind. In industry, basic research is defined as research that advances scientific knowledge but does not have specific immediate commercial objectives.

⁷ The objective of applied research is to gain the knowledge or understanding to meet a specific, recognized need. In industry, applied research includes investigations to discover new scientific knowledge that has specific commercial objectives with respect to products, processes, or services.

⁸ Development is the systematic use of the knowledge or understanding gained from research directed towards the production of useful materials, devices, systems or methods, including the design and development of prototypes and processes.

additional phase to the process, namely adaptation. Thus overseas subsidiaries in the group may find it necessary to adapt the product and /or the production process, in minor or peripheral ways, to meet host country needs or aspects of the production environment. The relationship between basic research, applied research, product development and product adaptation is illustrated in Figure 1. In this approach, therefore, overseas subsidiaries carry out adaptation development when necessary. In the second alternative the development/innovation stage itself is decentralized, making the process responsive to the needs of a global-innovation strategy.

Figure 1: Different types of R&D Laboratories in this research



Source: Pearce (1997, 2002)

R&D by MNEs in the Culture-free industry

Although there have not been enough research on different types of R&D laboratories in the different types of industry, previous research⁹ on the analysis of various aspects of subsidiaries' R&D activities suggests that competence creating subsidiaries have established R&D laboratories to utilize local knowledge and creative inputs, including technology, to develop new products aimed at expanding the global marketing scope of their MNE group in the culture-free industry. If a subsidiary has basic research laboratories, it tends to pursue

⁹ Research has targeted the culture-free industry (electrical and electronics industry) in Malaysia, Thailand and Singapore, and the culture-specific industry in Thailand and Singapore. Interviews were carried out for 10 Japanese MNE subsidiaries and questions were centered a) what type of R&D laboratories they have, 2) what type of R&D activities they have, 3) the reasons behind the R&D level in the host countries, and other relevant questions. (Iguchi: 2009)

collaborative research linking inter-organizationally with such as a university and public research institutes.¹⁰ Since basic research is defined as research that advances scientific knowledge but does not have specific immediate commercial objectives, those who have basic research has been doing research on the projects which nothing directly to do with what they produce or offer in host countries. We can also assume that R&D laboratories in the basic research laboratories in the culture-free industry have been carrying out “seeds” research through utilizing local research inputs. However, results found out that in the culture-specific industry, collaborative research has been confirmed even though the laboratory has the role of product development.

There are some differences between the culture-free industry and the culture-specific industry (Iguchi: 2009). The results also suggested that there are grouping pattern of R&D by MNE group (MNE parent) in decentralizing R&D to South East Asian countries. Some subsidiaries mention that driving forces of their R&D efforts are influenced by parent MNE in home countries. As we mentioned, basic research has been carried out mainly in home and developed host countries until recently. Whether a MNE decentralize higher competence level of R&D (basic research) to host countries, such as Malaysia, Thailand and Singapore or not are determined by MNE parent. The results also suggest that once subsidiaries become competence creating subsidiaries, their roles of R&D and production networking have further been enhanced through their activities in host countries, e.g. from product development laboratory to applied research laboratory, thus results in higher autonomy level.

In order to develop products with brand new concepts, it becomes necessary to integrate multiple ideas by organizing a wide variety of research members who have diversified cognitive approaches. We focus on our study on the “culture-specific industry” through identifying how R&D in subsidiaries contributes to MNEs’ product development in the global market.

R&D by MNEs in the Culture-Specific Industry

¹⁰ Although sample size is small, the results found out that in the culture-free industry, there are positive relationship between basic research and collaborative R&D (Iguchi: 2009).

Our research focuses on R&D by the MNEs in the culture-specific industry from various home countries, namely Kao Corporation (Japan), Procter and Gamble (U.S.A) and Unilever (UK and Netherland). Kao was originally founded in 1887 and Kao was formally established in 1940 in Japan. In fiscal year 2009, Kao's turnover was \$12,993 million, with an operating income of \$985.4 US millions (net income \$656.2 million). Kao invested about \$519 US million in R&D in 2009. In total, Kao has 33,745 employees with global production and sales networking operations in 24 countries. Kao's first foreign direct investment was Thailand and Taiwan, ROC in 1964. P&G was established in 1837 in U.S.A. In 2008, P&G had subsidiaries in over 80 countries. In 2008, turnover was \$83,503 million, operating income was \$17,083 (net profit \$12,075), and R&D expenditure was \$2,226 million with 138,000 employees worldwide. P&G has 24 global brands which have over \$1 billion sales. P&G conducted first foreign direct investment to United Kingdom in 1930. Although Unilever was officially established in 1930, the original companies that joined forces to create Unilever were already well established before the start of the 20th century. In 2008, the turnover of Unilever was €40.5 billion; while operating profit was €7,167 million (net profit €5,285 million). Unilever invested €927 million in R&D. It has 174,000 employees over 270 countries. There are 13 brands with over €1 billion sales.

There are some common characteristics and variables of our targeted three companies. Firstly, all three manufacture and sell products in the culture-specific industries, such as toiletry products. Secondly, they constantly maintain global sales figures with increasing trends over years as Table 1 identified. As indicated on Table 1, both P&G and Unilever have dependent more than 50% on the overseas sale. However, Kao's data remains below 30%. Although Kao's data shows low dependency on the overseas sales figures compared to the ones for P&G and Unilever, these figures imply all three companies are competing globally and regionally through global production and sales networking as well as R&D networking. From their global business activities, they can launch new products (or product ranges and brands) through rapid product development process. Thirdly, their R&D expenditures are high enough to compare with sectors such as pharmaceuticals, implying all of them have corporate innovation strategies within the group. Finally, they started FDI from early stages, as early as 1930 for P&G, and 1960s of Kao was fairly early for Japanese companies. While there are other global competitors in the industry, these common features are only seen in

these three companies from different national origins.

Table 1 Overseas Sales Ratio of Kao, P&G and Unilever

	1991-93	2001-2003	2006-2008
Kao	20.7%	25.8%	27.9%
P&G	48.2%	48.6%	59.3%
Unilever	41.1%	59.3%	64.4%

Notes: Overseas sale ratios of Unilever calculated using sales from Western Europe and outside Western Europe. 1991-1993 ratio of P&G constructed from 1992-1993 data, from 1991-1992 for Unilever due to the restriction.

Source: obtained from online data base (Lexis-Nexis Academic and Mergent online) and provided by Kao.

Research questions, Hypotheses and research methodology

Recent shifts toward liberalization of trade and investment and global standardizations of products or process specifications have been implemented by organizations such as WTO. Rapid development ICT (Information and Communication Technology) seen in the internet technology has further accelerated business model across borders. As a result, business activities traditionally carried out within a home country of MNEs have been outsourced and parent MNEs have become decentralized by utilizing the most efficient specialized inputs in host countries in a global market. These trends have further accelerated the global competition and required shortening trend of the product development periods for globally compatible products. In order for firms to meet requirements by the global market with diversified minds and demands, firms become to face risks associated with higher costs for securing required R&D resources for developing diversified technological factors. Although MNEs still have core R&D functions in a home country, as mentioned earlier, these trends have led MNEs to reconfirm the necessity for collaborative research with other internationally distinguished organizations such as universities, public research institute, not only in a home country but also in a host country in order to meet diversified demands in the global or regional markets.

We observe how subsidiaries' capabilities may have changed over time and how rapidly MNEs decentralize its R&D activities. Based on the theoretical argument discussed earlier, we assume that decentralization of

R&D and diversification of R&D activities will have positive effects to knowledge creation process for MNE subsidiaries, and hence the MNE group as a whole. Therefore, we have four hypotheses for strategic behaviors of MNEs in the culture-specific industry in the global competitive environment, which has high tendency being influenced significantly from cultural factors of the targeted market or region.

Hypothesis 1:

We assume that those firms with higher dependency on the overseas market have diversified researchers in the R&D facilities and become collaborative organizations. As a result, outputs of R&D shift from individual projects to collaborative projects as the number of national origins increases

Hypothesis 2:

Firms with higher dependency on the overseas market leverage capabilities of R&D organizations external to the MNEs. (e.g. universities, research institutes and firms in overseas, not in a home country).

Hypothesis 3:

MNEs in the culture specific industry have higher tendency to leverage R&D capabilities of subsidiaries in a host country.

Hypothesis 4:

MNE subsidiaries in the culture specific industry have higher tendency to enhance networking and collaborative research practices with external R&D organizations (such as local universities, public research institutes and local firms) in a host country

In order to analyze our four hypotheses, we use scientific and technological research papers, since many outcomes of project activities in R&D laboratories are often published in journals in the form of research papers. In order to clarify how MNEs create knowledge strategically during the process of new product

development for global markets or regional markets, we employ methods which analyze the research papers as outcomes of knowledge creation activities by MNEs. We searched technological papers in which the names of researchers and engineers belonging to Kao, P&G and Unilever which are competitive in developing new products in the culture-specific industries. The periods studied are selected as 1981-1983, 1991-1993, 2001-2003, and 2006-2008. The authors utilized the JSTPlus (database of the Japan Science and Technology Agency) on technological papers. Technical and scientific papers are limited to those published in the UK, U.S.A., and Netherlands where major scientific journals are published. The total number of papers by these three companies is 2,893, of which 519 were published in the period of 1981-1983, 779 in 1991-1993, 823 in 2001-2003, and 772 in 2006-2008.¹¹ For dependent variable, we use “overseas sales ratios” as proxy for “dependency on the overseas market”, due to the data limitation.

Hypothesis Analysis

This section examines what category those papers are grouped into: papers by individual researchers, papers written jointly within a company, papers written in collaboration with other organizations, and papers whose projects were conducted by authors from foreign national origins. Through these processes, we try to examine the extent of characteristics and globalization of organizational knowledge creation structures of these three MNEs, Kao, P&G, and Unilever.

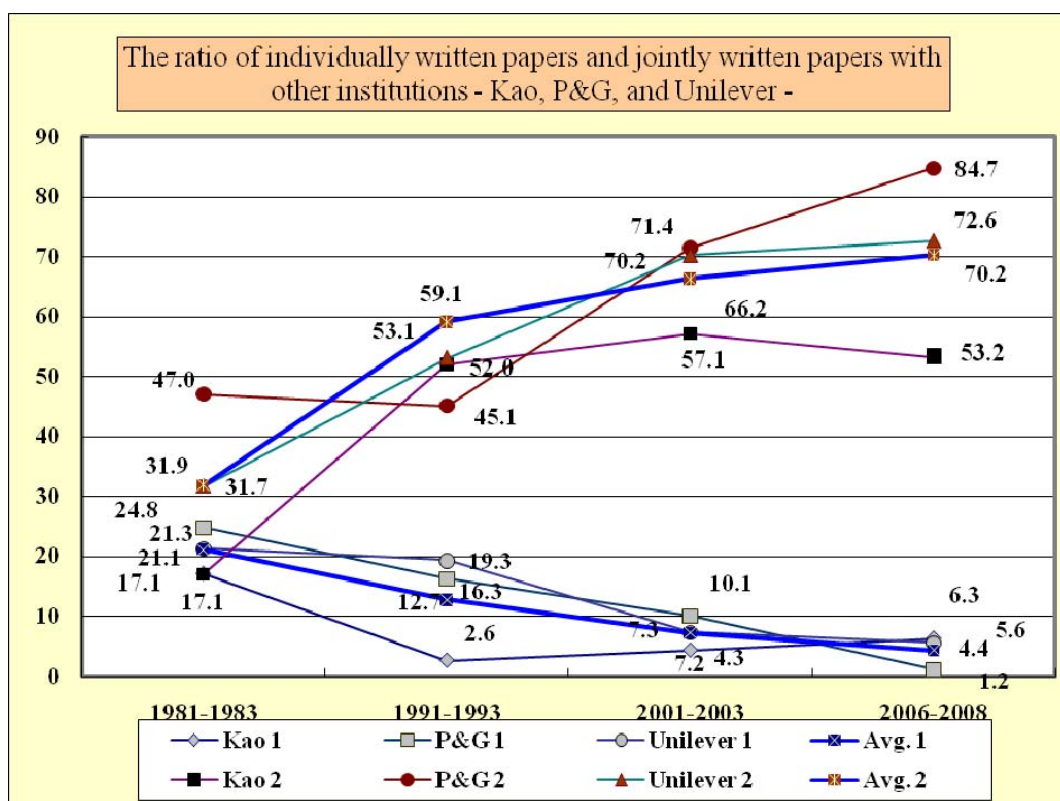
Hypothesis 1:

First of all, we are going to carefully discuss hypothesis 1, we assume that those firms with higher dependency on the overseas market have diversified researchers in the R&D facilities and become collaborative organizations. As a result, outputs of R&D shift from individual projects to collaborative projects with increasing number of national origins. Figure 2-1 shows the ratios of individually written papers and jointly written papers with other organizations, which are constructed based on the number of papers written under the name of researchers belong to three MNEs, through categorizing the paper is written by individually (one author) or jointly (with researchers belong to external organizations, such as universities, research institutes

¹¹ This methodology is also used in other literatures (Hayashi and Serapio, 2006)

and other firms).

Figure 2-1: The ratio of individually written papers and jointly written papers with other organizations (universities and research institutions) – Kao, P&G and Unilever –



Notes 1: Kao1, P&G 1 and Unilever 1 represent the ratios of individually written papers

Kao2, P&G2 and Unilever 2 represent the ratios of jointly written papers with other institutions.

Notes 2: Individually written papers imply a paper written by one author. Jointly written papers are outcomes of collaborative research with researchers belong to other organizations such as universities, research institutes, and other firms. Most of our sample indicates jointly written papers are outcomes of collaborative research with universities.

Source: JSTA(Japan Science and Technology Agency) and JSTPlus (database of JSTA)

In 1981-1983, 17% to 25% of the papers by each MNE were written individually. However, as the figure clearly shows, the ratios for each MNE have constantly declined and between 2006-2008 their ratios

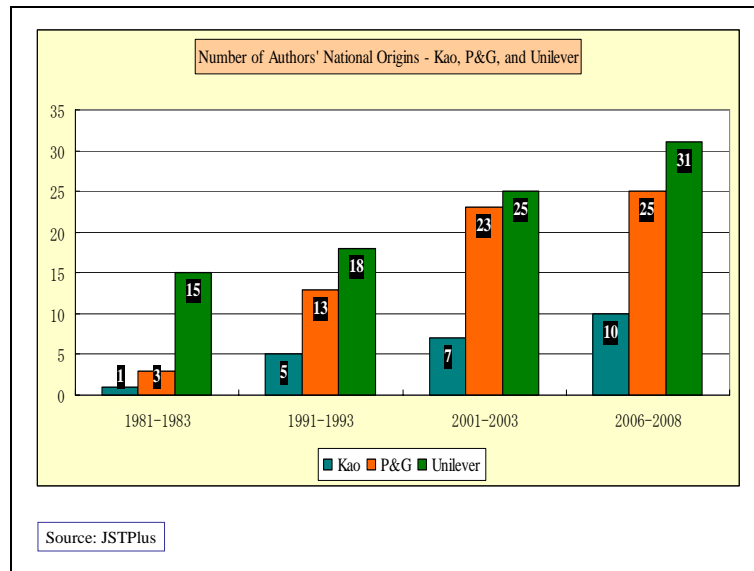
remain 1.2% for P&G, 5.6% for Unilever and 6.3% for Kao. Average ratios of three MNEs also declined from 21.1% (1981-1983) to 4.4% (2006-2008). It is notable that the ratio of P&G dramatically declined from 24.8% (1981-1983) to 1.2% (2006-2008). The result of the individually written papers clearly shows increasing trends to emphasize “knowledge creation process through collaborative research projects” to handle increasing demands for diversified technological area and market-specific preferences rather than “knowledge creating activities by individual research work” in order to do R&D for new product development.

Instead of declining the ratio of individual research works, as outcomes of collaborative research projects conducted between these three MNEs and external organization we observe the ratio of jointly written papers. Average ratios of three MNEs have dramatically increased from 31.7% (1981-1983) to 70.2% (2006-2008). Particularly, ratios of P&G and Unilever have increased from 31.9% (1981-1983) to 47% (2006-2008) and 72.6% (1981-1983) to 84.7% (2006-2008) respectively. These trends imply P&G and Unilever’s R&D activities have shifted from “individual research work within the MNE” to “knowledge creation process through collaborative research projects” in order to do R&D for new product development.¹²

As Figure 2-2 suggests, the number of national origins of affiliations where authors (researchers or engineers) belong to has consistently increased from 1981-1983 to 2006-2008. The ratios of Kao, P&G and Unilever have shown in 1981-1983 were 1 country for Kao, 3 countries for P&G, and 15 countries for Unilever, and in 2006-2008 were 10 countries, 25 countries and 31 countries respectively.

¹² However, when we carefully examine the ratio of jointly written paper through inter-departmental projects within Kao (or P&G), Kao has higher ratios than P&G. Therefore, collaborative knowledge creation process within the firm has been actively pursued in Kao rather than P&G (Hayashi & Nakayama: 2009).

Figure 2-2 The number of national origins of affiliations of authors that Unilever's, P&G's and Kao's researchers and engineers are involved



Notes: National origins used here imply nationality of affiliate of the authors belong to and do not imply nationality of the authors' passport.

Source: Retrieved from JSTA and JSTPlus and combined by the authors

From Figure 2-2, newly created knowledge seen from paper publications in the scientific journals through research projects by authors (at the same time at least one of them belongs to one of the MNEs) in the R&D facilities during the process of developing new products for global markets by our targeted MNEs over the period of 1981 to 2008 has shown the emphasis on the mechanism of jointly researched projects with diversified national origins rather than declining individual research work by sole nationality. As a result, we can conclude that our hypothesis 1 is supportive for our chosen MNEs case.

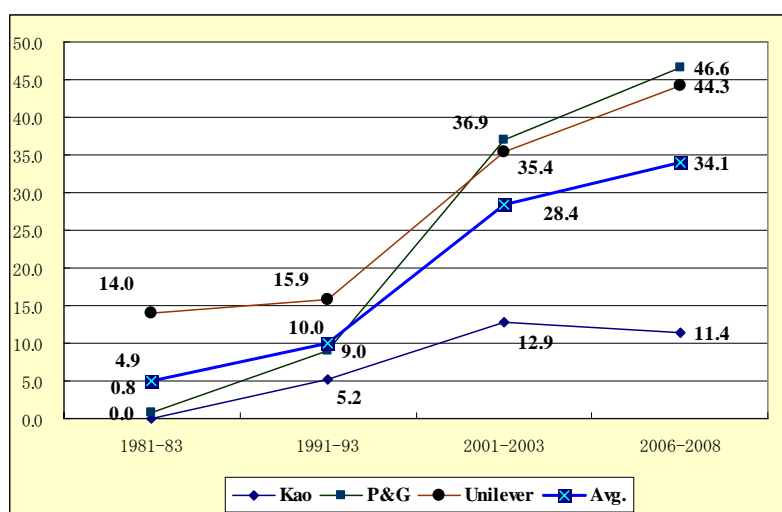
Hypothesis 2

Secondly, we are going to analyze our second hypothesis: Firms with higher dependency on the overseas market leverage capabilities of R&D organizations external to the MNEs (e.g. universities, research institutes and firms in overseas, not in a home country). We carefully examine if the name of researchers or engineers who belong to the overseas R&D facilities (such as subsidiaries, universities, research instituted, firms in

overseas) have been included as the authors or not in order to judge whether MNEs exploiting “capabilities of R&D organizations external to the MNEs in overseas”.

As Figure 3 shows, the average ratios of jointly written papers which include authors belong to overseas organizations in three MNEs have consistently increased from 4.9% in 1981-1983 to 34.1% in 2006-2008. Specifically the ratios of internationally co-authored papers by P&G and Unilever have dramatically increased from 0.8% (1981-1983) to 46.6% (2006-2008) for P&G and from 14.0% (1981-1983) to 44.3% (2006-2008) for Unilever. In comparison, Kao with lower dependency ratios for overseas sale figures than P&G and Unilever has remained lower ratios of internationally co-authored papers such as 0% (1981-1983) and 11.4% (2006-2008).

Figure 3 : The Ratios of jointly written papers which include authors belong to overseas organizations



Note: Overseas institutions include overseas subsidiaries, overseas affiliations, overseas universities, research institutes, and companies.

Source: JSTA, compiled from JSTPlus.

The results clearly suggest the ratios that MNEs create knowledge strategically through conducting joint research with researchers in the overseas organizations to exploit diversified knowledge obtainable from those who are in the overseas organizations have increased as firms expand new products at global scale. From

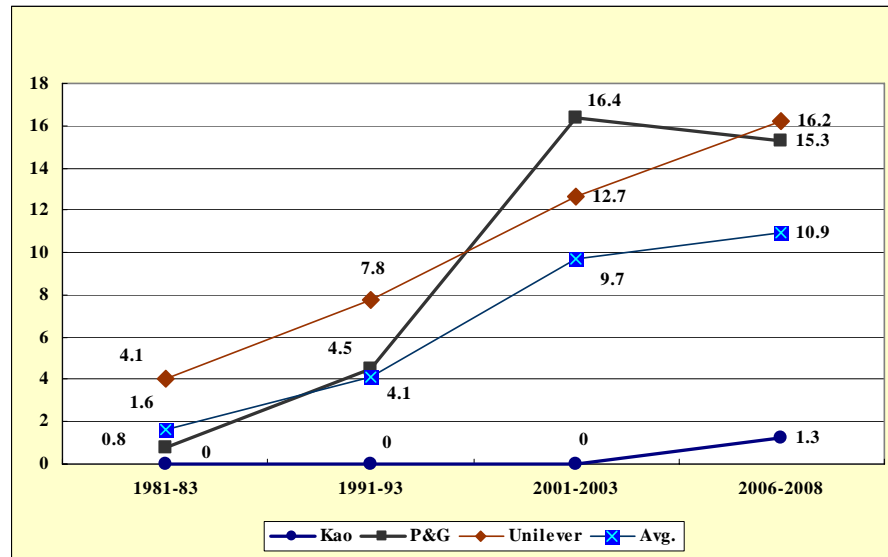
2000s, P&G and Unilever have experienced their overseas dependency ratios in terms of sales figure have become more than 50%. Compared to Kao which has the overseas dependency ratio with 20%, number of publication of internationally co-authored papers has increased dramatically for P&G and Unilever. Therefore, we can conclude that our hypothesis 2 is supportive for our chosen MNEs case.

Hypothesis 3

We are going to analyze our third hypothesis: MNEs in the culture-specific industry have higher tendency to leverage R&D capabilities of subsidiaries in a host country, due to the requirements for developing multi-domestic type products.

Figure 4 shows the ratio of research papers including authors belong to MNEs subsidiaries in host countries. Average ratios of three MNEs have consistently increased from 1.6% in 1981-1983 to 10.9% in 2006-2008. In particular, those ratios for P&G and Unilever significantly increased from 1981-1983 to 2006-2008; from 0.8% to 15.3% for P&G and from 4.1% to 16.2% for Unilever. However, those ratio for Kao have remained 1.3% even in 2006-2008, imply Kao has not fully exploit R&D capabilities of subsidiaries in host countries. The reason behind the low level of utilization of R&D capabilities of Kao is either because subsidiaries are not competence creating subsidiaries or mechanisms of knowledge creation within the Kao has not fully developed. For our hypothesis three, we can conclude that results are supportive for P&G and Unilever, but not supportive for Kao. Therefore we cannot fully support our hypothesis but partially support our hypothesis.

Figure 4: The ratio of research papers including authors belong to MNEs subsidiaries



Note: Papers by overseas subsidiaries mean those written by researchers/engineers who belonged to overseas subsidiaries.

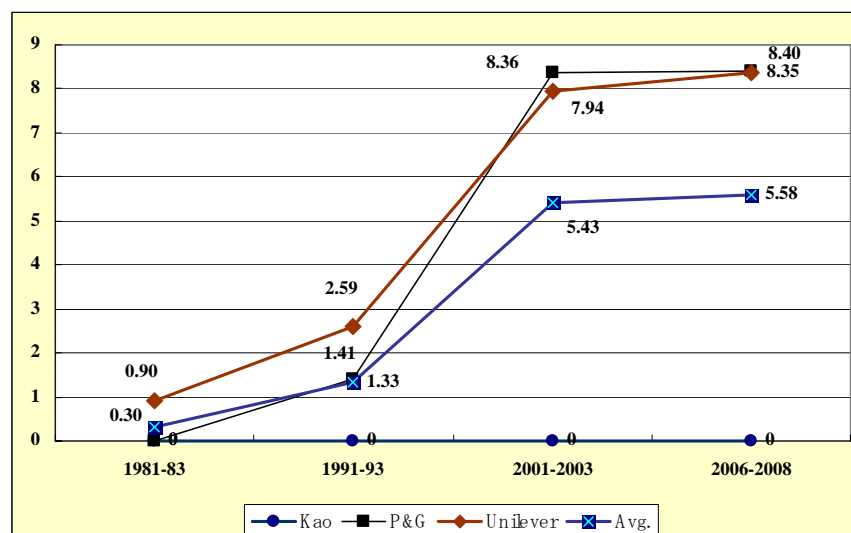
Source: JSTA, compiled from JSTPlus.

Hypothesis 4

Finally, we are going to examine our hypothesis 4; MNE subsidiaries in the culture specific industry have higher tendency to enhance networking and collaborative research practices with external R&D organizations (such as local universities, public research institutes and local firms) in a host country, due to the requirements for developing multi-domestic type products. (or locally or regionally preferred products)

Figure 5 demonstrates the ratios of jointly written papers by authors belong to subsidiaries in a host country and local organizations in the host country external to the MNE subsidiaries

Figure 5: The ratios of jointly written papers by authors belong to subsidiaries in a host country and local organizations in the host country external to the MNE subsidiaries.



Note: Joint paper between overseas subsidiaries and local institutions means those between overseas subsidiaries and local Universities, research institutes, or companies.

Source: JSTA, compiled from JSTPlus.

As Figure 5 shows, in 1981-1983 the average ratio of jointly written papers between researchers in MNE subsidiaries in a host country and researchers belong to the research organizations external to the MNEs in the host country for three MNEs was below 1%. At this period, the ratios clearly provide evidence that the collaborative research between subsidiaries and local research organizations in a host country has not been seen. However, from 2001-2003, in particular from 2006-2008, the ratios for both P&G and Unilever have achieved above 8%, implying that collaborative research between R&D in subsidiaries and local organizations external to the MNEs has been implemented.

In addition to the jointly written papers between researchers in subsidiaries in a host country and researchers in the research organization external to the MNEs subsidiaries in the host country, if we include jointly written

papers between researchers in subsidiaries and researchers in research organizations located third country¹³, the ratios of both P&G and Unilever exceed 10%. However, even in the period of 2006-2008, we do not see any evidence that Kao's subsidiary in a host country has collaborative research activities with researchers belong to external organizations in the host country, such as local universities, local research institutes and local firms.

Therefore, we can conclude that results are supportive for P&G and Unilever, but not supportive for Kao. Therefore we cannot fully support our hypothesis four but partially support our hypothesis.

We have carefully analyzed our hypotheses using the data we corrected for Kao, P&G and Unilever. For P&G and Unilever, our analysis suggests that we can conclude that the results are supportive for all four hypotheses. For Kao, our analysis suggests that we can conclude that the results are supportive for Hypothesis 1 and 2 but not supportive for Hypothesis 3 and 4.

As we already mentioned in Figure 2-2, the number of national origins of affiliations of authors that Unilever's, P&G's and Kao's researchers and engineers are involved have increased from 1981-1983 to 2006-2008. The ratios of Kao, P&G and Unilever have shown in 1981-1983 were 1 country for Kao, 3 countries for P&G, and 15 countries for Unilever, and in 2006-2008 were 10 countries, 25 countries and 31 countries respectively. We would like to look at the evolutionally phenomena of national origins with Table 2.

¹³ Countries exclude home country and a host country where the targeted subsidiary is located.

Table 2: The national origins of affiliations of authors (1981-1983)

	National Origin of Authors	1981-1983		
		Unilever	Kao	P&G
1	Australia	(**)		
2	Belgium	*		(*)
3	Canada	*		
4	Switzerland	*		
5	Germany	(*)		
6	Spain	*		
7	Finland	(**)		
8	France	(*)		
9	Ireland	*		
10	Israel	*		
11	Japan	*	***	
12	Netherlands	***		
13	South Africa	*		
14	UK	***		(*)
15	USA	**		***
Number of national origins of authors		15	1	3

Note: (1) * shows under 4 papers, ** shows 5 -9 papers, and *** shows more than 10 papers.

(2) Total number of national origins of authors means that of nationals of affiliations to which authors belonged.

(3) Stars in the parenthesis show that it includes papers written by researchers who belonged to the overseas subsidiary. On the other hand, cases without parenthesis show that papers are jointly written between researchers at home and overseas institutions.

Source: JSTPlus

Table 3: The national origins of affiliations of authors (2006-2008)

	National Origin of Authors	2006-2008		
		Unilever	Kao	P&G
1	Australia	**		
2	Austria	*		**
3	Belgium	***	*	(***)
4	Bangladesh			*
5	Bulgaria	**		*
6	Canada	**	*	**
7	Switzerland	**	*	(**)
8	China	(***)		(**)
9	Czech			*
10	Germany	(***)		***
11	Denmark	**		*
12	Spain	**	*	*
13	Finland	(*)		*
14	France	(***)		**
15	Greece	*		*
16	Hungary	*		
17	India	(***)		*
18	Iran	*		
19	Italy	***	*	(**)
20	Jamaica	*		
21	Japan	*	***	(***)
22	Kenya	(*)		
23	Korea	(*)		**
24	Lithuania	*		
25	Mexico	*		
26	Netherlands	***	*	**
27	Norway			*
28	New Zealand	*		*
29	Poland	*		
30	Russia			*
31	Singapore			(*)
32	Sweden	***	*	*
33	Turkey			*
34	Taiwan	*		*
35	UK	***	*	(***)
36	Ukraine	*		
37	USA	(***)	*	***
Total number		31	10	27

Note: same as shown in Table 2

Source: JSTPlus

As Table 2 and 3 clearly demonstrate, national origins of authors who belong to one of three MNEs and co-authors have not merely increased in volume. Evidences suggest that members of collaborative research in R&D activities have generated by researchers in a R&D of MNE subsidiaries in a host country and authors who belong to R&D facilities in a host developing countries. In particular, results from both P&G and Unilever suggest evolution of R&D capabilities of their subsidiaries in host developing countries such as India and china has become clear. On the other hand, results from Kao do not suggest evolution of R&D capabilities of their subsidiaries even in 2006-2008. Internationally co-authored papers have been conducted by Kao but limited to the authors between R&D facilities in a home country and overseas universities.

Conclusion

We are going to clarify the relationship between mechanism of global knowledge transfer and knowledge creation process by MNE groups and source of global competitive advantages. We also try to investigate from our analysis to what extent national origin of human resources in the R&D facilities has been diversified and to what extent MNEs in the culture-specific industry leverage local R&D human resources and construct R&D networking within the region in developing new products for enlarging regional markets.

Our findings suggest that knowledge creation mechanism and innovation system of MNEs have evolved from individually centered research approach to organizationally collaborative research approach, from closed research practices within on firm to inter-organizational open research practices, and research activities in one host country to exploiting global network systems. Importantly, MNEs specific strategic knowledge creation system have evolved from global R&D network system which have been centered in the headquarters in a home country to subsidiaries' driven R&D network system which influenced by enhanced R&D capabilities and subsidiary evolution. Thus MNEs' global strategic knowledge creation systems have developed through the base of global R&D capabilities networks obtained by MNEs group as a whole. In other words, we have contributed to clarify the "global mechanisms of strategic knowledge creation" by MNEs as sources of revised "global competitive advantages" or "global dynamic capabilities" which are different from the general and conventional views on sources of competitive advantages and dynamic capabilities.

Conventional argument on MNEs dynamic capabilities from the point of view of R&D capabilities were discussed research capabilities of home country or global R&D capabilities in general. However, analysis on the R&D capabilities in overseas subsidiaries and mechanisms of knowledge transfer and knowledge creation through global R&D networking has been necessary in order to argue capabilities of knowledge creation as a source of MNEs-specific dynamic capabilities rather than dynamic capabilities of firms in general.

Issues related to inter-organizational linkages between capabilities of subsidiaries and MNEs headquarter in the home country have been discussed through subsidiary evolution (Birkinshaw & Hood:1998) from dynamic capabilities point of view, Home-base-augmenting or Home-base-exploiting R&D (Kuemmerle:1997) from globalization of R&D point of view. Literatures also suggested “supply-side factors such as obtaining R&D human resources and access to new technology” (Florida:1997), competence-creating subsidiaries and competence-exploiting subsidiaries (Cantwell & Mudambi:2005) for the linkages, and dynamism of enhancement of R&D capabilities of overseas subsidiaries and MNEs headquarters (Asakawa:2001a,2001b,2004). However, we assume that conventional literature on overseas subsidiaries have tried to categorize using subsidiaries level of capabilities.

However, compared to P&G and Unilever, although networking of global knowledge creation by Kao has been developing, Kao has not fully achieved networking of global knowledge creation which has exploited subsidiary evolution of Kao’s own overseas R&D facilities in subsidiaries. This is the deterministic differences between MNEs with obtaining global innovation system involving global knowledge creation, such as P&G and Unilever and MNEs without achieving the mechanism, such as Kao. In other words, this research suggests that in order to become critical source of dynamic capabilities which can be created competitive advantages in the global market, the knowledge creation mechanisms which were centered in the home country and Japanese-MNE specific cross functional knowledge creation within the firm observed by Kao’s case can be necessary condition but not sufficient condition.

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Appendix 1: Nationality Code

Nationality Code					
1	AUS	Australia	21	ITA	Italy
2	AUT	Austria	22	JAM	Jamaica
3	BEL	Belgium	23	JPN	Japan
4	BGD	Bangladesh	24	KEN	Kenya
5	BGR	Bulgaria	25	KOR	Korea
6	CAN	Canada	26	LTU	Lithuania
7	CHE	Switzerland	27	MEX	Mexico
8	CHN	China	28	NLD	Netherlands
9	CZE	Czech Republic	29	NOR	Norway
10	DEU	Germany	30	NZL	New Zealand
11	DNK	Denmark	31	POL	Poland
12	ESP	Spain	32	RUS	Russia
13	FIN	Finland	33	SAF	South Africa
14	FRA	France	34	SGP	Singapore
15	GRC	Greece	35	SWE	Sweden
16	HUN	Hungary	36	TUR	Turkey
17	IND	India	37	TWN	Taiwan
18	IRA	Iran	38	UK	United Kingdom
19	IRL	Ireland	39	UKR	Ukraine
20	ISR	Israel	40	USA	USA