Transferring Knowledge of Manufacturing Techniques in Multinational Corporations: Preliminary Findings

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Abstract: With the growth of the multinational corporation (MNC) has come the need to understand how parent companies transfer knowledge to, and manage the operations of, their subsidiaries. This is of particular interest to manufacturing companies transferring their operations overseas. Japanese companies in particular have been pioneering in this regard, with techniques such as the Toyota Production System (TPS) for transferring the ethos of Japanese manufacturing and maintaining quality and control in overseas subsidiaries. A great deal has been written about the process of transferring Japanese manufacturing techniques, but much less is understood about how the subsidiaries themselves, which are required to make use of such techniques, actually acquire and incorporate them into their operations. The research on which this paper is based therefore examines how, from the perspective of the subsidiary, knowledge of manufacturing techniques is transferred from the parent company.

There is clearly a need to take a practice-based view to understanding how the local managers and operatives incorporate knowledge about manufacturing techniques into their working practices. In-depth qualitative research was, therefore, conducted in the subsidiary of a Japanese multinational, Denso Corporation, involving three main manufacturing initiatives (or philosophies), namely 'TPS', 'TPM' and 'TS'. The case data were derived from 52 in-depth interviews with project members, moderate-participant observations, and documentations. The aim of this paper is to present the preliminary findings from the case analyses. The research contributes to our understanding of knowledge transfer in relation to the circumstances of the selection between adaptation and replication of knowledge in the subsidiary from its parent. In particular this understanding relates to transfer across different flows and levels in the organisational hierarchy, how the whole process is managed, and also how modification takes place.

Keywords: knowledge transfer, subsidiary in MNC, in-depth practice-based view.

Introduction

The past thirty years have seen the rapid development of multinational corporations (MNCs). Scholars have been observing the aspects of economic investment as well as their existence and development, but recently the aspect of knowledge, particularly on how MNCs manage its knowledge has emerged (Gupta and Govindarajan, 1991; 2000).

With this fast growth of MNCs, has come the need to understand how parent companies transfer knowledge to, and manage the operations of, their subsidiaries.

This is of particular interest to manufacturing companies transferring their operations overseas. Japanese companies in particular have been pioneering the development of techniques such as Kaizen, and elements of the Toyota Production System (TPS) such as Kanban, which can be useful tools for transferring the ethos of Japanese manufacturing and maintaining quality and control in overseas subsidiaries.

The main characteristics of Japanese MNCs that have been seen since the mid 1970s are: a sense of belonging that is much higher compared with that in Western companies, the appointment of fewer local personnel on their boards of directors, senior executives and top management, and stronger control their overseas subsidiaries than with Western companies (Urakami, 2000). Against this background which provides the context for this paper, the focus is on how Japanese parent MNCs transfer knowledge to their subsidiaries, and how the subsidiaries manage their operations and incorporate the knowledge.

Japanese MNCs and transferring knowledge of manufacturing techniques

The term 'Japanisation' was popularised by Oliver and Wilkinson (1991) in the UK, and borrowed from Turnbull (1988). It actually originated with a Lucas Trade Union official, who used it to describe the various changes in work organisation and employee relations being undertaken in his organisation in the mid 1980s. The word Japanisation is regarded as a loose, descriptive term used to denote a range of industrial practices associated with major Japanese companies, and which have seemed for some to represent a major shift in industrial organisation (Harris, 1995) that is also labelled as a shift from 'Fordism' to 'Toyotism' (Womack et al, 1990). This movement has created interest both in the technical methods of change and other social and organisational aspects (Harris, 1995).

Schonberger (1982) in his seminal work on Japanese Manufacturing Techniques, outlined nine main points that were his so-called "hidden lessons in simplicity". They which include, among others: the transportability of management techniques, the JIT (just-in-time) and quality control techniques that produce a 'habit of improvement', and the idea that culture is no obstacle and techniques can change behaviour as long as the plant configurations are simplified and production line management is flexible towards ultimate self-improvement. In his follow-up book, "World Class Manufacturing", Schonberger (1986) illustrates the success stories of American corporations that have adopted the JIT approach and total quality control strategies that could be implemented in any factory under the main recipe of continuous rapid improvement, which includes changing procedures and concepts, and strengthening employee involvements and interactions. Monden (1983), explains in detail how the Toyota Production System works and provides detailed explanations on Kanban, quality and lead-time production that bring out a practical approach to production management, are given. However, the detailed super micro-phenomena on how these happen within the setting of an organisational hierarchy are still lacking, and an understanding of these is the aim of this research.

Oliver and Wilkinson (1992) argue that Japanese manufacturing methods demand more supporting conditions as they are interdependent among all social actors involved. This means that as a number of parties are involved in this process of Japanisation, certain conditions must be met for success. In follow-up research, Oliver et al (1998) found that the Japanisation debate could be elaborated further in respect of: 1) the reality and coherence of Japanese management principles, 2) the universality of Japanese methods, 3) the implications for transfer to other contexts, 4) the adoption of Japanese methods outside Japan, and 5) the impact of the methods on various actors.

In their 1998 paper, Oliver and his colleagues focused on the human resources and shop floor work aspect via productivity performance. These were then further elaborated in 2000 with additional importance placed on the distribution of responsibility - what they called ‘lean teamworking’ which includes Just in time (JIT), kaizen and the Toyota Production System (TPS). Hence, the projects that come into the research context in this research are in line with the trend.

The elaboration of knowledge transfer from this position could possibly explain what and how processes are transferred and implemented in the building of project-based teams in a subsidiary of a Japanese MNC. This could be achieved by examining how knowledge is diffused among the team members.

Basically, when talking about knowledge transfer in organisations, one needs to refer back to the main definition of knowledge transfer and be reminded that it is about moving knowledge from one part of the organisation to another (or all other) parts of the organisation which is considered to be more than just a communications matter. Knowledge transfer is more complex because, firstly, knowledge resides in organisational members, tools, tasks, and their sub-networks (Argote and Ingram, 2000), and secondly, much knowledge in organisations is tacit and hard to articulate (Nonaka and Takeuchi, 1995).

Argote and Ingram (1999) define knowledge transfer as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another". They further point out that the transfer of organisational knowledge (i.e., routine or best practices) can be observed through changes in the knowledge or performance of recipient units. This process of knowledge transfer is becoming increasingly important in organizations, especially in the MNCs, and effective management of these distributed organisations requires knowledge of everything that is to be transferred from one individual, team, department, or geographical division to another (Argote and Ingram, 2000).

Inkpen and Dinur (1998) suggest that tacit knowledge requires the use of individuals as knowledge transfer agents, and that individual interaction results in successful transfer of tacit knowledge. Very similarly, Petersen et al (2001) propose the need to match tacit knowledge with rich communication media and explicit knowledge with written media. They argue that a misfit in the characteristic of the knowledge and transfer mechanism will result in poor transfer performance. Ylinennpaa and Nilsson (2000) also suggest the use of files, and IT-based mechanisms to transfer explicit knowledge while ad hoc interaction and coaching systems are proposed to transfer tacit knowledge.

This is supported by Davenport and Prusak (1998), who argue that transfer of knowledge involves both the transmission of information to a recipient(s), and the absorption and transformation of that information by that person or group. Even in the knowledge management system, the usage of technology is very much related to the aspect of the person (Edwards et al, 2005). To be of value to the organisation, the transfer of knowledge should lead to changes in behaviour, changes in practices and policies, and the development of new ideas, processes, practices and policies (Bender and Fish, 2000).

Knowledge flow, on the other hand is a term to indicate which directional way the knowledge goes in the organisation (Nissen, 2002). This term is used interchangeably by Gupta and Govindarajan (2000) with knowledge transfer, especially in connection with knowledge, moving through the organisational

hierarchy, which normally means travelling from and between different levels of management and units in the organisation.

When exploring the phenomenon of knowledge transfer, it is, therefore, best to take the MNC as the platform as it is commonly conceptualised as a network of units (Schlegelmilch and Chini, 2003) and in this network, units have strategic mandates and thus access and transfer knowledge from different positions (Asakawa, 1995; Gupta and Govindarajan, 1991; Tsai, 2001).

However, much of the empirical research on the differentiated MNC still tends to focus on characteristics of knowledge and characteristics of senders and receivers rather than on organisational means of transferring knowledge (Foss and Pedersen, 2002). Moreover, as much of this literature is silent on the sources of transferable subsidiary knowledge (see Porter and Solvell, 1999; Forsgren et al, 1999), there is limited intelligence regarding how the process of knowledge transfer actually occurs in the organisation (see in Pedersen et al, 2003; Argote and Ingram, 2000). Nor is there a great appreciation of knowledge transfer in the manufacturing (Epple et al, 1996; Galbraith, 1990) or the service sectors (Baum and Ingram, 1998; Darr et al, 1995). Hence, it is important to illuminate the details of knowledge transfer in a range of organisations (Argote, 1999; Szulanski, 1996).

The studies on the amount, direction, and dimensions of knowledge flows occurring across both national and organisational borders, have indicated that these features all have important implications for MNC-level innovative performance (Yamin and Otto, 2003), and support previous research suggesting that too much international knowledge transfer within the MNC will stifle creativity and innovation of individual units (Ghoshal and Nohria, 1993; Yamin, 2002).

In broader literature, the term knowledge flow is also related to global phenomena involving knowledge flow in the area of MNCs, which includes the sharing and transferring of knowledge within MNCs, and how efficiently MNCs share knowledge across HQs and subsidiaries (Gupta and Govindarajan, 2000; Doz et al, 2001; Kogut and Zender, 1993).

Chini (2004) in her study underlines that there are four main steps taken in MNC knowledge transfer; which are externalization, combination, socialization and internalization. It is also found that ‘conservative’ knowledge management tools such as database and face-to-face meetings are dominant in knowledge transfer while culture was found insignificant in term of MNC knowledge transfer.

From most of the previous studies measuring knowledge flow within MNCs, it can be seen that this is normally measured vertically between HQs and subsidiaries, without placing any emphasis on what and how the knowledge processes flow inside one subsidiary (see Nobel and Birkinshaw, 1998; Gupta and Govindarajan, 2000; Subramaniam and Venkatraman, 2001; Hakanson and Nobel, 2001; Birkinshaw et al, 2002; Almeida et al, 2002; Cummings and Teng, 2003; Foss and Pedersen, 2003; and Minbaeva et al, 2003).

This is closely related to the field of technology transfer, where technology passes from research and development to production, using what is known as ‘vertical transfer’ (Decter et al, 2007). In other words, most of the studies mentioned have been concerned with the knowledge-based view, focusing on the macro aspects of knowledge flow.

Hence, it becomes important to consider the issue of knowledge transfer in a micro-setting, in order to learn more about the roles played by individuals. The micro-setting of an MNC subsidiary will provide the opportunity to gain a deeper understanding in this respect, and this is in line with the suggestions about the need to take a practice-based view to understanding how local managers and operatives incorporate the knowledge into their working practices

The Japanese MNC is indeed a good contextual setting for a study of knowledge flow, since over the last years, there has been a widespread interest among scholars in the importance of knowledge management in firms, particularly, in multinational corporations (e.g. Ghoshal and Bartlett, 1988; Zander and Kogut, 1995; Szulanski, 1996; Gupta and Govindarajan, 2000; Eisenhardt and Santos, 2002; Birkinshaw et al, 2004) in which the various types of knowledge flow have been investigated.

Therefore, the importance of examining projects within MNCs lies in their size and internal linkages which present the opportunity to explore different approaches to knowledge transfer or knowledge flow. Projects normally involve cross-sectional flows throughout the hierarchy, involving personnel from different levels in the organisation, and they are seen as places where most knowledge is created, shared and transferred (Bresnen et al, 2003; Koskinen et al, 2003). Thus, the validity and the originality of how the knowledge transfer happens are much clearer and this represents another novel feature of this research.

Issues of knowledge transfer in MNCs: towards a micro-perspective of knowledge flow within the organisation

One of the central issues in the cross-border transfer of firm-specific resources, including knowledge resources (Kostova, 1999; Morosini et al, 1998), is whether or not and to what extent, the firm should adapt the resources to fit local conditions (Bartlett and Ghoshal, 1989; Prahalad and Doz, 1987). Fit with the environment is argued to be essential not only for subsidiary success but also for survival (Lawrence and Lorsch, 1967; Sorge, 1991) and streams of literature in organisational theory (Kostova, 1999; Kostova and Zaheer, 1999; Scott, 2001), international business (Bartlett and Ghoshal, 1989; Griffith Hu and Ryans, 2000; Nohria and Ghoshal, 1999; Prahalad and Doz, 1987), and international marketing (Cui and Liu, 2001; Yan, 1994) have suggested that adaptation is necessary in order to ensure fit with the relevant characteristics of the local environment, which typically differ from those in the source environment along a number of critical institutional and market dimensions.

In terms of transferring knowledge, two main approaches are used to fit in with the local condition, these being replication and adaptation. The significance of adaptation is that while it is sensible that the subsidiary, and hence the transferred practices that it uses, must achieve fit with the local environment, focussing solely on fit creates a potential dilemma. As a result, even with experience, neither the multi-national firm (MNC) nor the subsidiary may fully understand the practice nor be able to completely codify it, making it become sticky, or difficult, to transfer (Szulanski, 1996; von Hippel, 1994).

Thus, one important established dimension to differentiate among knowledge transfers is the extent of exact copying of knowledge in other parts of the organisation, which is generally categorised as replication or adaptation (Szulanski, 2006). Replication refers to those knowledge transfers where a particular practice is copied in as detailed a way as possible. On the other hand, adaptation allows the receiving unit to adapt the knowledge and make changes according to the idiosyncrasies of its context (Szulanski et al, 2002; Williams, 2002).

Researchers suggest that firms need to focus on replication in order to best leverage knowledge (Szulanski et al, 2002) although it has been found difficult (Szulanski, 1996; 2001). Empirical work by Williams found that investments in both replication and adaptation have a positive impact on knowledge transfer (Williams, 2002). Knowledge is also known to face the process of codification and needs to be de-codified for the transfer among experts to be achievable (Hall, 2006).

The previous studies on replication have found that the success of knowledge transfer depends on the accuracy of the replication (Szulanski and Cappetta 2000, Szulanski et al, 2000), and on its appropriate adaptation for the new organisational settings (Argote and Ingram, 2000), while in other work, scholars have treated adaptation as the absence or degradation of replication (Winter and Szulanski, 2001).

Different studies have revealed that organisations with a similar template of knowledge in actions are benefiting from much greater transfer than those that need to translate and adapt them (Nelson and Winter, 1982; Winter and Szulanski, 1998; Szulanski and Jensen, 2001; and Rivkin, 2001), and that transfer will inevitably require increasing adaptation as an organisation becomes more open and interdependent with its environment (Epple et al 1996; Winter and Szulanski, 1998).

In terms of seeking an in-depth understanding of the phenomenon of knowledge transfer, the Japanese MNCs would provide a good platform for a study as they are well known for their universal approach in transferring knowledge, particularly in the automotive industry (Kenney and Florida, 1995).

Therefore, when considering the issue of knowledge transfer, particularly when trying to gain an in-depth appreciation of the processes involved, the study environment should be selected not only to provide a good empirical ground for research, but also to be able to provide examples of different knowledge flows running concurrently. This is confirmed by Minbaeva (2007), who outlines the importance of paying attention to the individuals in the transfer process, in order to better understand it, as they are the heart of knowledge transfer projects. This is a condition that would fit in empirically to fill in the gap.

With regard to knowledge transfer and communication flow in organisation, in the traditional model, large organisations normally have many layers of managers and personnel where “formal reporting structures are more detailed at the top than at the bottom” (Davenport and Prusak, 2000). Decision-making flows vertically up and down this chain of order, and often communication also flows in the same way. Thus, this process has become known as top-down and bottom-up.

According to Kluge et al (2001), effective top-down and bottom-up communication is very important in making existing knowledge profitable to the organisation. However, effective communication across the hierarchy is tricky and this makes knowledge very difficult to transfer. If an organisation supports communication networks that operate freely, where knowledge provider and knowledge seekers can assess information and knowledge through shorter and effective paths, it will certainly enhance knowledge transfer within it. Moreover, the application of the different levels of hierarchy and flow of order in an organisation has been found since the early phases of MNC initiatives such as in the zero defect programme and quality circles activities (Bennett, 1986).

More importantly if the contextual settings of the organisation are meant to facilitate projects involving knowledge flow from different directions that could suitably fit with the different flow and prescribed by the projects themselves. This involves the problem of knowledge explicated in databases or handbooks, routines and procedures vs. face-to-face contacts and meetings between organisational members, in which any other form of different communication flow in a related area is under exploration.

This is also related to the contextualisation and de-contextualisation of knowledge, in which there is the idea of transporting or transmitting an objectified package of knowledge (Nilsen, 2003), and therefore, it is strongly believed that the way knowledge flow changes according to context, is associated with the different processes that are likely to be in evidence.

This is very important as there are differences in the type of 'place' or 'instrument' or 'application' in which knowledge transfer or flow are emphasised. The different processes involving 'visualisation' of procedures in transferring knowledge, that is to say the process in which the knowledge is transferred through steps of instruments involving visual aids, provide evidence concerning the importance of this area.

Collectively, these views expressed in different studies, are refining and shaping the focus of research in this field, and opening up new insights, not only with regard to how the different knowledge flow processes have different impacts, but also on how the processes are involved and take place.

As Davenport and Prusak (1998) argue, the transfer of knowledge of value to the organisations involves both the transmission of information to a recipient and the absorption and transformation by that person or group. This transfer of knowledge should lead to changes in behaviour, changes in practices and policies and the development of new ideas, processes, practices and policies (Bender and Fish, 2000).

Denso Corporation: The research context

The Denso Corporation is a leading supplier of advanced automotive technology, systems and components for all the world's major automakers. It operates in 32 countries and regions with more than 112,000 employees who are active in all aspects of the automotive business. Sales, product development and design and manufacturing, and working in co-operation with regional car manufacturers and suppliers to provide the most suitable solutions to regional requirements, gave the Corporation global consolidated sales totalling US $30.6 billion for the fiscal year ended March 31, 2007 (Denso, 2007).

The management principles of Denso are focused on customer satisfaction through the provision of quality products and services, global growth through anticipation of changes, environmental preservation and harmony with society, corporate vitality, respect for individuality, and each Denso associate (employee) must possess the Denso spirit of creativity in thought and steady in action, be co-operative and pioneering as well as trustworthy (Denso, 2007).

Denso (Malaysia), which is the research site selected for this paper is a subsidiary wholly owned by Denso Corp, and was established in 1980 since when it has become the largest automotive components manufacturer in Malaysia today, and a major automotive components supplier to the national car projects as well as to

Japanese cars built in Malaysia. Instantly associated with quality, Denso continuously selects and implements improvement efforts that have the greatest impact on the key business plans and goals. This is done by continually focusing on achieving high quality and productivity, by optimising product design and reducing waste, and by variation in manufacturing process

Denso (M) has always taken innovative actions ahead of time. It is among the first in the Denso Group of Companies that has been awarded the prestigious ISO/TS 16949 by the SIRIM and "International Automotive Task Force (IATF)", a body that represents car-makers and suppliers worldwide. The company is also certified in the ISO 14001 Environmental Management System which recognises commitment and effort in maintaining the environment.

There are numerous projects running in this plant site, but three main ones are purposely selected to suit the three main manufacturing initiatives (philosophies) that would provide into a clearer understanding on how they are transferred.

Case 1 – Denso TPS (Toyota Production System)

The history of Denso TPS goes back to 1973 at DNJP (Denso Japan – the HQ of Denso Group). This was originated from Kaizen Activity instructed by the Toyota Motor Corporation, which designed this TPS system, and that is how it got its name - Toyota Production System (TPS), which has becoming a worldwide recognisable established manufacturing standard, especially in the automotive sector, and particularly relating to the lean production initiatives.

However, Denso, being a world-leading automotive supplier, which initially had Toyota as its main customer in the 1970s, developed its own TPS system to adapt its products and manufacturing processes. Therefore, starting from Japan, Denso spread this TPS system worldwide to its subsidiaries and in 1996 basic kaizen activity was begun in Denso Malaysia (DNMY). There were five members involved at that time and Mr F (the TPS Department Champion, and one of the respondents) was the selected officer who went to Japan for a one month training period that year.

Since 1996, the line improvement (kaizen) efforts were held individually. Individually in this context should not be understood as an individual person per se, but rather as an initiative that was conducted individually in separate departments where the members were attached, thus bringing only minimal impact to the company in total.

Come 2002, a company-wide TPS team was established (initially known as the Kaizen Project Team). It combined all the members to start the first improvement in the Condenser Line in the Thermal System Plant. This involved close transfer supervision from the Japanese HQ manager who came to DNMY to conduct the first training in respect of Kanban Simulation.

In 2003, the Kaizen Project Team was restructured to become the TPS Project Team with eight members who were directly seen by the MD. In 2004, the TPS Team was expanded to two sections, namely the Improvement Team and Small Fabrication. The former section focuses on line improvement while the latter helps with the machinery or equipment-related items. Finally, last year in 2005, this TPS project team was upgraded to be a department by itself, and this reorganisation made the TPS Department a company-wide activity.

This TPS Department Project provided the researcher with the main empirical location of the research, where the researcher interviewed key personnel and

observed their relationships formally in their meetings as well as their informal interactions.

Case 2 – Denso TPM (Total Productive Maintenance)

TPM stands for Total Productive Maintenance. The history of the Denso TPM Project (as mentioned by Mr M, the GM of Maintenance at Denso Malaysia) goes back 40 years to DNJP (Denso Japan – the HQ of Denso Group). Mr M is also the co-ordinator of the TPM initiative in DNMY, and one of the respondents.

However, in Denso Malaysia (DNMY), TPM is quite different from that reported in textbooks as it is actually more towards a management type of activity or job, in the matter of how to co-ordinate it to benchmark against the international activity, because TPM is considered as an international kind of activity. TPM involves machines, how machines are kept, or maintained in general, and has an emphasis on how to improve machine maintenance in general, which involves looking into who handles the machines, what systems maintain the machines, and how to enhance machine knowledge, which of course requires education and training.

TPM in DNMY involves the implementation and co-ordination of all these activities, "as a system, and TPM in Denso is a unique activity by itself, it's not only like the normal TPM per se in the international market where there are pillars, elements and so on, but the TPM that was brought to us from DNJP to DNMY is more on Denso way of TPM. It is very unique activity because in TPM the Denso way, we are looking at a very specific area, on maintenance management", said Mr M, the GM (TPM co-ordinator).

Case 3 – Denso TS Project

TS16949 is the new international system tailored for the automobile world. As in TPS and TPM, the researcher managed to interview intensively with the co-ordinator of the project who is also the DNMY Quality Director, Mr N. The TS team consists of a group of middle management from each department in DNMY. Hierarchically they are similar, in the middle zone.

TS16949 is the new system, before which there were ISO9000 and 9001, which are well known systems that have been implemented since 1994. Unlike the others however, TS applies additional requirements over and above ISO requirements that the Denso team members are quite familiar with, and in order to fully understand this new system, DNMY has had to engage an external consultant, to teach the team what is expected by the system and how to implement it.

Methodology, Aims and Questions

It is clear from the above review that while the issue of knowledge transfer in MNCs has received considerable attention in the literature, there is still a lack of knowledge about how subsidiaries incorporate knowledge about manufacturing techniques from their parent companies.

The aim of this research is, therefore, to understand the processes by which parent companies transfer knowledge of manufacturing operations to their subsidiaries. Additionally, the study aims to evaluate the relative success of each approach (adaptation/replication) to further plot the characteristics, or provide propositions of

knowledge transfer behaviours in the knowledge flows, and in the different settings. A particularly relevant theme is how subsidiaries both replicate and adapt knowledge from parents and the circumstances in which replication or adaptation occurs, as depicted in the following diagram:

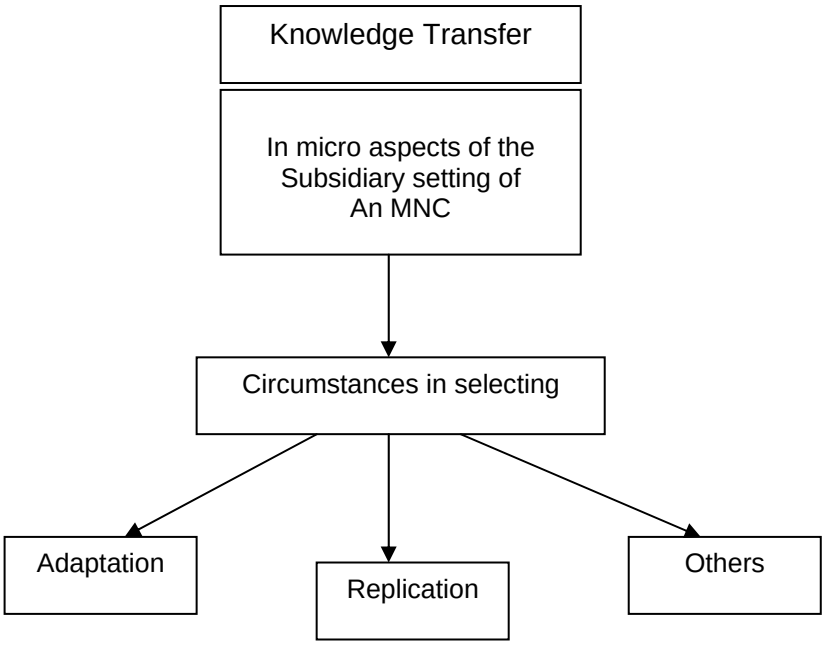

Figure 1: The Framework of the Study

The main research questions are:

- How do parent companies transfer knowledge of manufacturing operations to their subsidiaries and how is the knowledge being transferred within the subsidiary?

Other questions involved are:

- How does knowledge replication and adaptation occur in the subsidiary?
- What are the circumstances and criteria that show replication and adaptation of knowledge across different levels of knowledge flow between the hierarchies of the subsidiary?
- What are the factors that determine the selection of adaptation and replication in knowledge transfer and how are they developed?
- What are the issues facing the selection and implementation of either approach (adaptation/replication)?

The methodological approach involves a qualitative case study, using three cases from three different projects in a subsidiary of an MNC (DNMY) that involves three main manufacturing initiatives (philosophies).

This case study is an empirical inquiry that investigates a contemporary phenomenon within a real-life context where the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used. This is a preferred strategy when "the investigation has little control over events and when the focus is on a contemporary phenomenon within some real-life context and its generalisability is determined by strength of the description of the context" (Yin, 1984, p23).

The case study approach is useful when a phenomenon is broad and complex, when a holistic, in-depth, investigation is needed, and when a phenomenon cannot be studied outside the context in which it occurs (Yin, 1994) and case study will typically combine several qualitative data collection methods such as interviews, documentation, and observations, but can also include quantitative data such as questionnaires and time-series (Dube and Pare, 2003).

In quantitative research, the random sampling technique is common to ensure a generalised result. Conversely, in a qualitative study, and in particular where the main objective is to attain an inclusive understanding of the cases and the relationships of phenomena rather than generalisation, purposeful sampling is applied. Other considerations for the case-selection include the company's readiness to participate in the research and accessibility for me as the researcher.

The study takes an inductive approach using qualitative methods and draws upon data collected from the three cases; TPS, TPM and TS from DNMY. The data were derived from 52 individual interviews with project members, moderate-participant observations, and associated documentations.

The whole data comprises 52 interviews of 60-90 minutes each, nine meetings including formal and ad-hoc meetings, one open seminar, two staff training sessions, three plant tours, five meals and informal functions, and documentation of project materials. The process of data generation was a long-term one that included a series of e-mails and telephone conversations. The interview and meeting data produced more than 900 pages of transcription. Related photographs, documentation and images were also collected throughout the data collection process.

The data were analysed using thematic analysis based on Boyatzis (1998). All interviews were tape recorded and transcribed for analysis which involved deductive coding (based on previous literatures) as outlined in the template organising style by Crabtree and Miller (1999), and also the inductive coding (themes emerging from the interviews) approach of Boyatzis (1998). The data were analysed using identifiable broad themes and patterns in the textual data derived from interview transcriptions.

Data collection and analysis are interwoven in qualitative research. Once coding was completed, the codes that had common elements were merged to form categories and the coded sections of data were placed in categories in the data collection methods used. Some codes were placed in more than one category. The categorised data were then printed and stored manually in files with the name of each category. The categories derived from each data collection method were then clustered around each research question.

Then, the related patterns were combined into sub-themes and the themes and sub-themes that emerged were gathered together. Further validation was achieved by checking with the literature, and on some occasions by asking the interviewees for feedback, thus making the theme analysis much more concrete. The qualitative data were also analysed using a constant-comparative method where the saturated points were achieved to be validated by the new findings. This process was instrumental in getting the answers to the research questions.

Where events or conversations had been recorded in more than one of the methods used (for example, in observation and interviews), both transcripts were reviewed together after initial coding. Then journal entries were reviewed to check if there was any evidence of extraneous circumstances influencing the researcher's interpretation

of events, or impinging on the event being recorded, and to review any other interpretations that were perceived at the time.

Data Analysis from the Three Cases and Elaboration of Themes

TPS as mentioned earlier, is a manufacturing system that mainly focuses on cost reduction through the elimination of "mouda" (waste), and waste could be anything, be it a process, a job or some other type of work that contribute no added-value to the product manufactured. Thus, through the TPS concept, Denso must become a consistent and reliable supplier meaning that its manufacturing processes must be applied with good manufacturing techniques to product a high quality and profitable product with profitable, from low cost production, satisfying both the manufacturer and the customer.

This philosophy underpins the success of Japanese companies that now produce better cars at more competitive prices. The beauty of TPS is that the focus of its implementation is through 'visualisation'. As Mr F mentioned in the interview, with TPS implemented in the line, anyone walking through the line can understand what is happening because the visual aids are self-explanatory.

The main TPS Activity in DNMY is through 'Strict Production Lead Time (L/T) Reduction'. This involves the knowledge transfer aspect of setting up the TPS committee, building the TPS activity board, and conducting meetings, one of which the researcher had an opportunity to observe. The main medium of knowledge transfer was through face-to-face discussions, documented materials (specific work flow orders), ad-hoc meetings, and of course, the new medium in realisation of 'knowledge transfer' – that being 'visualisation'.

In order to achieve TPS success, the Principles and Approaches of TPS must be adopted. These involves four principles of Kaizen, which originated in Japan (Denso Japan), plus the two main concepts used in the approach, namely JIT and "jidoka". JIT is "Just In Time" and Denso JIT means to only produce or transfer the needed products, in the time and quantity required (meaning meeting customer demands without carrying excess stock), while jidoka is a concept that relates to the machines that are built with the ability to detect abnormalities such as malfunctions, and quality problems; and delay operations such that the associates (operators) can stop the line when abnormalities occur by pushing the line-stop button (known as "Andon"). When the Andon siren rings, the supervisor and any other engineering personnel attend the line to deal with the problem and restore the production as soon as possible.

In applying JIT and jidoka, the kanban system which is a card order system in which the card itself acts as the 'ordering plan' that tells the associates which model to manage/run/produce, how many units are required, and the specifications and related information for the product. This system of kanban was mentioned by most interviewees as a state-of-the-art system which is not found in other MNC manufacturing companies (based on the interviews with those who have experience in other companies). There are also eight control tools related to TPS which are clearly visualised on the shop-floor.

The means of knowledge transfer in TPS involves direct implementation, appointing a champion, streamlining the work-flows, creating and using the TPS board and Suggestion Scheme, and also utilising the "Gemba" technique (Gemba means "go to the exact place"). Overall, this new TPS system of production is introduced line by line across different departments in the whole plant

It is found that the knowledge transfer flow of this TPS is specially built and develops through the "bottom-up" flow. The operators (associates) and supervisors receive training in the TPS Department for a certain amount of time, and after mastering the new knowledge, they return to their former departments 'transferring' the new knowledge to their colleagues, and further up to their superiors. This was how the original department was established, i.e. after the return of the champion (Mr F) to Denso (Malaysia) from Japan, he started to transfer the new knowledge directly to the shop floor.

However, the best aspect is the use of ASEAN Jishuken Activity (developed by the other Association of South East Asian Nations, or ASEAN, Denso overseas group of companies – OGC) which includes Gemba. Immediately when a problem arises, and essentially its practice involves all those associated with a problem to be present at the site where it occurs. This is actually the main place where new knowledge could blossom. Basically the delegates gather in the TPS line to see, understand and solve any problems that emerge.

In term of replication and adaptation, both approaches are found concurrently, but when a matrix showing factors and characteristics is considered, this TPS case which involves bottom-up flow, applies more replication than adaptation. Among other factors involved are educational level, seniority and experience, multi-tasking skills (super-operators) and motivation. TPS in DNMY could be summarised as a project from 'individual line improvement scale' to 'company wide driven department'.

TPM in DNMY involves a set of unique activities because within TPM the Denso way, the maintenance management involves basically the production, engineering and maintenance, plus tools and machines or machine designing. Under this Denso TPM concept, there is one evaluation standard, called the Basic Work Management, or Work Maintenance. After the two managers went to Japan for intensive training which was based on the 18 elements of TPM, involving production, engineering, and maintenance and design, how to conduct activities, for example, when discussing how to improve the operation rate, what are the activities that can be conducted, and reference should be made not only to technical activities but also to those involving people, and the techniques that can be used. For instance the 'Loss Reduction Activity' and 'Why why analysis', which are required to bring this new approach and method of activity into practice for the whole DNMY community.

In terms of replication and adaptation, although both approaches are found concurrently, when a vector of matrix across factors and characteristics is taken into account, this TPM case which involves top-down flow applies more adaptation and modification than replication. Among other factors involved are educational level, seniority and experience, multi-tasking skills (super-operators) and motivation. Also another interesting factor involved here is emotion, for instance, the TPM module at the operator level is designed to appeal to the caring aspects of the operators' personalities, since the machine is pictured as a baby and the message is given that it should be taken care of as though it were a baby. This approach of transferring the knowledge although through a simple adapted module (printed document), but with the injection of proper emotion given in the training, means that the operators receive a very loud and clear message, i.e. the machines need to be cared for as their babies.

The means of knowledge transfer in TPM involves making analogies of stories (see below), and also by introducing different activities in the line (one is W-W-A = Why-Why-Analysis, which is like a cause and effect, or fish-bone, diagram because it is shown that one needs to ask five levels of Why). Others are involved in launching a

campaign (5S Scheme), training and instruction, as well as daily morning short meetings at TPM corner.

It is also found out that the knowledge transfer flow of this TPM is specially developed through the “top-down” flow, which the co-ordinator (a General Manager level) initiated after lobbying top management to make it policy and to implement it all the way down to the shop floor level.

The checking mechanism in respect of TPM progress and its alignment with the requirements includes monthly MD plant-tours that involve thorough inspections and checks on the development of the TPM project in DNMY. TPM in DNMY could be summarised as a project that ‘thinks globally, but acts locally’.

For the ***TS*** case, the project initially started in preparation mode 18 months before the certification process, during which time the organisation started by setting-up the committee, steering committee and working committee, which designed the activities and the schedules, starting from documentation, preparation, awareness training, implementation, audits, management review, and some campaigns, and also the training for which consultants were engaged. These steps are quite similar in practice among MNCs when quality comes into picture.

Most of the knowledge is transferred by means of face-to-face communications, where meetings and simulations of the problems faced by the departments are practised beforehand as well preparations being made with the documentations. The knowledge is mostly created through problem-solving activities and discussions.

In terms of approach, it was found that more adaptation and towards modification is applied, that a matrix across factors and characteristics are taken into account, this TS case which involves lateral flow across departments, is affected mainly by the factors of charisma, seniority and experience, as well as educational level, respect and motivation.

It is also found that the knowledge transfer flow in this TS case is specially developed within the “lateral” flow, which was initiated by the co-ordinator, who together with the consultants and other middle managers (mostly section heads and section managers), plans and works out the requirements for certification. They do this initially in meetings and later in their own departments.

Finally, in respect of TS progress and its alignment with the requirements, DNMY was audited by the CB – certification body, and after three audit exercises, it was finally certified. This certification must be renewed annually, and the committee teams remain active holding meetings and exercises to maintain the certification standards. In fact, in testing whether the same knowledge on TS is truly understood, a ‘checking’ mechanism which involves another third and qualified body was used, which validated the knowledge transfer process. TS in DNMY could be summarised as a project that is “received from the teacher, and checked by the head-teacher”,

Conclusion

The research will contribute to our understanding of the phenomenon of knowledge transfer, and of the processes and flow of knowledge within and between different organisational levels. This will be of value, as previous studies have focussed on the projects and transfer of knowledge across different units and organisations without taking the flow of knowledge into consideration (Argote, 1999; Eisenhardt and Santos, 2000) while others have explored the relationship between the sender and

receiver of the knowledge (Szulanski, 2000). Previous qualitative research has examined attitudes towards knowledge transfer, and electronic ties for technical knowledge transfer (Constant et al, 2004); and also on the perceptions and main motivations of knowledge transfer (Fraser et al, 2000); and barriers in knowledge transfer (Swart and Kinnie, 2003).

Different studies have revealed that organisations with a similar template of knowledge in actions are benefiting from much greater transfer than those that need to translate and adapt them (Nelson and Winter, 1982; Winter and Szulanski, 1998; Szulanski and Jensen, 2001; and Rivkin, 2001), and that transfer will inevitably require increasing adaptation as an organisation becomes more open and interdependent with its environment (Epple et al 1996; Winter and Szulanski, 1998).

The present study takes a more in-depth approach to understanding the nature of knowledge transfer from the perspective of the subsidiary itself, how managers and operatives put into practice knowledge of manufacturing techniques, and the circumstances in which they both replicate or adapt knowledge from the parent company. Therefore, my findings distinguishingly differ from the above as previous studies did not find and examine the circumstances and factors in the approach of knowledge transfer; either applying replication or adaptation.

Thus, the main contribution to the theory of knowledge transfer and flow is in the exploration and understanding of the circumstances and criteria involved in selecting whether ‘adaptation’ or ‘replication’ or ‘others’ which is suitably applied in different knowledge flow situations.

This will also bring into focus the contribution to the practical world in as much as: (a) when and how to choose ‘replication’ or ‘adaptation’, that finally will clearly outline the KT behaviour in individuals when choosing between “‘replication’ and ‘adaptation’”, and (b) concluding and exploring the new finding that not only using one type (either ‘replication’ or ‘adaptation’ only) in one subsidiary, and (c) for the practising field contribution, a model of how and when to choose replication rather than adaptation, and vice-versa in KT projects.

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