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# Triad perspective of global supply chain integration

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# Triad perspective of global supply chain integration

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## Abstract

**Purpose** − This study examines the implementation of triad coordination among R&D, production and marketing activities when they are separated globally. We explore key factors driving global integration to promote triad integration.
**Design/methodology/approach** − Qualitative data were gathered from in-depth interviews on the home appliance business at a Japanese firm, Company X. As a single case-study triangulation effort, from 2008 to 2019, 24 interviews were conducted with those responsible for R&D, production and marketing.
**Findings** − A third-party organisation promoted triad and global integration. Key factors driving the global integration of new product development to overseas local markets included the externalisation of local tacit knowledge into explicit knowledge. Key factors driving triad integration included the front loading of problems conducted at early stages of product development.
**Originality/value** − Previous studies focused on supply chain integration (SCI) of directly linked activities, including R&D and production, production and marketing and marketing and R&D, and attempted to solve their dyadic trade-offs. This study focuses on a triad integration field among R&D, production and marketing in the supply-chain research, because the triad perspective can help clarify the complex phenomenon of global SCI.

**Keywords:** Global supply chain management, supply chain integration, tacit knowledge, externalisation, front-loading

**Papers:** Research paper

### Introduction

With economic globalisation, the degree to which business activities are dispersed in various countries has increased, making supply chain integration (SCI) more difficult. Parts and materials are commonly procured from several countries, final assembly takes place in low-paying countries and final products are exported worldwide. It is difficult to manage and coordinate these global activities effectively. Above all, coordination among

different companies requires advanced management, as pointed out in past supply chain research (Lee *et al.*, 2007; Sezen, 2008; Eltantawy *et al.*, 2009; Lo and Power, 2010). Global integration of the inter-enterprise supply chain is the issue.

With inter-organisational integration, global *intra*-organisational integration has become a problem. Pursuant to the globalisation of companies, there are many cases where functions, including research and development (R&D), production and marketing, are dispersed across many countries. For example, the Toyota Motor Corporation in Japan has 28 production bases and 170 marketing bases across the world according to home page of Toyota Motor Corporation (Toyota Company's Global Overview, 2019). Simultaneously, large production bases in the U.S. and Thailand also host R&D activities. At first glance, it appears that the core functions are completed in the host country. Although the R&D centre in Thailand employed 2,500 engineers in 2014, 300 among them were Japanese. Nearly all platform development was done in Japan. Under these circumstances, it becomes possible to introduce competitive products to market not only by integrating R&D, production and marketing to the host country but also by merely coordinating with the home country.

In previous literature, industry players considered the supply chain as a critical feature that helps create high value products and services for end consumers (Lee *et al.*, 2007; Sezen, 2008; Eltantawy *et al.*, 2009; Lo and Power, 2010). Manufacturing firms are commonly forced to compete profitably without establishing inter-organisational collaborative relationships or mutually beneficial partnerships with suppliers and distributors (Stock *et al.*, 2010). Similarly, intra-organisational (cross-functional) integration is a prerequisite for competition (Turkulainen and Ketokivi, 2012). Therefore, from the perspective of supply chain management (SCM), there are inter- and intra-organisational integrations, and this paper focuses on the latter.

Effective and efficient supply chain coordination requires the integration of all product-flow processes. In the current global economy, each multinational company (MNC) competes successfully with the help of cooperative partners around the world (Gulati *et al.*, 2000). Thus, SCI remains a critical factor for global SCM.

Although the integration of all supply chain activities from upstream to downstream is vital to realise high-performance outcomes, this integration is highly complicated because of the diverse actors (Bowersox *et al.*, 2000; Fawcett and Gregory, 2002; Nagashima, 2017). Too often, different departments and organisations work independently (Bowersox *et al.*, 2000).

The purpose of the present research is to examine how to implement triad coordination among R&D, production and marketing dispersed across countries. This paper explores key factors driving global integration to promote the triad integration.

The article draws on a case study of a Japanese electronics manufacturing company, Company X. First, the paper presents an overview of the literature on new product development for overseas local markets and global SCI. Second, the case study is presented. Finally, concluding remarks for researchers and practitioners are made.

## Theoretical background and literature review

There are two problem areas addressed by this article. One is new product development for overseas local markets. The other is global SCI.

### *New product development for overseas local markets*

*Taskforce team for developing products*

Since the 1990s, as economic globalisation has advanced, the question of how MNCs efficiently carry out R&D and produce and sell products for overseas markets has become

increasingly important to answer (Bartlett and Ghoshal, 1989; Birkinshaw and Hood, 1998; Kuemmerle, 1999; Subramaniam and Venkatraman, 2001; Govindarajan and Trimble, 2012). In international business studies, a central issue is the trade-offs between the needs of global and local markets in the face of globalisation (Samiee and Roth, 1992; Cavusgil *et al.*, 1993). In particular, when the local market is a developing country, there are often large differences among the needs for global products. Thus, trade-off problems likely arise (London and Hart, 2004; von Zedtwitz *et al.*, 2015). It becomes difficult to adapt the technologies and knowledge developed in the home country to the product strategies in the local markets (Govindarajan and Trimble, 2012).

To address this issue, Govindarajan and Trimble (2012) argued that, to achieve product innovation for emerging countries, it is effective to establish task force organisations, called 'local-growth teams' (LGT) (e.g. venture companies) that are independent from their home countries in the local markets. The LGT is a cross-functional organisation with various functions required for development. This research looks at how MNCs can effectively organise themselves to develop, produce and market products for local markets.

*Difficulty of transferring tacit knowledge*

A major challenge MNCs face when developing products for local markets is how to successfully incorporate the needs of foreign customers that are not easily accessible into product development. Subramaniam and Venkatraman (2001) argued that the success or failure of product development for local markets abroad depended on how the company could explore the implicit knowledge buried in the local market and share and transfer it successfully within the company. Tacit overseas knowledge, on the other hand, is an unspoken and often subtle understanding of the differences in cultures, tastes, habits or customs. Tacit knowledge is required to understand the unique needs of the country, because it depends on the views and interpretations of individuals observing consumer behaviours. It is difficult to objectively organise these cultural mannerisms as consistent, explicit descriptions. Thus, various interpretations arise. How tacit knowledge is interpreted changes the design and specification choices of the new product being developed (Subramaniam and Venkatraman, 2001).

To realise this, it is effective to organise a cross-national team in which overseas human resources with experience developing new products and local human resources are mixed, so that tacit overseas needs rooted in local market cultures can be unearthed (Subramaniam and Venkatraman, 2001). In recent years, tacit intellectual know-how has been regarded as particularly difficult to transport (Grant, 1996; Nonaka, 1994). Intellectual resources depend on birthplace and have tacit intellectual elements that add to the costs of transfer (Winter, 1987; Kogut and Zander, 1993; von Hippel, 1994; Cavusgil *et al.*, 2003). In particular, it is difficult to transfer and share tacit knowledge embedded in local markets within MNCs (Szulanski, 1996; Gupta and Govindarajan, 2000; Adenfelt and Lagerström, 2006). Therefore, based on detailed case studies, the present research explores the ideal organisational form of international product development that takes advantage of tacit overseas knowledge.

***Global SCI***

The creation of new products is a multifaceted effort involving various functional divisions, such as R&D, production and marketing. Previous research has shown that the degree of integration among these functions significantly impacts a firm's competitiveness index (Olson *et al.*, 2001; Brettel *et al.*, 2011; Turkulainen and Ketokivi, 2012; Turkulainen *et al.*, 2017). This issue leverages the same logic as the SCM

discussion. Existing studies on SCM can be broadly divided into two types: those that focus on intra-company organisational collaboration and those that focus on inter-company collaboration extending to consumers and suppliers (Flynn *et al.*, 2010). The focus of this research is on internal SCM.

Although this intra-SCI becomes more vital as globalisation advances and as functions are distributed around the world, the integration is very complex and difficult, given the diversity of actors along the supply chain (Bowersox *et al.*, 2000; Meixell and Gargeya, 2005; Fawcett and Gregory, 2002; Nagashima, 2017). The difficulty faced is primarily caused by the common trade-off relationship among the objectives of functional organisations (Skinner, 1969; Silveira and Slack, 2001). The conflicting and dyadic relationships among each function of R&D, production and marketing are elucidated as follows.

*Integration of R&D and production*

The integration of R&D and production has gained importance because of the increase in production outsourcing in recent years (Kotabe, 1998; Kotabe and Murray, 2004). In particular, for digital consumer goods, horizontal integration has progressed well, and electronics production service has expanded (Sturgeon, 2003).

Under these conditions, there is homogeneous product performance between firms, and the focus of competition shifts from product differentiation to the speed of volume increase and the expansion of the product line-up (Christensen, 2003). In parallel, the advantages of carrying out both R&D and production in the same company are extolled. Although U.S. firms historically have tended towards R&D innovation (Starr and Ullman, 1988), it is well known that they have been able to maintain competitive advantages even in commodity products through production innovation (Wheelright and Clark, 1992). Additionally, the question of coordinating R&D and production is related to the issues of concurrent engineering, which is considered vital to the competitiveness of Japanese manufacturing companies (Takeuchi and Nonaka, 1986; Clark and Fujimoto, 1991; Fine, 1998).

*Integration of production and marketing*

Research on the conflict between production and marketing can be traced back to Shapiro (1977). See Parente (1998) for a review. The production perspective emphasises a need to manufacture standardised products in large volumes, whereas the marketing perspective stresses the need to provide the maximum range of products with short delivery lead times with flexible quantities. This conflict between production and marketing has been called the productivity dilemma (Abernathy, 1978). Studies about concepts related to just-in-time production and lean production systems that have been evolved by Japanese companies are included in this area (Schonberger, 1986; Womack *et al.*, 1990).

*Integration of marketing and R&D*

Much of the previous research on marketing and R&D interfaces has focused on the results of marketing and R&D interactions in new product development projects (Maltz *et al.*, 2001). Research has been conducted mainly from the viewpoint of conveying market information to the R&D division (Becker and Lillemark, 2006).

Although there are several incompatibilities between the functions of marketing and R&D, there remains a debate on the need for integrating these functions (Griffin and Hauser, 1996; Lau *et al.*, 2010). For example, marketing sections interact with customer needs, which are oriented towards short-term responses, whereas R&D sections tend to

be oriented towards product innovation through medium- to long-term efforts. The need for systems to adjust to such conflicts in a company has been discussed (Lawrence and Lorsch, 1967).

*Need for comprehensive and triad perspectives*

Most studies have focused on the SCI of directly linked activities, such as R&D and production, production and marketing and R&D and marketing. They explored methods to solve dyadic trade-offs (Kahn, 1996; Silveira and Slack, 2001). However, this produces limited insight and fails to capture SCI comprehensively as a single system firm-wide perspective (Hammer, 1990; Naylor *et al.*, 1999; Chen *et al.*, 2007; Brettel *et al.*, 2011).

Brettel *et al.* (2011) produced a comprehensive perspective study, finding that the effectiveness of functional integration among the three functions for new product development varied depending on whether the project was in development or the commercial phase and whether the product was incremental or innovative. They found that functional integration was more effective in developing innovative products. Olson *et al.* (2001) came to a similar conclusion. Thus, when companies develop innovative products, functional collaboration and integration among the three functions are indispensable.

Innovative product development carries higher risks and uncertainties than incremental products (Danneels and Kleinschmidt, 2001). Related to the discussion of transnational product development for MNCs, product development for local markets in developing countries is equivalent. Unlike global products that are developed for home or multiple markets, products that target local countries often require new customer value appropriate for that local market. The concept of new customer value reflects disruptive innovation (Christensen, 1997).

Although existing research has shown that triad-functional collaboration and integration are particularly vital when creating innovative products, it has not been clearly presented how to do so. For example, according to Turkulainen *et al.* (2017), to achieve functional integration, team structures (i.e. a group of individuals from different units working together and sharing collective responses for outcomes), integrator roles (i.e. a formal role serving as a contact between and within organisational units) and relationship building (i.e. informational communication across organisational units through various means) are key activities. However, Turkulainen *et al.* (2017) did not clarify the role of each activity in promoting functional integration in specific contexts, such as new product development.

Therefore, this research clarifies the organisational mechanisms for realising the internal SCI required in new product development, especially in the development of innovative products (i.e. products for emerging local markets).

## Research design

The literature review provided an understanding of the organisational presence needed to promote the integration among R&D, production and marketing. Subsequently, the aspects that should be taken under closer observation when attempting to fill the research gaps are determined.

*Theory building*

The unit of analysis is SCI among R&D, production and marketing. The focal issue is the exploration of the processes and organisational capabilities of SCI, aiming to improve performance outcomes. Our approach is one of theory building from case-study analyses. Eisenhardt (1989a) showed that theory building from case studies analysis was relevant

when analysing a contemporary phenomenon in a real-life context or when the boundaries between phenomena and their context were not clearly evident. There remains a lack of empirical studies on SCI among R&D, production and marketing on new product development in overseas markets (Song *et al.*, 1997). The boundaries between SCI and context are not clearly evident (McCarthy *et al.*, 2002). Scholars have used case studies to develop theories about topics as diverse as group processes (Edmondson *et al.*, 2001), internal organisations (Galunic and Eisenhardt, 2001; Gilbert, 2005) and strategy (Mintzberg and Waters, 1982). Building theory from case studies is a research strategy that involves using one or more cases to create theoretical constructs, propositions and/or midrange theories from case-based empirical evidence (Eisenhardt, 1989b). Case studies are rich, empirical descriptions of particular instances of a phenomenon that are typically based on a variety of data sources (Yin, 1994). Dyer and Wilkins (1991) explained that, if executed well, case studies could be extremely powerful when the general phenomenon is described so well that others have little difficulty identifying the same phenomenon in their own experience and research. The central notion is to use cases as the basis from which to develop theory inductively. Theory is emergent in the sense that it is situated in and developed by recognising patterns of relationships among constructs within and across cases and their underlying logical arguments (Eisenhardt and Graebner, 2007). Central to building theory from case studies is replication logic. That is, each case serves as a distinct experiment that stands on its own as an analytical unit, emphasising the rich, real-world context in which the phenomena occur (Eisenhardt and Graebner, 2007).

We have chosen an exploratory case study and a research question directed at SCI teams within their context.

*Single case-study method*

Case studies can involve single or multiple cases. In this paper, a single case-study method is applied to clarify a complex phenomenon and to provide a context for real SCI of R&D, production and marketing new product development in overseas markets, using rich description and deep interpretation of related actors. Siggelkow (2007) identified that a single case study forces a writer to attain a deeper understanding of the subject to create a high-quality theory. Otherwise, single case studies force a writer to richly describe a phenomenon's existence and to create better research than a multiple case study. The writer also can question old theoretical relationships and explore new ones when a single case study is used (Siggelkow, 2007). Moreover, the approach of the case in a single detailed study can increase variety, enabling a truer sensing of complicated sets of events (Weick, 2007).

*Data collection and analysis*

The data for this study were collected from three overlapping sources: in-depth, semi-structured interviews; documents and observation studies. These sources were triangulated to maintain integrity (Miles and Huberman, 1994; Silverman, 2006). Triangulation refers to the use of multiple methods or data sources in qualitative research to develop a comprehensive understanding of phenomena (Patton, 1999). Triangulation also has been viewed as a qualitative research strategy to test validity through the convergence of information from different sources.

Regarding data-source triangulation, most qualitative researchers studying human phenomena collect data through interviews with individuals or groups; their selection of the type of interview depends on the purpose of the study and the resources available. Fontana and Frey (2000) described the in-depth interview as one of the most powerful tools for gaining an understanding of human beings and exploring topics in depth. In-

depth interviews, ranging from structured and controlled to unstructured and fluid, can elicit rich information about personal experiences and perspectives (Russell *et al.*, 2005).

Based on the notion of purposeful sampling, managers were interviewed about the SCI of R&D, production and marketing on new product development in overseas markets of Company X from 2008 to 2019. Further, the methods of working with each function internally in China, with the parent company in Japan and retailers in China were investigated as well as the nature of the evolution of the processes, organisations and performances outcomes. In total, 24 interviews were conducted with Company X from 2008 to 2019 (Table 1). The authors conducted four interviews with six managers of R&D and planning, four interviews with two managers of the China Lifestyle Research Centre (CLR-Centre), nine interviews with 12 managers of manufacturing (production and purchasing); six interviews with 11 managers of marketing and sales; and one interview with one manager of SCM. They provided sufficient context to identify the background, motives, objectives, structures, processes, roles, responsibilities and performance evaluation related to initial SCI. In particular, the same interviews were conducted with these different main actors of integration to secure an accurate collection of information.

[Table 1 about here]

All interviews began with open questions about Company X's SCI and the management of building those processes and organisations. As the interviews progressed, the questions gradually became more structured, delving into procedures and mechanisms for knowledge sharing within Company X and the specific challenges they faced when entering new markets. All interviews lasted 90–300 min. In addition, non-participant observations were made in retail stores in China six times from 2008 to 2019 to develop an understanding of how product values were assessed in the markets. Finally, Company X's internet home page, which provided access to company's activities, was systematically examined. The documents not only supplied interesting information, they also allowed us to control for memory bias by comparing interview statements with the collected document data (Miller *et al.*, 1997).

The study included analytic generalisation relying on the following measures. First, a convergence of multiple data sources was created. The research used interviews, field notes, company documents and records to develop interpretations. Second, interviews were conducted with the main actors of integration to secure an accurate collection of information. Third, all data was documented and tracked to maintain a verifiable chain of evidence. All informants involved in this research conducted member checks, reviewing and approving notes as well as reports pertaining to Company X. Fourth, reliability was established by using a protocol and a database at a common location for data collection and analysis. The research team followed this protocol for interviews and documented all data stored. Fifth, multiple investigators on the research team enhanced the confidence in the findings via a triangulation of evidence and fostered divergent perspectives. Sixth, entering the field was done with the frequent overlap of data analysis with data collection, including field notes to speed analysis and reveal helpful adjustments to data collection.

This study provides the framework for empirical support from a triad perspective to explore how to implement triad coordination among R&D, production and marketing dispersed across various countries (Fig. 1). This approach should shed light on findings that may have been overlooked from the dyadic perspective, but are vital to obtain high-performance outcomes.

[Figure 1 about here]

**Case of Company X in China**

Company X is Japan's leading electronics company with consolidated sales of 8-trillion yen and 280,000 employees (April 2019). Its business areas include B-to-C activities, such as home appliances, beauty, health care etc., B-to-B activities, such as cooling and heating appliances for commercial use, automotive parts, and industrial components. Company X was organised around considerably independent business units (BU) segmented by product categories, such as washing machines, air conditioners, and television sets.

Company X's entry into China began in 1987 with the establishment of a joint venture to produce cathode ray tubes. Then, Company X planned each business individually to enter China and created a joint venture using Chinese capital to establish a production base in China. By April 2001, 44 local companies had been established by BUs in China. Company X had positioned China as its global production base, and its BUs transferred resources to their subsidiaries in China. For example, production process know-how, quality management techniques and SCM were transferred. In the early 2000s, China accounted for a large portion of its global productions (often over 30%) in the area of home appliances.

Furthermore, Company X has an organisational structure combining two types: manufacturing (R&D, production and marketing) in Japanese BUs of the home country and sales overseas of the host country. This organisation was established to balance both manufacturing and sales. However, having all manufacturing functions and skills built in BU organisation makes it complex for a sales organisation to work closely with the manufacturing organisation because of differences in values, processes and methodologies.

***Development of business in China***

*Organisation for production and development*

This research focuses on home appliances in China. BUs producing microwave ovens, refrigerators and washing machines set up a business base in China aiming to export them. However, these projects were decentralised by BUs, and coordination and cooperation among the BUs were extremely limited. Such decentralised management occurred similarly in Japan, but it was particularly remarkable in China, where local partners of joint-venture differed by BUs.

From 2000 to 2006, Company X underwent a radical transformation under the leadership of a new chief executive. In 2003, as part of this transformation, Company X aggregated BUs under higher-level units called 'business domain companies' to minimise the duplication of businesses and more effectively share resources, such as R&D, product development, production and marketing, across related businesses.

Through this reorganisation, Company X created 14 domain companies. One was the Home Appliances Company that was headquartered in Japan. Given that the domain companies were assigned the mission of creating synergy among BUs, there was a parallel effort in China to aggregate subsidiaries of related BUs. Then, the Company X Home Appliances China was established in 2003.

Company X has established several of its home appliances production companies in Hangzhou, located southwest of Shanghai. Company X considers Hangzhou as a key location for its home appliances operations in China. However, owing to the historical development of production plants by strongly independent BUs, some of its home appliance subsidiaries are located away from Hangzhou.

*Organisation for sales*

X China was established in 1994 to oversee business activities in the Chinese market. When it was founded, it had sales of 4 million RMB. Then, sales increased steadily, reaching 1 billion RMB in 1997, 5 billion RMB in 2003, and 14.4 billion RMB in 2007. The number of employees increased from 186 in 1994 to 1,848 in 2007.

X China was originally established to support each BU's sales activity in the Chinese market. However, X China took direct charge of sales in the Chinese market. X Marketing Sales China was established under X China in April 2007. Until then, each BU sold its own products in the Chinese market. Since then, however, X Marketing Sales China has purchased products from BUs and sold them. Company X's press release at the time explained the reorganisation as follows:

> *We are working to strengthen our product line-up and market response capabilities by strengthening our manufacturing and sales collaboration with BUs, and we have established a system that enables us to share information, such as customers, subject lines and channels, thereby demonstrating our comprehensive capabilities. Under one management system at the top, we will establish sales BUs for each of nine products. BU sales by product are the source of the growth and profitability of sales companies. As a result of this structural reform, we have established a system to thoroughly strengthen our marketing and sales capabilities.*

After this change, the sales activities of refrigerators, washing machines, air conditioners etc., was carried out under the same strategy and management as in the field of home appliances. In 2008, out of 1,268 employees of X Marketing Sales China, 251worked at the home appliances division.

Then, development, production and sales became separate organisations, as shown in Fig. 2, making it difficult for the two organisations to work together. Traditional BUs controlled global development, production and sales, whereas China's BUs controlled development, production and exports. Only sales in China fell out of the BU's direct control.

***Product development for the local market***

As described, Company X's business in China started with production activities and gradually increased its sales in the Chinese market. Under these circumstances, the development of localised products for the Chinese market became an important issue.

*Limitations of concentrated development in Japan*

In terms of local adaptation, the development of production subsidiaries required the creation of local competitive value in the form of production facilities operational under the local conditions and constraints with local human-resource development. In particular, key people on the shop floor were trained extensively at their respective BUs in Japan. Thus, during the early phase, many production companies in China were integrated into the global network. During integration, competitive value was created mainly in the production arena.

During this phase, local development teams were built in China. Resource transfer for development was achieved through extensive training of key local staff at the training site at the headquarters in Japan, and via on-site coaching by engineering expatriates sent from Japan. Local competitive value in the manufacturing function was largely created through the training of local personnel, who were presumably more familiar with the local conditions and constraints. Product localisation during this phase, however, was rather

limited and did not extend beyond simple modifications of products developed in Japan. There were attempts to introduce locally assembled products, and product planning staff members from Japan were briefly stationed locally, but those efforts did not result in significant success in the local market.

On the other hand, some Chinese staff at the sales company in China understood the local market. They sometimes suggested local product planning, but the proposals were never taken up. One reason is that they were not professional planners. The second was that, because sales, development and production in China were separate organisations, the proposal for development was on the BU side, another organisation. It was thus very difficult for Chinese sales representatives to convince the Japanese engineers in Japan.

*Establishment of China Lifestyle Research Centre*

In its home country, Company X was strongly concerned with extensive studies on how individual households and people use home electronics products and their general lifestyles related to the use of such products. The Home Appliances Company, for instance, has a Lifestyle Research Centre that offers study services for all its BUs. In particular, each BU has its own product planning team, and the Research Centre works closely with product planning teams.

However, Company X did not have similarly extensive lifestyle research activities overseas, and their products in the markets outside Japan were largely modifications of base models developed for domestic markets. Although their overseas sales were growing continuously, there was a clear awareness among the top management at Company X in the early 2000s that, without an in-depth understanding of local markets, their competitiveness in overseas markets, particularly in emerging markets, would never reach a critical position for Company X's globalisation agenda. This concern was particularly acute for China, owing to its mega-size and rapid economic growth.

Addressing this concern, Company X created the China Lifestyle Research Centre (CLR-Centre) in Shanghai in 2005 as a subsidiary of X China (Fig. 2). The CLR-Centre represented Company X's first serious attempt overseas for an in-depth understanding of local lifestyles. The objectives of the CLR-Centre included product planning rooted in Chinese consumer research and creating a database of consumer information in China and disseminating it throughout the company. The CLR-Centre focused on washing machines, refrigerators and air conditioners under the jurisdiction of the Home Appliance Company. Their mission was to propose specific product concepts reflecting the needs of Chinese consumers to the development departments in Japan, the production departments in China, and the sales departments in China based on the results of thorough surveys.

[Figure 2 about here]

The CLR-Centre started with three staff, increasing to seven in 2008 and nine in 2017. There was only one Japanese, Director A at the CLR-Centre at the time of its establishment, and the rest of the staff was local Chinese. The Chinese were nearly all women, because users of home appliances were often women.

Director A had broad experience as a product planner at a home appliance BU and had worked closely with the Lifestyle Research Centre in Japan. He carefully hired local staff and personally trained them. He was a powerful source of resource transfer. Through the CLR-Centre in Shanghai, the R&D team in Hangzhou was beginning to be integrated into the home appliances' product planning and development network, which represented the second wave of integration in addition to the company's production network.

Director A developed and implemented unique recruitment practices to select people who fit the centre's mission. Nearly 20 people were selected from many applicants for each position and called for detailed interviews. One of the interview questions asked applicants to interpret raw data. Some provided only superficial interpretations, whereas others provided interesting interpretations that led to product ideas that appealed to the market. When applicants were hired, they were trained to acquire technical and cost knowledge needed to create product concepts. Director A emphasised data interpretation rather than data collection. He told us the following:

> *We employ insightful people. The recruitment process involves a review of documentation and several interviews. During the interview, you show the raw data and ask what you can read from it. Some people follow what's on the surface and others can read deep down, but those with a 'sense' can easily see through this interview. We are focusing on how to hire insightful people. The overall tendency of the employed is that there are many women. The reason is that the concept proposal is made directly to the BU by them, so it is a condition that they can speak Japanese, and there are many women who meet this condition. In the case of men, they are quick to understand the mechanism and technology, so they tend to think that the feasibility is difficult. The point is that women can make proposals purely from a consumer perspective.* (Sep. 20, 2010)

*Activities of the CLR-Centre*

Although working cooperatively in a combination with two different organisational structures can be laborious and challenging, the CLR-Centre, as a third-party organisation, proved to be the pillar in China for deeper localisation. The trained staff at the CLR-Centre began collecting critical knowledge and insights on the local lifestyles related to the use of home appliances.

They first create hypotheses about consumer needs. Then, they test the hypotheses using actual data. They revise and retest the hypotheses, propose focused product plans to BUs and follow up on commercialisation. The CLR-Centre proposes a concept for product planning 2–3 years in the future. In response to this proposal, BU's product planning activities take place while considering cost and productivity.

The basis of their activities is thorough field work. Specifically, group interviews, home visits and street surveys are conducted. Group interviews are conducted 20 times per year covering a total of 140 people. The information is used to evaluate and discover potential market needs. About 400 home visits are conducted annually to check the use and dissatisfaction of products. A total of about 800 people conduct street surveys five times per year, which are used to evaluate hypotheses and designs.

About 10 proposals are made for one product category per year. It takes about 10 months to review several plans. Not all of the proposals will be adopted, and the commercialisation potential is about 10%. Additional proposals may be made while the content of the proposal is being considered. By sharing the information with the sales staff, it is possible to make a better plan.

In addition to group interviews and other conventional marketing research tactics, the staff members visit individual homes. They examine, for example, the size and height of the kitchen counter, the location and space size of their refrigerator and the width of their kitchen entrance. Although the global standard width of refrigerators is 60 cm, they found that the width of kitchen entrances in China is mostly 55 cm wide. Based on this finding, Company X developed and introduced slimmer 55-cm-wide refrigerators into the Chinese

market. The market responded enthusiastically to this localisation, and the sales increased ten-fold.

Sales staff members have reported this type of information for some time. However, they have been unable to persuade their BUs, because they did not have data as detailed as the CLR-Centre. BU hesitated to change the width of refrigerators because it required a large investment in moulding.

Another key contribution of the CLR-Centre is the creation of a local lifestyle database. The database is quite extensive, covering many product categories for customer preferences specific to different income groups and regional characteristics. For instance, rice cookers must consider regional preferences, such as short-grain rice in northern China, medium-grain rice in central China and long-grain rice in southern China. Similarly, rice porridge is popularly served for breakfast in China and many use rice cookers to prepare it. However, in the north, thin porridge is preferred. In the south, the porridge is served much thicker. Such detailed lifestyle information was systematically collected into the database and made available to BUs and their subsidiaries in China. The CLR-Centre found that the assembled information represented a value for local adaptation and its ready availability for BUs and their subsidiaries promoted resource sharing that could, in turn, lead to strengthened cross-border integration.

*International communication*

The CLR-Centre aims to propose new product concepts based on systematically collected market data, knowledge on technological enablers and cost considerations. A member of the staff is usually assigned to a particular product category, such as washing machines and refrigerators. Staff members have regular meetings with the engineers of the corresponding BUs and their local subsidiaries, as well as the Home Appliances' Technology Centre in Japan. There are about three debriefing sessions per year for each product, and all departments related to the product participate. The session comprises about 10 people.

Through repeated meetings, staff members were introduced to their engineering counterparts in Japan and local subsidiaries; they established informal networks with them. The staff members then began to interact with the engineers more informally through telephone calls and email exchanges.

Generally, production sections, such as BUs, tended to standardise the products as much as possible, and R&D sections tended to be oriented towards product innovation rather than customer needs, whereas marketing sections come face-to-face with customer needs. However, the CLR-Centre has developed effective cooperative relationships with BUs in Japan and their local subsidiaries, extending beyond conflicting relationships, through formal and informal networks. The CLR-Centre's staff gained technological knowledge, and the engineers at home appliance based in China and Japan developed a deeper understanding of the local market conditions in China. This was possible because of the CLR-Centre's ability to create deeper local knowledge. In other words, deeper local adaptation led to profound global integration.

Director A described the difficulty of communication between the CLR-Centre's Chinese staff and Japanese BU's as follows:

> *Local needs can be identified based on extensive factual evidence. However, the problem is how to persuade the Japanese side. Product planning audits are conducted by business domain. Most products go through the process of obtaining approval from Japan. At that time, people with different sensitivities make judgements, so it is difficult to pass the plan, and even if it passes, the product will be different from what*

*you want. Because China is an Asian country like Japan, although sensitivities are different from the beginning, efforts to understand them have an adverse effect as a result* (Sep. 20, 2010).

However, even if commercialisation is realised by the CLR-Centre's proposal, there are cases where recognition is not always consistent among divisions. This leads to market failure. In fact, the 55-cm-wide refrigerators did not sell as well as expected. As a product concept, it was proposed as one with high value, even though it was slim. The BUs, however, did not fully understand the concept and made the design and materials of the product cheaply. It was not easy to maintain the original concept through development, production and sales.

A host of successful product introductions in the local markets via cooperative relationships resulted in solid trustworthy relationships and interdependence between the CLR-Centre in Shanghai and the engineers in Hangzhou, and between the BUs and the Home Appliances Company in Japan. This has, in turn, altered the authority distribution towards greater autonomy of local operations.

Generally, at this stage, there is a trade-off in meeting local customer's needs appealed by overseas subsidiaries while seeking advantages through integrated global operations tended by the parent company. In this case, through the local R&D capabilities that are built, the decision on new product introduction for the local markets has, in effect, come under the local authority since 2008. The final formal decision still belongs to the respective BUs in Japan, but this is to ensure global coherence for basic design elements, such as chassis for washing machines.

In the next section, one of the successful examples of the product planning proposed by the CLR-Centre is described.

*Case: Bacteria-sterilising washing machines*

1. Survey and fact findings

The CLR-Centre surveyed more than 300 Chinese households in detail on how they did their laundry. First, they looked at how they washed (e.g. washing machine, hand-washing, professional laundry services) and each item used (e.g. sheets, towels, shirts, underwear). They also investigated the location, size, and installation path of the washing machines. They found that most Chinese washed sheets with a washing machine, whereas 86% washed their underwear by hand, even if they had a private washing machine.

2. Examination through in-depth interviews

One female member of the CLR-Centre focused on the fact that many people washed their underwear by hand. The member thought that there must have been a strong reason behind this fact, and a potential need could be identified if the reason was figured out. The CLR-Centre conducted repeated in-depth interviews with Chinese consumers. As a result, it became clear that many consumers agreed to the following recognition:

*At that time, it was highly likely that public places in China were contaminated with bacteria. As a result, their outerwear is dirty when coming home from outside work. If dirty outerwear and underwear are washed together in a washing machine, there is a risk that the underwear could be contaminated. Therefore, consumers wash their underwear by hand without putting it in a washing machine to prevent germs from adhering to the underwear.*

3. Concept proposal

Based on the consumer recognition revealed by above examination, the CLR-Centre made two proposals at regular meetings with the R&D department in Japan. The first idea was to develop a washing machine that could reliably sterilise clothes while washing. Second, because there as a wide range of needs for sterilisation in China, they planned to install sterilisation devices on products other than washing machines.

4. New product development

Ultimately, three departments including R&D Japan, production China and marketing China were convinced of the importance of the product concept with sterilising capabilities proposed by the CLR-Centre. Based on the Centre's proposal, Company X promoted commercialisation in cooperation with the three departments.

At the time, there were already one or two companies in China that were selling washing machines with bacterial sterilising functions. However, it was not uncommon that the newly introduced functions were not as trustworthy as their Chinese manufacturers claimed. The market, hence, did not always respond positively to new products espousing new functions. Company X had the technical capability to develop a sterilising device on its own but decided to conduct a joint research with Shanghai Jiao Tong University. They believed that the joint research would increase the credibility of new products for Chinese consumers, because Shanghai Jiao Tong University was one of the premier university in China. They jointly developed a light-emitting diode Ag bacteria sterilisation device.

5. Introduction to the market

The device was introduced to the Chinese market in 2007 under the brand name 'Anti-Bacterial Diagonal Drum Washing Machine'. This machine was the top-end model out of three models. The price was 7,000 RMB, which is 1,000–2,000 RMB higher than the average price of top-range products. Simultaneously, Company X introduced products equipped with sterilisation devices in refrigerators and air conditioners.

X Marketing Sales China then publicised its study data, proving the effectiveness of its bacteria sterilisation device and announced that the device was developed in collaboration with Shanghai Jiao Tong University. It believed that the collaboration with the famous institution would contribute to the market acceptance of Company X's washing machines.

In its first 10 months on the market, Company X's market share in China jumped from 3% to 15%. The most expensive model among the three accounted for 60% of sales. In 2009, 2 years later, Company X introduced a small-sized sterilising washing machine for the middle class at a price of 4,000–5,000 RMB. They determined by exhaustive measurements the marginal size of the average middle class home.

**Discussion**

In the case study, the CLR-Centre was a driver promoting global integration among R&D, production and marketing (Fig. 3). The Centre is a third-party organisation that is, in general, not usually capable of successfully promoting integration. The Centre enabled this through various hypothesis tests to explain explicitly to Japanese engineers in the home country the intuition of the local Chinese researchers in the host country that could not be achieved by the existing organisation, such as production and marketing departments in China.

This case supports the literature on boundary spanning, where roles evolve in the organisation's communication network to fulfil the essential function of linking the

organisation's internal network to external sources of information, where widespread communication across boundaries tends to be difficult (Tushman, 1977).

So, why would such a third-party organisation connect R&D, production and marketing in this case? This question is explored from the perspectives of triad integration and global, as follows.

[Figure 3 about here]

*Triad integration at an early stage: front-loading*

SCI has been considered relay integration in the form of R&D production and production marketing as product development progresses (Krishnan *et al.*, 1997; Krishnan and Ulrich, 2001). However, it is necessary to consider the integration of those three functions in a triad. If problems that occur during mass production are not solved at the product development stage, it will be costly and time consuming to push the problems back to the R&D section. Additionally, it would be too late to recognise that it is a product that marketing cannot sell, once the relay of production marketing comes up. Consequently, it would be better to solve the problem related to those three functions as early as possible.

Thomke and Fujimoto (2000) examined how to use 3-dimensional computer aided design (CAD) effectively by examining the production time at each stage of product development when it was introduced to manufacturing by 3-dimensional CAD. As a result, an efficient development project that promoted early problem identification and solving led to efficiency and lead-time improvement. However, it took a lot of production time at the beginning. Such a project that solves a problem at early stage of development is characterised as front-loading the problem (Thomke and Fujimoto, 2000; Szulanski *et al.*, 2016). Thomke and Fujimoto (2000) argued that it took time to solve the problems at an early stage, because many problems pile up early. However, front-loading contributes to rework elimination that can lead to improved efficiency.

The CLR-Centre was positioned as the most upstream entity in new product development through the activities of advanced product planning. At the early stages, the front-loading of problems can be conducted via the CLR-Centre's communication with R&D, production and marketing.

*Global integration by externalisation*

To develop a local product, local knowledge is required and must be understood intuitively by the local Chinese. However, it is not clear how to do this with an external organisation. In this case, the Centre logically transferred this local knowledge on the Chinese market in a form that could be understood by Japanese engineers. In other words, the Centre converted local tacit knowledge into explicit knowledge and conveyed it effectively to Japanese engineers. In that sense, the Centre was in charge of the externalisation process of the socialisation–externalisation–internalisation–combination (SECI) model (Nonaka and Takeuchi, 1995).

Converting tacit knowledge on the Chinese market into explicit knowledge and conveying it effectively to Japanese engineers was possible because of Japanese language capabilities of the Centre staffs, who communicated between Chinese staffs in the Centre and Japanese engineers in the BUs.

On the other hand, the marketing department in China could not transmit such tacit knowledge on the Chinese market as explicitly. Thus, Japanese engineers had some difficulties developing the products requested by the marketing department in China.

With the SECI model, tacit knowledge can be transferred by sharing tacit knowledge itself (socialisation) or converting tacit knowledge into explicit knowledge

(externalisation). Subramaniam and Venkatraman (2001) argued that by assigning persons holding tacit knowledge of overseas markets to development teams, the knowledge within those teams would be utilised effectively for higher product development performance. However, they did not reveal how tacit knowledge was understood or shared in the development team. Nonaka and Konno (1998) observed that socialisation involving the sharing of tacit knowledge required sharing of the same experience in the same context. This is considerably difficult for persons in different countries.

If all core functions, such as R&D, production and marketing, are managed locally, such tacit knowledge could be shared easily via the LGTs advocated by Govindarajan and Trimble (2012). However, in this case, the main function for R&D remains in Japan. Thus, it is necessary to share knowledge across borders. Sheng et al. (2015) argue that subsidiary tacit knowledge does not contribute directly to the product innovation of MNCs. They have empirically shown that cognitive (i.e., task efficacy), behavioral (i.e., affective trust), and environmental (i.e., organic structure) factors improve MNCs' product innovation ability and weaken the negative effect of subsidiary tacit knowledge level on MNCs' product innovation ability (Sheng et al., 2015).

Therefore, externalisation of tacit knowledge would be another important way to share and transfer the local tacit knowledge. From this perspective, it was extremely important that the CLR-Centre executed their fieldwork thoroughly by collecting market data to demonstrate their hypotheses and proposing them to Japanese management.

The same phenomenon can be recognised in international knowledge transfer from other aspects. For example, when Toyota expanded its overseas production bases in the U.S. at full scale, they made their utmost efforts to convert tacit knowledge about their production into explicit knowledge (Inkpen, 2008). At that time, even in Japan, Toyota promoted the activities for texting about knowledge, although it was not always necessary. Moreover, they transmitted a text on the philosophy of manufacturing at Toyota. Although this text was in English at first (Ohno, 1988), it was translated into different languages around the world. This text was useful for persons working for Toyota in various countries to understand Toyota's manufacturing vision.

Externalisation of market knowledge is difficult, because most of the knowledge is rooted in culture, lifestyle and history of the country of the market. Certainly, it is difficult for foreigners to intuitively understand those contexts. However, the CLR-Centre has shown that it is possible even for foreigners to understand the local knowledge owned by local people in a form that makes sense. For locals, it may be a cumbersome process to externalise that which they intuitively understand. In that sense, it may be quicker to create a development team solely with local people. However, there remains the possibility that product development may proceed with ambiguity even with tacit knowledge. Furthermore, it is possible to drive projects with false beliefs. However, persuading foreigners who cannot understand tacit knowledge with explicit knowledge and logic has positive repercussions, in the sense of avoiding mistakes.

**Concluding remarks**

Existing studies have made it clear that SCI is important. However, they have not shown how to implement it. This study provides three theoretical implications that address this important research gap. First, the CLR-Centre drove promote global integration among R&D, production and marketing. Second, implementation of this triad, as opposed to dyadic integration, was possible thanks to the front-loading of problems conducted at early stages of product development. Third, the externalisation of tacit knowledge into

explicit knowledge promoted by the Centre was very important for global integration of the triad.

While the R&D function is retained in Japan, the CLR-Centre makes it possible for the R&D of home country Japan and local R&D, production and marketing in the host country of China to be well connected. Although previous studies addressed the question of where overseas R&D sites should be located (Kenny and Florida, 1993; von Zedtwitz and Gassmann, 2002) and the coordination and management of R&D sites that have been relocated worldwide (Nobel and Birkinshaw, 1998; Reger, 1999), existing studies have focused on the issue of expanding R&D functions that were concentrated in the home country. Thus, the present research shows how to effectively integrate R&D, production and marketing for local markets in an environment where R&D functions are concentrated in the home country.

However, when entering the next stage (shifting Japan's R&D function to China), there another level of the problem will present itself, about how to develop, produce and sell differentiated products locally in China and how to convert and translate tacit knowledge on cross-organisation's sources of information into explicit knowledge. Further theoretical and empirical research should be the next agenda for research.

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