Local Engineers as Knowledge Liaison: How Denso India Succeed in Developing Wiper-System for Tata Nano

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Abstract: Developing localized products that accurately reflect the needs of local customers became an important issue for many Japanese companies that have globally expanded using standardized products. This is because the reasoning and value standards of local customers concerning cost or product performance are tacit market knowledge. Thus, the technological knowledge of home country engineers is not enough for developing successful localized products. Here, the role of local engineers becomes critical. In the case of Denso India, local engineers have been sent to Japan for training since the late 1990s, that is, when new Denso factories were launched in India. The purpose of the training is to strengthen local engineering capabilities by encouraging talented local engineers. This served to effectively connect Japan’s technological knowledge with the knowledge of local markets. The local engineers who were trained in Japan have access to technological resources at Denso’s headquarters. In addition, local engineers can observe and

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A part of this paper was originally published as Kim (2012) in Japanese.
interpret customer needs more accurately and incorporate them into products designs because they share tacit market knowledge with the local customers. This case highlights the importance of training and utilizing local engineers for connecting technological knowledge in the headquarters with market knowledge in the host country.

Keywords: localized products, knowledge liaison, technological knowledge, market knowledge, local engineers, Denso India

Introduction

Product localization is frequently cited as a keyword for emerging market strategy. Accurately understanding local customers’ needs and developing and supplying products that incorporate those needs is important for multinational firms to gain success in emerging business markets. Then, how is a company able to develop such products? What is required from these companies to have successfully developed localized products? For example, research on global business management emphasizes communication between a headquarters and a local subsidiary. The frequency and contents of communication are important because communication is considered a proxy variable to measure knowledge exchange. Communication is particularly emphasized in the studies discussing innovation by overseas subsidiaries (Ghoshal & Bartlett, 1988; Ghoshal, Korine, & Szulanski, 1994; Mudambi, Mudambi, & Navarra, 2007; Nobel & Birkinshaw, 1998). Discussions about “global product development team” also stress on communication among team members. This type of collaboration is also called as “virtual team,” because the team members work together despite physical distances and cultural gaps. These studies share a consensus about the importance of establishing trust among team members through mediums of social
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exchanges and encouraging communication flow (Ambos & Schlegelmilch, 2004; Gassmann & Zedtwitz, 2003; Govindarajan & Gupta, 2001; Lagerstrom & Andersson, 2003; Moenaert, Caeldries, Lievens, & Wauters, 2000). This is based upon the assumption that new products are created through knowledge sharing among team members spread across the world.

Figure 1 shows the types of knowledge that are necessary to be shared between the headquarters and a local subsidiary when developing localized products.

Previous studies have discussed technological knowledge (Almeida & Phene, 2004; Pearce & Papanastassiou, 1996) and market knowledge (Lord & Ranft, 2000; Subramaniam, Rosenthal, & Hatten, 1998) separately, depicted on the horizontal axis of Figure 1. In addition, the vertical axis shows dimensions of knowledge. Many studies explored explicit knowledge and tacit knowledge when it comes to product development (Lagerstrom & Andersson, 2003; Leonard & Sensiper, 1998; Lord & Ranft, 2000; Madhavan & Grover, 1998; Nonaka, 1994; Subramaniam & Venkatraman, 2001). All the

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**Figure 1.** Required types of knowledge for product development
types of knowledge are believed to be necessary for successful product development. Considering the tacit nature of knowledge (Polanyi, 1966) and stickiness of it (von Hippel, 1994), it is difficult to develop a good product for a local market that is physically distant and culturally diverse from the home country, which in this case would possess limited types of knowledge. In other words, even though the headquarters may be rich in technological knowledge, without accurate market knowledge regarding local market needs, its products will not be successfully localized. Similarly, if a local subsidiary with rich market knowledge takes a leadership in developing a localized product, it cannot fully exert its strength as a multinational company without properly utilizing technological knowledge that has been accumulated in its home country. Thus, when the headquarters and a local subsidiary that are located far away from each other collaborate for a localized product development project, it becomes particularly important for both to integrate their knowledge.

This is why four types of knowledge (Figure 1) are all necessary for successful product development. This paper discusses the necessity and method of knowledge linkage for product development, which is indirectly mentioned in many previous studies. Denso India’s (hereafter DNIN) case study is used to illustrate the primary objective of this paper. Although many Japanese automobile suppliers have globally expanded their businesses, most of their local production is targeted to Japanese automobile manufacturers. Denso launched its business in India 25 years ago, and until recently, would supply products only to Japanese automobile assemblers such as Suzuki and Toyota. Recently, Denso won a contract for the wiper system adopted by Tata Motors, a leading automobile assembler in India which ranks third in terms of market share in the Indian automobile market. More importantly, the wiper system was for the Tata Nano, the vehicle that attracted worldwide attention because of its ultra-low
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cost. DNIN was able to successfully win the contract despite having no previous business record with Tata Motors and many other global and local suppliers participating in the competition.

This paper will briefly explain DNIN’s business history in India, followed by the process of winning the contract for Tata Nano. In addition, it discusses the development of wiper system and the role of local engineers in the process. As the work load regarding engineering and development in a home country may increase and the numbers of engineers may decrease, many companies outsource their low-end development processes (Kim, 2010a, 2010b, 2012). While this type of labor division can be expressed as utilizing local engineers’ hands, this paper emphasizes the advantages or necessities of utilizing their brainpower or knowledge. The development of successfully localized products becomes possible when local engineers fulfill their role of effectively connecting local market knowledge with the technological knowledge at the headquarters.

Denso’s Business in India

In 1986, Denso began its operations in India upon the establishment of SRF Nippon Denso, Ltd., a joint venture with a local company named SRF (Shri Ram Fibres Ltd.). The motive of Denso’s India business was to facilitate Suzuki and Toyota’s request to manufacture in and supply to India, both of which entered the Indian market in 1983 and 1985, respectively. This can be attributed to the Indian government having set a certain level of local procurement obligations for automobile assemblers.

However, in 1992, Toyota withdrew from the Indian market. DNIN struggled to survive and secure customers. For a while, DNIN’s main customer was Maruti Suzuki and Japanese two-wheeler
manufacturers that had small business volumes. Since the mid-1990s, many foreign automobile assemblers have established their businesses in India. This allowed DNIN to expand its customer base from Maruti Suzuki and Yamaha to Honda (two and four wheelers) and Suzuki (two wheelers).

Furthermore, Toyota re-entered Indian market in 1997. To respond to the re-entry of Toyota and to cope with regulations of the Indian government, in 1998, Denso set-up new factories such as DENSO Kirloskar Industries and DENSO Haryana. It can be said that DNIN’s business has stably grown since 2000s. DNIN’s main customers were Japanese automakers, and Denso responded to the increasing product volume of their existing customers, rather than increasing the number of customers.

**Denso’s Challenge for Tata Motors**

Next, the paper describes the process of how DNIN won the contract for Nano’s wiper system and the role and significance of local engineers in the process. The suppliers’ list of Tata Nano shows overwhelming predominance of local and global suppliers and only few Japanese suppliers. Especially, approximately 90% of the suppliers are Indian local companies, which mean they sincerely believe and support the challenge of Tata Motors, along with the primary cost factor.

DNIN employed the following processes and systems to participate in and win the contract for the Nano project: Denso had not participated in the development of the wiper system for Nano from

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1 In the first half of the 1980s, four Japanese motorcycle companies entered into India either through a technical partnership or joint venture.
3 According to a survey conducted in DNIN in August, 2009.
the very beginning. In fact, three other companies besides Denso participated in the bid for the development project of the wiper system. However, no satisfactory proposals were made by these three companies. Thus, Tata asked DNIN to sign the contract competition in 2006, a year after the launch of the Nano project.

Product development and the supplier selection process at Tata Motors were different from those of Japanese assemblers. Tata asked multiple suppliers to join from the early stage of product and collaboratively conduct simulations. Finally, Tata selected two suppliers and signed a contract with them for selected parts. This “dual supplier contract” is common business practice in the Indian automobile industry. Various proposals and discussions are carried out in the process of selecting two suppliers. First, Tata Motors presented the primary specifications of the product to multiple suppliers using a basic concept of overall product system. In the process, for example, one supplier may have a good solution about regulations while the other may have good ideas for cost reduction. Therefore, Tata Motors invited multiple suppliers to “brainstorm” in the nascent stage of product design. After obtaining the best ideas, Tata made a counter-proposal to the suppliers. In principle, suppliers who satisfy Tata’s wish list would win the contract.4

With no previous business experience with Tata Motors, DNIN needed to learn about the business practice first. Thus, DNIN requested advice from various local companies, with which it previously had capital or technological partnership, such as Subros, Pricol, and Lucas-TVS. These local companies enjoyed a long-term business relationship with Tata Motors and DNIN was able to get considerable helpful advice from them.

So, who in DNIN took up the task of product development for Tata

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4 According to an interview conducted with Tata Motors (February, 2011).
Nano’s wiper system? The engineers in charge in Tata Motors were of Indian nationality. Thus, to proceed effectively among Indians, a local Indian engineer who was working for DNIN assumed the role of, so to speak, a chief engineer. He was trained in Japan and familiar with Japanese design standards and product development operations and practices. Product development was mainly done in India by a team that was led by the chief engineer and sent to Japan for tests and evaluations. Although there were simple equipments for testing in India, the final test for durability and quality was done in Japan.

The “project team” at DNIN consisted of three engineers and one chief engineer, who were also the supervisor. The chief engineer, who could speak Japanese, coordinated with the engineers in Japan. Meanwhile in Japan, two engineers provided considerable support during the process, that is, from contract confirmation to determination of specifications. Both of these engineers were employed by Asmo Co. Ltd., a subsidiary of Denso, which manufactures motors for wipers in Japan. In addition, an Asmo engineer was temporarily transferred to DNIN.

**Product Development Lead by Indian Engineers**

What were the proposals that Denso made to Tata Motors that resulted in them winning the contract? DNIN gave highest priority to Tata Motor’s design standard, values, market environment and product usage in India. The Indian engineers were at the center of this challenge. For DNIN, this was a brand-new trial because it conventionally followed global standard for product development. With the above local conditions firmly in place, technical proposals were then added. An interviewee at DNIN described the product planning stage during initial development

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5 Wiper motors are produced in the Asmo Kosai plant in Japan.
process as follows:

At first, the Indian engineers of Tata Motors suggested that only a motor and wiper arms were sufficient as a system and believed that other parts were unnecessary. Their reasoning was if a wiper moves that is enough. However, DNIN considered the issue from the perspective of performance stability and added a number of functions. Of course, due to applications of the additional parts, the cost itself increased compared to the original suggestion by Tata Motors. However, DNIN was able to persuade Tata Motors by explaining their viewpoint from a technical perspective.

It was the first time that DNIN was able to take this type of approach, called “optimizing activities,” within the company. Market environment and product usage in India were considered priority.

“In India, the rainy season is short, but intense.”6 India’s monsoon season may be defined by short spells of heavy rainfall, perhaps an hour or so. Because the climatic conditions are very different from those in Japan or Europe, where it rains throughout the year, different ways of thinking or approaches were required. Assuming that people generally refrain from driving during the heavy rainfall, a proposal to limit the wiping area was made, keeping with the local regulations of India of course.

Considerations of local conditions and wiper usage resulted in the product design of a single-armed wiper; it was believed that “it is unnecessary to wipe the passenger side window. It is sufficient for a wiper secure the driver’s view.”

In this case, India’s climate conditions (e.g., spells of squalls or heavy rainfall) and the peoples’ driving style (e.g., rash driving or some prefer not to drive during heavy rains) can be classified as explicit knowledge that is codifiable. This is also a part of necessary

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6 Although it differs by region and year, the monsoon in India is mostly between June and October because the climate is strongly influenced by the monsoon winds from the Himalayan Mountains and the Thar Desert.
local market knowledge, particularly for product development. On the other hand, user expectations about product (wiper) performance and durability and attitudes toward its usage are tacit market knowledge. Thus, correctly observing and interpreting tacit market knowledge and implementing it into product design is critical. As discussed in this case study, the engineers believed that “a single-armed wiper is enough, because it is unnecessary to wipe the passenger side’s window. Customers will be still satisfied with it.” This way of thinking has emanated from the local engineers’ primitive sense, which has developed in response to local conditions. This is what this paper refers to as “tacit market knowledge.”

Furthermore, realizing reasonable quality in keeping with Tata Motors’ cost goal and their customers’ expectations were crucial, because the Nano had to be designed as a low-cost automobile under the slogan of “the 100,000 rupee car.” The wiper system used in the Nano employed features that differed from Tata Motors’ internal standards in terms of warranty, durability, and design standards such as operating noise. Needless to say, the modified product standard for Nano was quite different from Denso’s global design standards and that of Maruti Suzuki, India’s number one automobile manufacturer. Various technical approaches were taken in DNIN to

Figure 2. Wiping width comparison (images)
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adopt “new quality and cost standards” that had surely never been experienced before. Ideas for omitting or replacing parts successively came from the development team of Indian engineers. Reduction, elimination, and replacement of items for cheaper ones were proposed from their view point. For example, the necessity and usage of various parts, such as wiper rings, bearings, and rubber caps were reviewed based on the characteristics of target users of the Tata Nano and India’s environmental conditions. As a result, they succeeded in achieving an approximate cost reduction of 30%.

These standards of customer value can also be classified as tacit market knowledge. Because, when reviewing parts and functions in the early stage of product development process, Tata Motor’s value standard about a balance of product quality and cost was critical. The optimum balance of function, quality, and cost that can satisfy the customer can be achieved through constant communications and interactions between the product developer and the customer and is extremely difficult to codify. Furthermore, due to

Figure 3. Conventional wiper system (above) and DNIN-developed wiper system for Tata Nano (below)
the product’s characteristics (automobile part), quality expectations of the final customer (automobile user)—for example, the Tata Nano’s wiper functionality—also becomes tacit market knowledge. These expectations must be correctly observed and interpreted by the developer.

Another Step Forward

There had been a clear division of labor between Japan and India until the development of Nano’s wiper system. Simply put, India applied basic products models developed at the Japan headquarters. Namely, process (1) through (6) in Figure 4 were performed in Japan while only (7) and (8), which included immediate responses to the local customers, were the responsibility of the design team in India. In addition, searching for local materials when the same were unavailable in local conditions, and performing “material localization,” or the assessment of whether local materials could fulfill the same functions, were a part of local engineers’ primary tasks.

This wiper system development project fell somewhat outside of the “application engineering only” range of their routine works. Namely, the local engineers performed process (5)–(8) (Figure 4); with technical support from Japan. It was the first time that the local engineers stepped into this wide range of product development works. It is believed that the experience would be very helpful for the local engineers and DNIN to expand their business in India.

In addition to the wiper system, DNIN also won the contract as the second supplier for Nano’s power window motors. It seems that DNIN’s proposal capabilities based on high technical knowledge was favorably evaluated by Tata Motors, which resulted in a subsequent contract. In other words, this experience not only increased the product development competence of the local subsidiary but also
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(1) Basic research
(2) Applied research
(3) Product concept generation
(4) Product development
(5) Basic engineering
(6) Mass production engineering
(7) Application engineering
(8) Evaluation

**Figure 4.** Functions of local product development

provided the opportunity to build the local customers’ trust.

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This case emphasizes the role of local engineers in the collaboration of tacit market knowledge and tacit technological knowledge in the process of product development. As mentioned, the way of thinking and local customers’ expectations are tacit market knowledge, while technical knowhow accumulated by Denso over several years, which cannot be expressed in specifications or drawings, is defined as tacit technological knowledge. Because these two types of tacit knowledge exist in physically distant locations, the intentional linkage of these two becomes an important managerial issue for the development of localized products. As one of the approaches, DNIN proactively trained local engineers and fully utilized their capabilities.

DNIN began training local engineers steadily since the mid-1990s, when they started to strengthen their production facilities and functions in India. At the beginning, the main purpose of training local engineers was to improve the manufacturing competitiveness
through strengthening production technology and maintenance of manufacturing facilities. Simultaneously, the needs of application engineering for local customers began to increase. This was because there was high requirement for local procurement, and DNIN established businesses not only with Japanese automakers but also local and the other global automakers, who needed application engineering of Denso products for local markets. Therefore, since late 1990s, DNIN began sending two engineers to Japan annually for a year’s training. As a result, they already had up to nearly 30 engineers who experienced training in Japan. The local engineers who experienced this type of training contributed to further product development through a two-way communications (Figure 5). This also reflects Likert’s (1967) argument that members who are positioned in overlapping areas with multiple means should become the cornerstones of the overlapping work units and fulfill the role of linking pins.

Tacit knowledge is an important factor for the communication of local engineers as knowledge liaisons. On one hand, smoother communications with Japan and local engineers can be facilitated by absorbing technical knowledge from Japan once they have already
acquired tacit knowledge, such as the way of working in Japan, approaches toward product development and manufacturing, and the value of Japanese engineers. The transfer and training of local engineers in Japan is not merely to improve technical ability related to design and development duties but was undertaken to obtain these types of tacit technological knowledge. Of course, social interactions with Japanese engineers (Moenaert et al. 2000, Govindarajan & Gupta, 2001) also facilitated smooth communication after the local engineers returned to their local base.

On the other hand, tacit market knowledge (including local customers’ feelings regarding cost, expectation about product performance, standards, and usage based on local climate and lifestyle mentioned in this paper), becomes critically necessary for communicating with local customers. Even when interpreting explicit knowledge from survey or market field research, it is very difficult to correctly interpret the result without the intuitions of local people. Generally, it is more difficult for outsiders to obtain tacit market knowledge than tacit technological knowledge. Thus, it is not easy for Japanese engineers to correctly grasp the tacit market knowledge by only several years’ residence in a host country. However, with this tacit market knowledge, there are new developments in the product design and specification options change. Moreover, it becomes possible to grasp market opportunities that are not easily perceived by other competitors (Subramaniam & Venkatraman, 2001). For this reason, the tacit market knowledge of local engineers is necessary when developing localized products.

DNIN built a framework that more correctly reflects the tacit market knowledge in its products by allowing local engineers to take lead in the process of creating the product. This paper showed that the collaboration process of market and technological knowledge by

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local engineers facilitated the successful development of localized products.\(^8\)

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Kim, H. J. (2010a). Kaigaikyoten no setsuritsu keii to seihin kaihatsu kiko no gurobarutenkai [Entry mode of local subsidiaries and global

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\(^8\) The case of DNIN presented in this paper illustrates the unique aspects in development processes conducted between automobile parts suppliers and assemblers (Konno, 2007). Unique product development processes and practices of Japanese companies can also be seen in other industries (Kuwashima, Takahashi, & Tamada, 2005; Tomita, 2009; Yasumoto, 2006). However, the essence of this case can be applied to various companies, such as durable goods manufacturers for general consumers. Because thoroughly understanding the local customers’ true needs and creating products that meet those needs is commonly desired by many multinational companies that are competing in emerging markets (Govindarajan & Trimble, 2009).


*Received August 30, 2012; accepted October 22, 2012*