

**Managing Lean Supply and Innovation:  
Cross-cultural Knowledge Transfer in an Multi-national Company**

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## **Abstract**

There is growing evidence that organisations are increasingly using the concept of lean supply to foster innovation. This paper considers key factors that influence this management approach in the context of the cross-cultural transfer of both codified and tacit knowledge embedded in a manufacturing process. It reports current empirical research on a multi-national company – American Power Conversion (APC)’s production line transfer from Galway, Ireland to Suzhou, P. R. China. It aims to explore the key factors influencing APC’s lean manufacturing and knowledge transfer, and further provide a base-line from which pragmatic advice can be given to companies pursuing manufacturing or supply strategies. The research proposes to make a contribution on examining the key factors that influence the effective transfer of knowledge between two important countries in the global manufacturing landscape.

**Keywords:** Innovation, lean supply, cross-cultural interaction, intra- and inter- organisational network

**Type of paper:** Work-in-progress

## **1 INTRODUCTION**

It has been popular to consider the multi-national corporation (MNC) as both an intra-organisational and inter-organisational network (Hakansson & Snehota, 1989; Frod, 1990; Snehota, 1993; Ghoshal & Nohria, 1997; Schmid et al., 2002; Andersson et al., 2002). From a view point of intra-organisational network, an MNC is linked by various ways between the headquarters and its subsidiaries (Hedlund, 1986; Doz & Prahalad, 1991). From a view point of inter-organisational network, an MNC’s subsidiaries are embedded in different local networks (Ghoshal & Bartlett, 1990; Forsgren et al., 2000). Ghoshal and Bartlett (1990) claim that an MNC can be explained by selected attributes such as structure of the inter-organisational network within which it is embedded. Evidence shows that different national cultures make different demands on organisations and offer them different opportunities (Gabriel, 1999, p. 168). By synthesising the intra- and inter- organisational network approaches, from a cultural perspective, this paper brings together the external networks (i.e. cultural contexts) in which an MNC’s knowledge transfer is taking place. It reports on an ongoing study of the supply chain transformation initiative based in a subsidiary of American Power Conversion (APC) located in the BMW (Border, Midland and Western) region of Ireland. Currently, a production line is transferring from Galway, Ireland to Suzhou, P. R. China. This research aims to explore the key factors influencing APC’s lean manufacturing and knowledge transfer, and to provide a base-line from which pragmatic advice can be given to companies pursuing global manufacturing or supply strategies. Hence, the research concerns: How does a network view incorporating intra- and inter-organisational perspectives assist understanding of cross-cultural knowledge transfer within an MNC?

The study is being carried out within the context of a period of significant change within both the Irish economy and the APC Corporation. Ireland is now entering a new era which requires a transition to an innovation economy (Porter, 2003). The Corporation has recently demonstrated strong financial performance and the ability to bring to market innovative product offerings

through in-house research and development (R&D) and strategic acquisitions. However, the company has stated in recent financial reports that it needs to transform its manufacturing processes by developing a lean customer-centric supply chain. The Corporation entered a major period of transition in the last quarter of 2006 with the announcement of its merger with Schneider Electric, a French electric equipment maker. With the continuing transfer of many of its products to offshore locations such as China, the Irish Operations functions are convinced that being a corporate leader in the area of process innovations is key to the long-term sustainability and development of the location.

This research employs an in-depth case study approach and builds on Leonard-Barton's (1998, p. 219) model of transfer of technological capabilities. The paper proceeds as follows. The next section provides a literature review on the concept of lean and innovation in the network context. A case description follows. Next the research approach is outlined and data collection is described. Following this, the initial findings are discussed. Finally the conclusions are presented in terms of the implications for researchers, practitioners, and future work.

## **2 LITERATURE REVIEW**

This section will place the study within established research and theory in the areas of lean supply, innovative organisations and information systems (IS).

### **2.1 The Concept of Lean**

Lean is a supply chain term defined as the “enhancement of value by the elimination of waste” (Womack & Jones, 2003). The idea of “lean supply” (Lamming, 1993) is adopted from the concept of “lean production” (Womack et al., 1990). According to Lamming (1993), the term originated from a major automotive-industry study, the International Motor Vehicle Program (IMVP), based in MIT during the period 1986-1990. Because of where it originated and the influence of Kiichiro Toyota, it is commonly known as the Toyota Production System (TPS). Although it was coined to describe the management approach used by Toyota in its production and supply, it is not about cars, nor is it solely about manufacturing. It is a flow of value unencumbered by hesitation, deviation or repetition (Cox & Lamming, 1997). An analysis of the techniques suggests that the methodology is an umbrella for many standard Industrial Engineering practices tied together as an integrated organisational process. Womack and Jones (2003) state that it is not the latest quick-fix program but requires a critical organisational transition from top-down directives to bottom-up initiatives where managers become coaches and employees become pro-active.

Furthermore, Tidd et al. (2005) propose lean thinking as a competitive advantage; in particular the practice of kaizen as a method of continuous incremental innovation over a long period. The analysis by Lamming (1993) of innovation in the lean production of new American automobiles concludes that the half-hearted commitment by senior management and transient project managers resulted in many basic problem not being resolved early on in the development. In addition, from a relationship point of view, Lamming (1993) says that competition in lean supply even includes collaboration with competitors as well as between customers and suppliers. In his later work, he summarises lean supply as the product of an operating attitude that recognises the cost associated with any departure from perfect execution of the tasks necessary to provide long-term customer satisfaction (Lamming, 1996). This objective is to achieve total eradication of those costs. Significantly, the latest “thinking” from Womack and Jones (2005) has shifted the

focus from lean supply to lean solutions and widened the concept to the process of consumption. However some researchers such as Christopher and Gattorna (2005) argue that fundamental changes in the environment of global competition and trends such as outsourcing require organisations to develop supply chain strategies that are aligned to “appropriate value propositions” and customer market segments.

This concept is very important for APC, because lean is major emphasis of this corporation. The APC Ireland location is currently undertaking a major global project on production line transfer to Suzhou, P. R. China through the implementation of lean practices and by developing an ambidextrous, customer-centric organisation.

## **2.2 Innovation in the Network Context**

Smeds (1994) proposes that innovation can create wealth in the whole national economy. According to Urabe (1988), innovation consists of the generation of a new idea and its implementation into a new product, process or service, leading to the dynamic growth of the national economy and the increase of employment as well as to creation of pure profit for the innovative business enterprise (p. 3). From a network perspective, innovation is a new element introduced in the network which changes, even if momentarily, the costs of transactions between at least two actors, elements or nodes, in the network (Cabral, 1998). Thus, innovation is a major force in networks and much of the empirical work on industrial networks has been done on new product development (Hakansson, 1987).

From an organisational perspective, Amabile et al (1996) propose: “An innovation begins with creative ideas . . . a define innovation as the successful implementation of creative ideas within an organisation. In this view, creativity by individuals and teams is a starting point for innovation; the first is necessary but not sufficient condition for the second (pp. 1154-1155)”. Luecke and Katz (2003) define that “Innovation . . . is generally understood as the introduction of a new thing or method . . . Innovation is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, or services. (p. 2).” Davila et al (2006) state that innovation, like many business functions, is a management process that requires specific tools, rules and discipline (p. xvii). Therefore, one of the main challenges for an organisation that is committed to innovation is the creation of an innovative culture. This task is also being spoken of as the challenge of generating an organisational “climate” with the increasing evidence of its positive link to innovation effectiveness (Leavy, 2005). According to Zien and Buckler (2004) successful companies create a culture where everyone participates in innovation and where it is seen as the fundamental way to provide value to customers. The importance of the motivation of technical professionals is of paramount importance as evidence suggests that it is better to have a team with A-rated motivations and B-rated capabilities than vice-versa (Katz, 2004). Herzberg’s (2003) seminal work on motivation found that people are “motivated by interesting work, challenge, and increasing responsibility”. Good management and working conditions will help to ensure that they do not become dissatisfied but will not meet their deep-seated need for growth and achievement.

From an IS perspective, supply chain solutions such as electronic data interchange (EDI) and enterprise resource planning (ERP) have been helping to manage operations for participants across the value chain for many years. Harland et al. (2002) argue that some of e-business and customer relationship management (CRM) solutions add great capabilities to supply chain execution by enabling added richness, timeliness, and security to mission-critical interactions,

These solutions include e-procurement, e-auctioning, order catalogue systems, e-marketplace, e-collaboration and web-hosted solution

### **3 CASE DESCRIPTION**

Founded in 1981, APC is a leading provider of global, end-to-end solutions for real-time ICT infrastructure. APC's comprehensive products and services for home and corporate environments improve the availability, manageability and performance of sensitive electronic, network, communication and industrial equipment of all sizes. APC is also a global leader of critical power with approximately US\$2 billion in sales in 2005, globally employs approximately seven thousand people and is a Fortune 1000 company. APC aims to set itself apart from the competition in three areas: financial strength, innovative product offerings and efficient manufacturing (APC, 2006). However, recent financial reports have stressed that the company needs to implement significant improvements in manufacturing and the supply chain (Results APCC, 2005, 2006). According to these published reports, the company must work to develop a "lean, customer-centric, ambidextrous organisation" in order to reach "optimal efficiencies in our processes".

APC has two locations in the West of Ireland that serve the EMEA region. The company announced a streamlining of its operations in Ireland in June 2006. The Manufacturing Operations site, based in Castlebar, employs approximately 100 people and a number of functions including sales, information technology, business support and R&D are situated in Galway with a workforce of approximately 300. The widening of focus from the manufacturing of discrete products, such as UPS, to the delivery of customised InfraStruXure™ solutions provides both challenges and opportunities for the Operations function. Responding to the supply chain challenge, a Lean Transformation project was set-up in the Castlebar campus in February 2006 with a cross-functional team of twelve members drawn from Management, Engineering, Manufacturing, Materials Planning, Quality, and Logistics functions. The Lean project team set an objective to quickly deliver the message that Ireland is responding to, and leading, the corporate initiative and to provide a platform for the Irish subsidiary to obtain a reputation as an innovative location. Initial corporate feedback is that this project is "ahead of the curve" in terms of the other regions. A major requirement from corporate executives was that any innovations resulting from the initiative could be replicated in other regions. The Corporation entered a major period of transition in the second-half of 2006 with the announcement of its merger with Schneider Electric.

APC Ireland is keen to take the leadership role in enhancing its global competitiveness by becoming a knowledge leader in the area of supply chain expertise. The manufacturing practices and processes used within APC have come under increased pressure from global competition. In addition, building up a lean enterprise is treated as an APC corporate wide task. Furthermore, APC is going through a significant time of transition due to proposed merger with Schneider Electric. Thus, the APC manufacturers, Galway and Suzhou, are working together to discuss the issues they face and to identify actions they can take collaboratively in order to successfully transfer production capability while enhancing corporate competitiveness by fostering innovation and learning.

The primary management IS in APC is Lotus Notes, a collaborative software system that manages its knowledge flows. It provides a tightly controlled environment for asynchronous group work; where collaborators can have different or independent work patterns. Also, an Oracle ERP system is employed by all APC manufacturers. The ERP system is considered very reliable

which facilitates the cooperation of users in APC. Moreover, the Operations Suggestion Process and the U shape layout encouraged everyone to come up with small improvement suggestions on a regular basis. Furthermore, to help people to be innovative, an APC internal training program is promoted by senior managers. The aim of this program on “creativity and innovation” is to introduce different thinking styles to individuals, which would help them to develop their initial ideas to something new. It is believed that the individual innovation would contribute to the systems and organisations. This program mainly targeted APC’s managers from various levels in EMEA (European, Middle East and Africa) region and aims to improve their understanding of individual innovation and to investigate the impact of leadership.

At this phase of the transfer, the pilot production was successfully transferred to Suzhou in early 2007. Currently, both locations are working to close out the pilot issues.

#### **4 RESEARCH METHOD**

An in-depth case study approach (Orlikowski & Baroudi, 1991; Walsham, 1993) is being adopted in this study, which involves the collection of qualitative data through semi-structured interviews and direct observations in both Galway and Suzhou. The lead researcher has full support from APC having been registered as a temporary employee and provided with a workstation in the Galway office. She attended the APC employee induction program and then is authorised to access the internal databases and to share the internal documents, e.g. project plans and meeting minutes of regular conference calls for this project.

The research project commenced during the summer of 2006. As a native Chinese, the lead researcher is able to interview in Mandarin or English as appropriate. Interviewees were conducted with company APC’s senior managers, mid-level managers and technicians who were the main actors and key project members involved in the production line transfer. At this stage, about fifteen interviews of sixty minutes in length have been conducted with managers representing various functions including manufacturing technology; new product development and training in both Galway and Suzhou. Most of the interviews were tape-recorded and transcribed for analysis.

Direct observations involved the lead researcher working from time to time in APC’s Galway office during the production line transfer period. The lead researcher observed employees’ interactions and tried to “enter the world of organisational members” (Taylor & Trujillo, 2004, p. 183) during their work as well as during breaks. Also, she took photographs of the “cell information board” and the particular production line. She spent hours examining employees’ communications conducted via telephone, email (Lotus Notes) and by means of the ERP system. Informal conversations and discussions with the interviewees, production line operators and other project members were held during each visit. These visits varied in duration; sometimes these lasted the entire day and at the other times there were only between 2 to 4 hours.

The qualitative data collected included researchers’ case study log books, field notes (e.g. interview notes, observation notes and conversation summaries), documents (e.g. emails, internal training materials and regular conference meeting minutes) together with relevant materials (e.g. posters, brochures and news from websites, industry publications, APC publications) to verify the collected data, gain more details and ‘behind the scenes’ information about APC. Also, the lead researcher’s social background was a critical resource making the sense-making and sense-reading easier during the data collection and analysis. Table 1 shows the details of data collection carried out during this period.

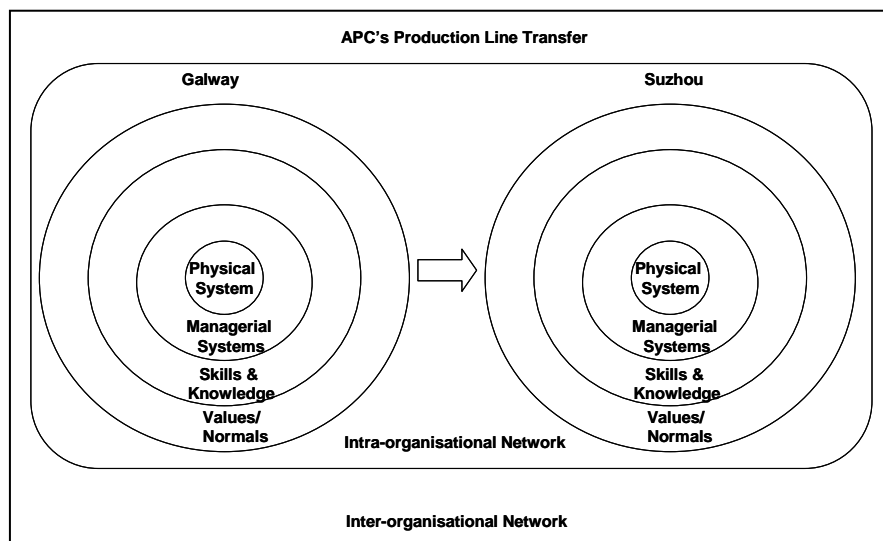
<b>Location</b>	<b>Lean Team</b>
Castlebar Galway	Senior Manager (2) Senior Manager (2) Manager (1) Project Leader (1) Engineers (1) Operators (2)
Suzhou	Project Leader (6)
<b>Total number of interviews</b>	<b>15</b>

*Table 1 Details of data collection*

This section of the paper has presented the context and methodology of the study and will now follow on with a discussion of a number of key findings.

## 5 KEY FINDINGS

Viewing APC's production line transfer from combined intra- and inter- organisational network perspectives reveals a complex network of factors which influencing APC's lean manufacturing and knowledge transfer. Drawing on Leonard-Barton (1998), these are captured in Figure 1 which constitutes a summary of our paper. Leonard (1998) claims that the successful innovators are organisations that build and manage knowledge effectively. They are most enthusiastic about pursuing knowledge and most likely to harness the power of innovation. Leonard-Barton illustrates the dimensions of the core capabilities along which all organisations must innovate: physical systems, managerial systems, skills and knowledge base, and values and norms of behavior. She views organisations as sites of learning and information transfer rather than as physical or financial entities. The workforce of a forward-looking organisation must be able to process and manipulate knowledge as well as perform particular skills. Top management must encourage creative chaos among disciplines within the organisation and benchmarking with competitors.



*Figure 1 APC's production line transfer (adopted: Leonard-Barton, 1998)*

The rest of this section will discuss of a number of preliminary observations and findings.

### *Physical systems*

As discussed earlier, the pilot of the particular production line ran successfully in APC Suzhou in early 2007. In this part of the Leonard-Barton's (1998) model, the capability is almost entirely confined to the physical system itself. At this point, a number of issues need to be closed out such as material transfer from APC different locations to Suzhou, local supplier selection, etc.

### *Managerial systems*

The APC employees interviewed in both Galway and Suzhou manufacturers expressed their views that although APC is an American company, it has different working styles in different locations. We identify that it can be accounted for by the management styles in Ireland and China. As mentioned previously, the governance and management in Irish companies requires a transition to an innovation economy, decision making at various levels are relatively easy (OECD, 2005, p. 107). However, many Chinese companies still adopt a highly centralized decision-making system as China is transforming from a central-planned economy to an open-market economy (Chen et al, 2007). Chen et al (2007) argue that the Chinese companies still highly rely on the leadership of top management rather than regulations and standard mechanisms. Therefore, a number of interviews of this research indicate that there is a lack of a shared understanding in the managerial systems on some issues of the production line transfer. For example, local sourcing in China had been discussed for a long time between Galway and Suzhou. It took a more complicated process in Suzhou than the lean team in Galway expected. Because of the different managerial systems in Ireland and China, the production line transfer had a number of issues to be closed out. This is also an important issue of intra-organisational network which is influenced by the inter-organisational network, i.e. Chinese central government managerial system.

### *Skills & knowledge*

Transfer of skills was not a problem in the assembly situation in APC Suzhou. Nevertheless, the mismatch between the production line and the skills of the operators can be more challenging. In Suzhou manufacturer, all the operators were much younger than the operators in Galway plant. They were about 20 years old, graduated from technical schools and didn't understand English at all. To cope with the problems they might be faced, two of Chinese engineers from Suzhou came over to Galway for a couple of weeks training on the particular production line. However, there was no working instruction (WI) (neither in English nor in Chinese) to guide the Chinese engineers. Because the production line was transferred from the U.S. without any WI years ago, all the operators in Galway assembled the product with their experience. Under these circumstances, the Chinese engineers built up their own WI in Chinese after training. Moreover, in order to function as designed, the production line required some adjustment for local conditions; also it was required to meet higher standard of test once it set up in Suzhou. To ensure the production line transfer smoothly, two of the Irish engineers joined the Chinese team in Suzhou during the production line transfer period. The next challenge after transferring this production line will be to update the line to meet the requirements of the expanding Chinese market.

### *Values/norms*

One of the most important values/norms in APC is safety. In terms of dress code and access to the production area, there was a significant cultural difference between both locations. In Galway, operators and engineers were casually dressed according to individual preferences. The strict requirement to wear safety glasses and safety shoes was implemented by means of a strong sense of cultural awareness. In contrast, Suzhou, this attention to safety was implemented by extra security check in the production area and through operators wearing different coloured safety shoes. The observation indicates that setting up an assembly line involves little transfer of values/norms.



## 6 CONCLUSIONS

This paper investigates the key issues in the production line transfer from Galway, Ireland to Suzhou, China based on an on going case study. By combing the intra- and inter- organisational network approach, our analysis reveal that viewed through the lens of Leonard-Barton's (1998) model, level 1, physical systems, was successfully transferred. However, there is a lack of a shared understanding at level 2, managerial systems, on some issues between these two locations, This is helpful for gaining a better understanding on the cross-cultural knowledge transfer within an MNC. Level 3, transfer of skills, still requires some adjustment for local conditions. It may be helpful to consider that a variety of factors may influence knowledge transfer if an MNC's subsidiaries are embedded in a diverse global environment. The study indicates that transfer of values/norms at level 4 of Leonard-Barton's model was not significant.

In the next phase of this project, therefore, it is proposed to explore both internal and external network factors which encourage/constrain people to innovate by investigating how APC manufacturers transferred their production lines between locations, i.e. Galway and Suzhou. It would contribute to the further development of Leonard-Barton's (1998) model in the context of global cross-cultural environment. In addition, since innovation is a major corporate objective of APC and Schneider Electric, the goal of achieving truly global co-operation to meet corporate objectives will be examined. We believe that our initial key findings will help managers understand the knowledge-based nature of technological transfer. Also, we hope that it will inspire them to think constantly about the potential building, sharing and transferring of technology-related knowledge to the mutual benefit of diverse global locations.

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