TRANSFERRING KNOWLEDGE OF MANUFACTURING TECHNIQUES WITHIN A SUBSIDIARY OF A MULTI-NATIONAL CORPORATION

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Thesis Summary

With the growth of the multi-national corporation (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 in 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. Much 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. This research therefore takes the perspective of the subsidiary in examining how knowledge of manufacturing techniques is transferred from the parent company within its surrounding (subsidiary). There is clearly a need to take a practice-based view to understanding how the local managers and operatives incorporate this knowledge into their working practices. A particularly relevant theme is how subsidiaries both replicate and adapt knowledge from parents and the circumstances in which replication or adaptation occurs. However, it is shown that there is a lack of research which takes an in-depth look at these processes from the perspective of the participants themselves. This is particularly important as much knowledge literature argues that knowledge is best viewed as enacted and learned in practice – and therefore transferred in person – rather than by the transfer of abstract and de-contextualised information. What is needed, therefore, is further research which makes an in-depth examination of what happens at the subsidiary level for this transfer process to occur. 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, Gambatte 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 and presented and analysed in episodes format. This study contributes to our understanding of knowledge transfer in relation to the approaches and circumstances of adaptation and replication of knowledge within the subsidiary, how the whole process is developed, and also how 'innovation' takes place. This study further understood that the process of knowledge transfer could be explained as a process of Reciprocal Provider-Learner Exchange that can be linked to the Experiential Learning Theory.

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

Dedication

To my beloved wife, and families.

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Works from this Research

Published work from this research

Jamsari **ALIAS**, David BENNETT, and Matthew HALL (2008) *Transferring Knowledge of Manufacturing Techniques in Multi-National Corporations: A Review of the Literature,* in Harorimana D and Watkins D (Eds) Proceedings of 9th European Conference on Knowledge Management, Academic Publishing International, Reading, United Kingdom, ISBN: 978-1-906638-11-5 (pp 11-18).

Jamsari **ALIAS**, David BENNETT, and Matthew HALL (2008) *Transferring Knowledge of Manufacturing Techniques in Multinational Corporations: Preliminary Findings*, in Jolly D (Ed) Proceedings of 3rd European Conference on Management of Technology, CERAM/IAMOT, Nice, France, ISBN 0-9815817-1-4(CD).

Unpublished work from this research

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List of Acronyms

FMEA	Failure Mode Evaluation Analysis
HQ	Head-quarters
IATF	International Automotive Task Force
Intra-MNC	Within the similar companies of an MNC
ISO	International Organization for Standardization
IT	Information technology
JIT	Just-in-time
Kaizen	Continuous Improvement
Kanban	An instruction call-card system for production processes
KT	Knowledge Transfer
KTA	Knowledge Transfer Approaches
MAJAICO	Malaysian Japan Automotive Industries Cooperation
MNCs	Multinational Corporations
muda	Waste in production system
PM	Preventive Maintenance
QC	Quality Control
R&D	Research and Development
SIRIM	Standards and Industrial Research Institute of Malaysia
SOP	Standard Operating Procedures
TPM	Total Productive Maintenance
TPS	Toyota Production System
TS	TS16949 Standards
WIP	Work in progress

Keys to Respondents' Verbatims

The following abbreviations and symbols are used in the quotes of interview transcripts in this thesis.

Italic/underline	emphasis in the quotes of transcripts
…	a pause of the interviewee during his/her conversation in the interview
… …	unfinished sentence of the interviewee during his/her conversation in the interview
~~	non-essential content located in the quoted quotes of transcripts not included in order to save space and maintain the flow of presentation of data
[ ]	owner of the conversation

Chapter One

Introduction

1.0 Introduction

This chapter provides an overall view of this thesis. It sets the background to the study, discusses its objectives and the rationale for pursuing them. Additionally, it provides an overview of the research design, and outlines of all the chapters in the thesis.

1.1 Background to the Study

Knowledge transfer is defined as "the process through which one unit (e.g., group, department, or division) is affected by the experience of another" (Argote and Ingram, 2000: pg 151). Argote and Ingram (2000) 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 the recipient units. This process of knowledge transfer is becoming increasingly important in organisations especially in the multinational corporations (MNCs). The reason being effective management of these distributed organisations requires knowledge possessed by the organisations to be transferred from one individual, team, department, or geographical division to another.

MNCs generally operate in several countries but are managed from one home country. A home office company or head-quarters (HQ) of the MNC is normally referred to as the 'parent' while the companies operating in other countries are called 'subsidiaries'. The subsidiaries usually contribute greatly to the MNCs' revenue, being involved in substantial direct investment in foreign countries, with engagement in active management and integration of operations located in other different countries (Birkinshaw & Hood, 1998).

Scholars have been observing the aspects of economic investment related to operations of MNCs as well as its existence and development for the past thirty years, but it is only relatively recently that the aspect of knowledge, particularly how MNCs manage their knowledge, has emerged (Gupta and Govindarajan, 1991; 2000). In the global economy, knowledge is a power that has become an important source of a competitive advantage to an organization, and thus it needs to be managed effectively (Malhotra, 2003). However, transferring knowledge is complex because of two main reasons. First, knowledge resides in organisational members, tools, tasks, and their sub-networks (Argote and Ingram, 2000). Secondly, much knowledge in organisations is tacit and hard to articulate (Nonaka and Takeuchi, 1995). With the fast growth pace of MNCs, there is a high need to understand how parent companies transfer their knowledge to, and manage the operations of, their subsidiaries. This is of particular interest to manufacturing companies, specifically Japanese MNCs, which set many of their manufacturing operations in overseas locations. Japanese companies in particular have been pioneering in 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 to overseas subsidiaries.

The Japanese MNC provides a good contextual setting for a study of knowledge transfer. In the extant literature, scholars have developed widespread interests in the importance of knowledge management in firms, particularly, in MNCs (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 many projects involves various types of knowledge. This situation provides avenues for further investigations into this topic, especially involving subsidiaries located in other countries such as Malaysia.

In general, most of the studies have focused on a macro perspective of knowledge transfer between parent companies and their subsidiaries regionally and globally (e.g., Nobel and Birkinshaw, 1998; Gupta and Govindarajan, 2000; Foss and Pedersen, 2002). Much have been written about the process of transferring Japanese manufacturing techniques, yet evidence is still lacking on the knowledge transfer process at the micro level, that is how the subsidiaries themselves make use of such techniques, acquire, and incorporate them into their operations. It is important to investigate the issue of knowledge transfer in a micro setting to enable a deeper understanding of the processes that occur inside of a subsidiary of a MNC, including the roles assumed by individuals in the process of knowledge transfer. In this thesis, the term *macro* refers to the wide picture perspective of the knowledge transfer process, for example, the process of transfer from the parent to the subsidiary, while the term micro refers to a small part of the transfer process and involves in depths examination of the phenomena of transfer at the subsidiary level. The absence of discourse of the knowledge transfer process at the subsidiary level of the MNCs results in the incomplete picture of the knowledge transfer process. This is a critical omission in the literature, as then, the knowledge transfer process is not fully understood. This lack of understanding can have serious implications in the knowledge transfer process, such that proper strategizing for the transfer can't be implemented. This problem can lead to ineffectiveness in the implementation, or even failure.

This research therefore, takes the perspective within the subsidiary to examine how knowledge of manufacturing techniques is transferred from a parent company to its subsidiaries by focussing on the projects within the subsidiary. According to Bresnen et al (2003) and Koskinen et al (2003), projects normally involve cross-sectional flows throughout the hierarchy of an organisation and its subsidiaries, involving personnel from different levels in the organisation. Projects are seen as the situations where most knowledge is created, shared and transferred. Thus, the process of knowledge transfer can be clearly observed and understood, and validity of the research is ensured.

Specifically, this study examines the micro perspective of knowledge transfer by investigating a Japanese MNC's subsidiary in Malaysia with the aim of understanding how local managers and operations incorporate the transferred knowledge into their working practices. Substantially, the investigation of knowledge transfer from this position can explain what and how, the knowledge are transferred and implemented.

In terms of transferring knowledge between MNCs and their subsidiaries, two main approaches are normally used to fit in with the local condition, these being replication and adaptation (Szulanski et al, 2002; Williams, 2003). The term replication refers to a situation when knowledge is copied or reproduced from the original source. Adaptation of knowledge on the other hand, occurs when one (the recipient) makes adjustments to the knowledge. However, according to March (1991) and Szulanski (1996, 2000), the replication of knowledge is quite difficult to realise. Adaptation requires that the transferred practices fit with the local environment; however, focussing solely on fitting the practices may create a potential dilemma. As a result, even with experience, neither the MNC nor the subsidiary may fully understand the practice nor be able to completely codify the practice or the knowledge, making it becomes sticky, or difficult, to transfer (Szulanski, 1996; von Hippel, 1994).

This study contributes to the knowledge transfer body of knowledge by empirically examining the dimensions, and characteristics of knowledge transfer. Findings from this study provide a basis for understanding the process of knowledge transfer in a project context, particularly within a subsidiary of the MNCs. With this knowledge, implications for practice are identified and recommendations for future research are suggested. The study findings make three important contributions to the understanding of knowledge transfer and its significance in a subsidiary of MNCs by:

1. Drawing on the rich data of three projects in a MNC's subsidiary's experiences, the study generates an understanding of how knowledge is transferred within the context of a subsidiary by providing details of the approaches to knowledge transfer within the subsidiary and their circumstances.
2. Incorporating the findings from this study with the insights from knowledge transfer of manufacturing techniques and practices from the literature help researchers and practitioners to clarify the process of replication and adaptation in MNC subsidiary knowledge transfer. The study generates a list of the significant categories and items of replication and adaptation for knowledge transfer in the project context; and

3. Dealing with the multi-faceted project context, this study adds significant content to researchers' and practitioners' understanding of knowledge transfer, particularly in replication and adaptation approaches as well as another emergent approach referred to as the innovation approach.

1.2 Research Question

Building upon the concepts of knowledge transfer, MNCs, Japanisation and project management, this study seeks to explain the process of knowledge transfer in organisational projects, particularly related to replication and adaptation within an MNC subsidiary context. Specifically, the study seeks to answer the following grand research questions:

1) **How does knowledge transfer within a subsidiary of an MNC occur?**

   Sub-questions:

   a. What are the knowledge transfer approaches (KTA) utilized in the transfer of knowledge?

   b. How does each of knowledge transfer approaches (KTA) within a subsidiary of an MNC occur?

2) **What are the necessary circumstances that make the transfer of knowledge possible?**

   Sub-questions:

   a. What are the circumstances (mediums and mechanisms) involved in the transfer of knowledge?

   b. What are the factors influencing the transfer of knowledge?

1.3 Research Objectives

The objectives of the present study are:

1. to explore how knowledge is transferred within an MNC subsidiary and how it is developed within the context of organisational projects.

2. to further understand the significant circumstances that make knowledge transfer possible.

1.4 Overview of Research Design

For the purpose of confidentiality, the actual name of the MNC will remain anonymous and in this study is known as Gambatte Corporation. The three cases focused on the company's three main manufacturing initiatives or philosophies, namely Toyota Production System (TPS), Total Productive Maintenance (TPM), and TS16949 (TS).

The methodological approach involves a qualitative case study, using three cases from three different projects in a subsidiary of a Japanese MNC. This methodology is selected based on Yin's (1984) suggestion that it is most suitable to investigate a contemporary phenomenon within a real-life context where the boundaries between phenomenon and context are not clearly evidenced and when multiple sources of evidence are used. The study begins by reviewing the literature, identifying the theoretical gap, and formulating the study's objectives. It then develops the study's conceptual framework, which functions as a guide for data collection and for providing explanation of the study's findings.

Following the suggestions by Eisenhardt (1989) and Stake (1994; 2005), data for this study were collected mainly from in-depth interviews, and observations, as these approaches are appropriate in order to gain a better understanding of how the knowledge transfer process takes place. The main data were derived from 52 in-depth open-ended interviews with project members across various ranks in Gambatte Malaysia. In addition to the interview, participant observations for data collection were conducted involving nine formal and ad-hoc meetings, one open seminar, two staff training sessions, three plant tours, five meals, and informal interactions. Documents regarding the projects selected for study were also used in data gathering.

The study's data analysis utilized a combination of thematic technique and episodic data presentation. There are a number of approaches that can be utilized in analyzing qualitative data (Boyatzis, 1998; Crabtree and Miller, 1999; Miles and Huberman, 1989). In this study, Boyatsis approach to inductive analysis is utilized to provide structure to the data analysis and theory development. All interviews were tape-recorded and transcribed. In this study, the Boyatsis approach is applied as the main thematic analysis in order to extract the broad themes and patterns from the qualitative interviews and observations. The Boyatsis approach enables confirmation of existing theories as well as capture of emergent themes and categories from the data.

In presenting the data, episodic approach, a data presentation technique in which the situations from the cases are snap-shot, observed and detailed out with its sequences in narrative is utilized (Denning, 2007). This approach helped shape-up the discussion of the findings, assisting the researcher and readers understanding of the knowledge transfer process in the MNC. This approach is frequently utilized in the field of nursing, medical, psychology and education that would bring out the real life situations into pictures and words (Polkinghorne, 1995; Braun & Clarke, 2006; Juniper, 2006; Boydell et al, 2010). The episodic approach being frequently utilized in these fields indicates its importance in critical fields that has high requirements for data accuracy and reliability. And thus, suggests episodic approach as having high reliability as a research methodology. Sixteen episodes were presented to describe holistic pictures of the knowledge transfer phenomena within the three manufacturing initiatives in the subsidiary.

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. 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. The emergent themes and sub-themes were compared with existing literature to answer research questions. On some occasions the interviewees were referred again for further clarification, thus making the theme analysis much more concrete. This process was instrumental in obtaining the answers to the research questions.

In reaching the study's closure, the case study methodology stipulates that the study's findings be linked to broader theories in order to attain a theoretical generalizability; this refers to a situation in which the study's findings are brought to an abstract level of explanation, through iterative corroboration with broader theories (Eisenhardt, 1989). In this regard, the study's conclusions not only explain itself, but also are able to provide explanation to many other similar situations or circumstances or interventions. As a part of reaching closure, this study corroborates the findings with the broader theories of learning. This process enables the study's findings to achieve a theoretical generalizability in that its conclusions are able to explain many situations of knowledge transfer process in organizations.

1.5 Structure of the Thesis

The thesis is arranged as follows.

Chapter One introduces the research topic and provides a general overview of the study.

Chapter Two discusses the main bodies of literature related to knowledge transfer, manufacturing techniques and practices, particularly replication and adaptation approaches. This chapter covers the importance of knowledge and how knowledge transfer relates to an organisation's competitive advantage. It also provides an explanation of the relationship between knowledge transfer, manufacturing practices, and projects.

Chapter Three describes the methodology employed in the study. It details the qualitative (interpretative) case study method adopted for the research and justifies the selection of this approach. In addition, the design of the study, issues relating to accessibility, data collection procedures, and research techniques employed are also discussed. It later describes the context of the case study, and provides a detailed elaboration of Gambatte Corporation together with its subsidiary, Gambatte Malaysia. Towards the end, it presents the demographic and sample of coding for the three cases in Gambatte.

Chapter Four presents the study's findings in the form of 16 episodes that are presented in full detail to provide the complete picture and information concerning how the situations happened in the local context of knowledge transfer based on observations and from interviews, to illustrate the process more clearly.

Chapter Five extracts the episodes, and provide the discussion of the episodes. It extracts the episode themes and analyses them using further supporting interviews, observations, and documentations.

Chapter Six presents the interpretation and analysis of the findings with detailed explanations. This chapter also provide discussions of the main findings where the approaches, characteristics, and criteria for knowledge transfer are explained. It provides a summary of the findings and discussion that thoroughly discusses the findings in light of existing literature, signifying where the results adds to existing literature on knowledge transfer.

Chapter Seven presents the conclusion of the research. An overall summary of the research objectives is given and the contributions of the research and its implications to theory and practice, together with suggestions for future work, are provided.

1.6 Chapter Summary

This chapter has presented the background towards current study and indicated its research objectives, research design, and the structure of the thesis. In brief, the objectives of the study are to understand, explore, and elaborate the process of knowledge transfer, and identify how replication and adaptation are applied and selected by the members of projects in an MNC's subsidiary. The next chapter presents review of the literature.

Chapter Two

Review of the Literature

2.0 Introduction

This chapter reviews the literature, with the aim of identifying the research gap, and conceptualizing the research questions and research objectives. Subsequently, a conceptual framework that guides the data collection and analysis and provides explanation of the empirical findings is presented. The chapter firstly draws upon the literature developed from the topics of manufacturing, development of MNCs, progression of Japanisation, and the area of knowledge and knowledge transfer. Then, the chapter explores the small area of intra-MNC knowledge transfer, concentrating on the research topic of replication and adaptation within the subsidiary, which is where the research gap exists. The overall objective of this chapter is to create a fundamental understanding of the importance of replication and adaptation in intra-MNC knowledge transfer from the perspective of the subsidiary.

2.1 Background

The past three decades have seen rapid development of MNCs, and a wealth of research in respect of economic and investment aspects as well as general developmental issues, but only recently has the issue of knowledge, particularly on how MNCs manage their knowledge, been considered (Gupta & Govindarajan, 2000). Moreover, much consideration has been given to the aspects of managing knowledge, as the knowledge possessed by an organisation comprises a major source of competitive advantage in many industries (e.g., Grant, 1996; Kogut & Zander, 1992; Nonaka & Takeuchi, 1995; Prahalad & Hamel, 1990). In addition, this knowledge-based approach has enveloped a large frame of reference comprising international business (e.g., Bartlett & Ghoshal, 1989; Kogut & Zander, 1993), organisation theory (Grandori, 2001; Grandori & Kogut, 2002), strategic management (e.g., Kogut & Zander, 1992; Grant, 1996), and the economic theory of the firm (Langlois, 1992; Garicano, 2000).

It is known that MNCs are involved in large scale units and numbers of organisations and that the knowledge approach normally adopted is in line with the macro perspective (Foss, 2006). This takes place in relation when one views the situation from a large organisation or view from over the top at large. In contrast, when a perspective is viewed from a less large and minute in-depth view, this is known as micro perspective. The micro perspective has become more important since MNCs are naturally characterised by relationships between head-quarters or parents with their subsidiaries aimed at ensuring the smooth flow of business transactions, and the capable management of knowledge, which in itself entails its competent transfer.

Among MNCs' main activities is manufacturing. The main approaches of modern age manufacturing started with the era of mass production known as 'Fordism', and developed progressively to the era of 'Toyotism'. Today, the approach of just-in-time (JIT), *kanzen* and lean manufacturing is synonymous with the advancement of the Japanisation era. Japanese MNCs are not only opening up corporations and subsidiaries, but also expanding their approaches towards manufacturing across the globe.

Since knowledge is generally viewed within MNCs through the use of a macro perspective, there is imperfect understanding of the MNCs' knowledge structures to gain a comprehensive understanding of knowledge structures within MNCs. Therefore, there is a need to consider knowledge using a micro perspective (Foss, 2006). Furthermore, a refined perspective of how MNCs manage their knowledge, and particularly how they transfer it to their subsidiaries needs to be developed empirically. Whilst much has been written about the process of transferring Japanese manufacturing techniques, 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 (Alias et al., 2008). This research fulfils this gap by examining the transfer of knowledge from the view from the subsidiary perspective. The following sections will further illustrate the literatures involved.

2.2 Knowledge and Knowledge Transfer

Knowledge as a field of study is becoming an interesting discipline. Since the discourse period of Plato, knowledge has become not only the philosophical question of what to search and seek, but also lately it has come to be known as a branch of management enquiry.

The discussions on knowledge have been around within various perspectives and across different fields. Making reference to Plato, Nonaka and Takeuchi (1995) defined knowledge as 'justified true belief' from its philosophical and religious aspects (Rosenthal, 1970). The importance of knowledge for firms and for society in general has been a salient long standing issue in a number of disciplines, including economics (Demsetz, 1988), sociology (Glaser et al, 1983), psychology (Broner et al, 2001), philosophy (Polanyi, 1962; 1998), and management (Nelson & Winter, 1982; Teece et al, 1990, Winter, 1987). More recently the perspective has advanced to the stage where knowledge has become a key ingredient in gaining a competitive advantage and a firm's main inimitable resource (e.g., Gnyawali et al, 1997; Kogut & Zander, 1992; Grant, 1996).

Knowledge also involves the acquaintance with facts, truths, or principles, gained from study or investigation and general erudition; and acquaintance or familiarity gained by sight, experience, or report; and also could involve awareness, as of a fact or circumstance. Blackler (1995) classifies the common images of knowledge in the organisational literature as embodied, embedded, embrained, encultured and encoded. The term embodied refers to knowledge that is action-oriented and required recipient doing it in context, while embedded refers to knowledge that resides within an organization's systematic routines and procedures. The term embrained refers to abstract knowledge, which acquisition depends on one's conceptual skills and cognitive abilities, while the term encultured relates to the process of achieving shared understandings between the knowledge transferor and transferee (recipient), whereas encoded is knowledge being transferred in the form of recorded signs and symbols. At a later stage, the state of knowledge is represented as knowing, which involves the processes of knowing being mediated—when knowing is being analyzed by the recipient as a phenomenon, situated--when knowing is occurring in a specific time and space of the recipient, provisional--when knowing is constructed and continuously developed on the part of the recipient, pragmatic--when knowing is a purposive effort by the recipient, and contested—when knowing is conceptualized by the recipient as object-oriented.

And Szulanski (2006) defines knowledge rather broadly as an entity which involves many phenomena, including routines, practices, and technologies. Hedlund (1994) further classified knowledge into three aspects, these being: cognitive, skills, and knowledge embodied in products.

Since Polanyi's seminal work, it has been accepted that knowledge has a non-reducible tacit part and that this is hard to transfer, as it becomes more and more tacit (Polanyi, 1967). Explicit knowledge is assumed to be capably transferred using documents, electronic media and through artefacts, whereas tacit knowledge requires more individual communication and training techniques such as mentoring or storytelling (Swap et al, 2001).

In fact, the definition of knowledge itself has prompted a lively epistemological debate (Shin, Holden & Schmidt, 2001). In conceptualising knowledge, one notion that has received agreement among researchers is that "data, information and knowledge are not interchangeable concepts" (Davenport & Prusak, 1998:1). Data, which could be defined as a set of objective facts are structured records consisting of signs and raw materials that need to be processed (Willke, 1998; Chini, 2004). Information on the other hand, is regarded as data with significance (Kriwet, 1997; Davenport & Prusak, 1998) in that its context deems it precious because the user composes information (Chini, 2004). And finally, knowledge comes together with the diverse portions of information with an interpretation and meaning (Nevis et al, 1995; Kriwet, 1997, Jashapara, 2004) which the three normally view as blocks, each block building on the one below, information deriving from data and knowledge deriving from information (Davenport & Prusak, 1998; Nissen et al, 2000; von Krough et al, 2000).

Knowledge in another perspective can also be classified as information (explicit knowledge) and/or know-how (tacit knowledge) (Nonaka, 1991; Simmonnin, 1997). Information is explicit knowledge that can be transmitted without loss of integrity once the syntactical rules required for deciphering it are applied. Thus, knowledge as information implies that the user knows what it means, and that it can be recorded in written form (Grant, 1996b; Nonaka, 1994).

Know-how is more complex than information, being the accumulated practical skill or experience that allows one to do something efficiently. Know-how has a personal quality that makes it difficult to formalise and to communicate because it involves both cognitive and technical elements and is not simple to jot down (Grant, 1996b; Nonaka, 1994). As noted by Chini (2004), information is static in conceptual terms, whereas knowledge is constantly changing, and while information is descriptive and explicit, knowledge can be explicit or tacit. Moreover, knowledge may also be defined as information whose validity has been recognized through a test of proof and can, therefore, be illustrious from opinion, assumption, beliefs, or other types of unverified information and the transition from data via information to knowledge as knowledge could be described in a hierarchy along which information and data generation can be assessed, transformed and developed to its higher level (Davenport et al, 1998, Liebeskind, 1996, Shin et al, 2001).

Davenport and Prusak (1998), argued that the transfer of knowledge as a transmission of information to a receiver and in turn the absorption and transformation of that information by that recipient (person or group). To be of worth to the organisation, the transfer of knowledge should direct to changes in manners, changes in customs and policies, and the development of new ideas, processes, practices and policies (Bender & Fish, 2000).

Another characteristic of knowledge that has received interest in the literature is complexity. A particular routine, practice, and knowledge is more complex when it has many different inter-dependent components, and the effect of complication on the transfer is proposed to be parallel to that of tacitness. Indeed, it has been found that it is difficult and less efficient to transfer compound knowledge (Simonim, 1999).

In dealing with the topic of knowledge transfer, therefore, as highlighted from the understanding of the concept of knowledge itself in the discussion above, an important point is that two ‘strands’ or ‘camps’ of thought in relation to the delivery of the contextual meaning of ‘knowledge’ have emerged.

These two principal strands which oversee the way people write about knowledge and the transfer of knowledge in the literature are often known as the objectivist and the practice-based perspectives. Firstly, the objectivist views knowledge as a ‘package’, ‘packet’ or tangible ‘things’ that can be moved around, kept, deported and stored (Nelson & Winter, 1982; Kogut & Zander, 1992).

This objectivist perspective treats knowledge as existing independently of the human mind, and that the transfer of knowledge occurs through a simple transmission between ‘sender’ and ‘receiver’ – hence use of the term knowledge ‘transfer.’ This perspective has a view of knowledge transfer dominated by ‘information theory’ (brought forward first by Shannon & Weaver, 1963) which is also known as mother of all model, which considers only how ‘packets’ of information (or can be say, data) are transmitted, but ignores the complex human dimensions involved in the ‘sending’ and ‘receiving’ of information, and how information is able to inform knowledge.

Secondly, there is the view that knowledge is a ‘process’, naturally involving ‘tacitness’ and ‘complexity’ as explained by Szulanski (1996), Ghoshal and Nohria (1997), Kostova (1999), and Hansen (1999). The outcome is also argued to be ‘knowing’ by Blackler (1995). This practice-based perspective maintains that knowledge does not have a life of its own, but is ‘tacit’ within people, becoming manifest and useful only when applied in practice. Thus within a practice-based perspective, it does not make sense to say that knowledge is transmitted or ‘transferred’ to a person: From the perspective of the person enacting knowledge in the context of application, knowledge is acquired through processes of 'situated learning' (Lave & Wenger, 1991) and 'learning by doing'. As well as through tacit processes such as observation, imitation and absorption, learning can also be derived cognitively through the processing of information. From the practice-based perspective, information is a codified and decontextualised representation of knowledge, not knowledge itself, and in order to inform knowledge, information need to be decodified and recontextualised in practice (Hall, 2006)

In short, the classification is sometimes divided into objectivistic and practice-based categories; the former considering knowledge as a parcel that can be transferred, while the latter emphasising knowledge as a process. Considering the context of the current study, the view taken by the researcher is in line with the second perspective which considers knowledge as a complex 'process'. Much 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 these techniques within their operations (Alias et al, 2008).

In different contexts, researchers have also proposed and found factors that are influential in knowledge transfer. For instance, Tsai (2002) argues that centralisation leads to knowledge sharing while social interaction has an opposite effect in MNCs (Tsai, 2002). Similarly, Ghoshal and Nohria (1997) found a positive effect of autonomy and networking on inter-subsidiary knowledge transfer and communication in multinationals. One trait of the receiver unit that consistently appears in existing literature is its absorptive capacity, which has been found to lead to more successful knowledge transfer (Gupta & Govindarajan, 2000; Schlegelmilch et al, 2003; Szulanski, 1996).

A strong theoretical contribution is offered by Krogh and Kohne (1998), who identify three phases of knowledge transfer: initiation, actual transfer, and integration. Furthermore, the authors also describe several factors, such as the nature of knowledge, the interaction of sender and recipient, motivation, and corporate and local culture that have a bearing on the knowledge transfer process. Dixon (2000) distinguishes between different types of knowledge transfer, namely serial, near, far, strategic and expert transfer and offers an integrated system. Dixon defines the term *serial transfer* when knowledge gained in one setting is transferred to another setting, *near transfer* when the explicit knowledge is transferred from the recipient repeating the same tasks performed by others, *far transfer* as tacit knowledge being transferred from the transferor to the recipient via non-routine tasks, *strategic transfer* as transfer of critical, unique knowledge and finally, *expert transfer* when a technical problem requires solutions from other expertise within the organizations.

In terms of the mechanisms on how knowledge is transferred, most researchers distinguish between IT-based approaches to transfer and more personal mechanisms. Hansen (1999) suggests that knowledge can be managed in two ways, through codification and personalisation. Petersen et al (2001) find that firms use written documents as transfer mechanisms more heavily if knowledge is purchased from outside whereas daily face-to-face communication is preferred for the transfer of knowledge generated by own experience. In a similar vein, Foss and Pedersen (2002) argue that interdependence among the units of a multinational will result in more transfers of internally-developed knowledge.

The traditional characteristics of knowledge also appear in the examination of knowledge transfer mechanisms. Inkpen and Dinur (1998) suggest that tacit knowledge requires the use of individuals as knowledge transfer agents and that individual interaction results in the successful transfer of tacit knowledge. 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 characteristics of knowledge and its transfer mechanisms 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 as means to transfer tacit knowledge.

Apart from steps in knowledge transfer, several other perspectives that suggest that knowledge transfer is a complex process in related to absorptive capacity (evaluation of how the recipient of the knowledge receives the knowledge), causal ambiguity (the difficulty of understanding knowledge - sometimes intended knowledge is only understood by particular people/bodies), medium (the channel by which the knowledge is transferred), and knowledge complexity (the type of knowledge that is actually transferable).

All in all, the term appeared in the literatures have limited usage towards producing the working definition of knowledge transfer. From the literatures, there is a need to have a strong stance on what is meant by the term knowledge transfer. Argote and Ingram (2000) provide an interpretation that "knowledge transfer" in organisations is the process through which one unit is affected by the experience of another; and that is becoming increasingly important in organisations especially in MNCs, such that the effective management of these distributed organisations requires that the knowledge acquired by them, which may well be tacit and not easily articulated (Nonaka, 1991, Simonim, 2004), can be successfully transferred from one individual, team, department, or geographical division to another (Argote & Ingram, 2000).

In the light of literature debate here, it is relevant to probe how knowledge is transferred between organisations and although the practice-based perspective denies that knowledge can be 'transferred', nevertheless use of the term 'knowledge transfer' is likely to convey what the organisation intends – that in the context of a vertical parent-subsidiary relationship, and particularly in the context of the Japanese MNC (which are famous for transplanting manufacturing techniques), the strategic intention is that the subsidiary replicates processes and practices prescribed by the parent. By taking a practice-based perspective on knowledge, existing research highlights the problematic nature of knowledge transfer between organisations. The following parts will entails the importance of MNC and its manufacturing practices as well as other aspects related to knowledge transfer.

2.3 Mass Manufacturing Practices to Lean Manufacturing

Manufacturing basically means the use of equipments, tools and labour to make merchandises for use or sale. The term may refer to a variety of human activity, most frequently applied to industrial production, in which raw materials are changed into finished goods on a large scale (Haynes, 2005). Manufacturing practices are the processes involved in making the manufacturing or production happen. These practices could also relate to the systems for making the product, and actually how the product is made, thereby involving its elements, tools, mechanisms, costs and documentation (Haynes, 2005).

In explaining manufacturing practices, there are two main streams of manufacturing practices, known as Fordism, and Toyotism. The former has been regarded as the foundation of mass production, while the latter is also known as Lean Manufacturing. Named after Henry Ford, Fordism as Womack et al (1990) observed, "in this century [the auto industry] has changed our most fundamental ideas about how we make things. And how we make things dictates not only how we work but what we buy, how we think, and the way we live." And the first transformation was indeed related to Fordism which involved transformation of craft production to mass production.

Fordism not only changed the character of production from craft to mass production, but it also triggered the economy by creating markets, functionalising specialisations in the divisions of labour, and also bringing the cost-effective aspects into the picture. Its main contributions to mass production and utilization were in the realm of process engineering with the hallmark of the system of standardisation that required nearly perfect interchangeability of parts; and to achieve this, Ford exploited advances in machine tools and gauging systems which made possible the moving, or constant, production line, in which each assembler performed a single, repetitive task.

The later years of the 1970s marked a second wave in the manufacturing era with slower world growth and production systems started to become more flexible, and that cost reduction became a major consideration with competent quality management and efficient inventory control marked as the main criteria. This was also highly related to the growth of Japanese industries. The development of this new manufacturing practice, characteristically known as lean manufacturing or lean production, or simply as 'Lean', represented a move towards gaining more value for less work. Originally, lean manufacturing was a generic management philosophy derived mostly from the Toyota Production System (TPS) (hence the term Toyotism is established), and it was only identified as 'Lean' in the 1990s (Womack et al, 1990). The approach is renowned for its focus on reduction applied by Toyota on its wastes (*muda)* in order to improve value, with various perspectives on how this is best achieved, and the steady growth of Toyota, from a small automotive production company to the world's largest automobile manufacturer (Ohno, 1988).

Toyotism concentrates on improving the smoothness of work, thereby steadily eliminating waste, and improving production time, as well as lowering costs through the application of various tools such as TPS, *Kanban*, *Heijunka*, and Total Productive Maintenance (TPM). These techniques cover the principles of pull processing, perfect first-time quality, waste minimisation, continuous improvement (*kaizen*), flexibility, building and maintaining a long term relationship, autonomation, load levelling and production control (Ohno, 1988). Details of these practices are elaborated upon in Chapter Five.

Japanese MNCs flourished in line with the development of Toyotism and not only brought with them capital for investments, but also new ways of working; hence, the term Japanisation came into being. The term Japanisation was popularised by Oliver and Wilkinson (1992) in the UK, having been borrowed from Turnbull (1988) who notes its origination by a Lucas Trade Union official, who used it to describe the various changes in work organisations and employee relations being undertaken in his organisation in the mid-1980s (Morris et al, 1998). 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 to some, to represent a major shift in industrial organisation. The concept of Japanisation involves marking a shift from Fordism to Toyotism that created some interest in the technical methods and other social and organisational bases. And to be effective, lean must be extended beyond the shop floor as they do in Toyota and the right process will yield right results (Liker & Morgan, 2006).

Schonberger (1982), in his seminal work on Japanese Manufacturing Techniques, outlined nine main points in his so-called “nine hidden lessons in simplicity”, which include among others: the transportability of management techniques, the JIT (just-in-time) and quality control that produces ‘habit of improvement’, and the idea that culture is no obstacle and that 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 masterpiece, entitled “World Class Manufacturing”, Schonberger (1986) illustrates the success stories of American corporations that have adopted the JIT (just-in-time) and total quality control strategies that could be implemented in any factory through a regime of continuous rapid improvement, which includes changing procedures and concepts, and strengthening employee involvements and interactions.

In his book, Monden (1983) explains in detail how the Toyota Production System works, providing explanations of *Kanban*, quality and lead-time production that generated the practical approach to production management, the micro phenomena concerning how these actually operate within the setting of an organisational hierarchy within a subsidiary are still under-researched, and this study explores this gap.

Oliver and Wilkinson (1992) argue that Japanese manufacturing methods demand more supporting conditions as they are interdependent among all social actors involved. Their argument is that as a number of parties are involved in Japanisation, certain conditions need to be in place to deal with the approach. In their follow-up research, Oliver et al (1998) suggested 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, and 4) the adoption of Japanese methods outside Japan, and 5) the impact of the methods on various actors.

In another paper, Oliver et al (1998) focused on the human resources and shop floor work aspects via productivity performance comparisons of the Japanese model in the UK. These were then further elaborated in the year 2000, and the importance of responsibility distributed among what they called 'lean teamworking' which includes Just in time (JIT), *kaizen* and the Toyota Production System (TPS) was highlighted (Delbridge et al, 2002). Hence, the projects within the research context in this research study are in line with the current trend.

Japanese MNCs have special characteristics that have been demonstrated since the mid-70s, these being: a much higher sense of belongingness than that of Western-based MNCs, less local personnel on the board of directors, and in senior executive and top management positions, and greater control of their overseas subsidiaries than that imposed by Western companies (Urakami, 2000).

Moreover, Japanese companies use lean manufacturing extensively and that lean manufacturing is a complex process and this requires a different and special way of perspective in study in which the micro perspective should be utilized.

Indeed, much of the work on core competencies, dynamic capabilities, and more generally the resource-based view of strategy, has failed to clearly establish the micro foundations of its arguments (Foss, 2006). Researchers in the MNC field thus need to devote more energy than others into rooting their 'macro' observations into 'micro' behaviours, and this study concentrates on this. Therefore, an understanding of the micro-foundations of knowledge must also include an appreciation of the micro-processes involved, since as Foss (2006) observes, it is essential to have this information in order to fully comprehend how knowledge develops in MNCs.

2.4 Studies on Knowledge Transfer in MNC

In dealing with MNC knowledge transfer, a macro perspective can be gained by considering the way transfer occurs, whether between the parent and the subsidiaries, as well as among the subsidiaries themselves. The former movement is usually referred to as 'vertical' while the latter is considered as 'horizontal' transfer, the actual knowledge itself being understood as the 'packet' which is believed to be easily moved around.

Most studies in knowledge transfer in MNCs have been conducted from this perspective, however this study focuses on knowledge as a process and hence takes a micro-perspective of MNCs' knowledge transfer (how the knowledge is transferred within the subsidiary). Some researchers refer to this as intra-MNC knowledge transfer, but this study extends this notion to include details of knowledge transfer as it happens inside the subsidiary itself.

Turning to the empirical contributions, Gupta and Govindarajan, (2000:3) observe that "very little systematic empirical investigation into the determinants of intra-MNC knowledge transfer has so far been attempted". Tsai's (2001) contribution discusses intra-organisational knowledge transfer in view of the particular units' centrality in the network and their absorptive capacity, while Inkpen and Dinur (1998) emphasise the importance of context in knowledge transfer and focus on contextual similarities between the knowledge source and the recipient in the transfer process.

Simonin (1999) also focuses on key barriers to knowledge transfer, such as cultural and organisational distance, and Szulanski (1996) outlines the 'stickiness' of knowledge and stresses the importance of established linkages between units for knowledge transfer, as do Kogut and Zander (1993), who focus on the problematic transfer of tacit knowledge.

However, much of the empirical research on the differentiated MNC still tends to concentrate on the characteristics of knowledge, and of senders and receivers rather than on the organisational means of transferring knowledge (Foss & Pedersen, 2002). Moreover, much of the literature is silent on the sources of transferable subsidiary knowledge (for example, Porter & Solvell, 1999; Forsgren & Pahlberg, 1992), although there are a few studies that do investigate how the process of knowledge transfer actually occurs in organisations (see in Foss & Pedersen, 2004; Argote & Ingram, 2000). The few studies that have been undertaken have arisen as a result of the need to understand knowledge transfer in real practice, in both the manufacturing (Epple et al, 1996; Galbraith, 1990) and service sectors (Baum & Ingram, 1998; Darr et al, 1995), with an emphasis on exploring the details of knowledge transfer specifically in organisations (Argote, 1999; Szulanski, 1996).

Studies on the amount, direction, and dimensions of knowledge flows occurring both across national and organisational borders are likely to have important implications for MNC-level innovative performance (Yamin & Otto, 2004), in which within an MNC will stifle creativity and innovation of individual units (Ghoshal & Nohria, 1989; Yamin, 2002). In broader literature, the term 'knowledge transfer' is also related to global phenomena involving knowledge flow in MNCs which includes the sharing and transferring of knowledge within them, and how efficiently these corporations share knowledge across HQs and subsidiaries (Gupta & Govindarajan, 2000; Doz et al, 2001; Kogut & Zander, 1993). At least nine major studies describe and measure knowledge flows in MNCs as described in Table 2.1.

Table 2.1: Summary of the Literature

Authors	Unit of Analysis	Major Findings
Nobel and Birkinshaw (1998)	110 subsidiaries in 15 MNCs	The communication methods vary depending on types of subsidiaries (regarding knowledge transfer and flow).
Gupta and	374 subsidiaries	Knowledge flows are associated with

Govindarajan (2000)	in 75 MNCs	the subsidiary's' knowledge stock, absorptive capacity, motivational disposition and the richness of transmission channels.
Subramaniam and Venkatraman (2001)	90 new product development projects in 52 MNCs	Effective ability to transfer knowledge leads to global product development capabilities.
Hakanson and Nobel (2001)	120 R&D subsidiaries in 18 MNCs	The higher the integration, the more technology flow from the subs to HQs.
Birkinshaw et al (2002)	110 R&D subsidiaries in 15 MNCs	Two dimensions of knowledge – observability and system embeddedness – influence knowledge flows.
Almeida et al (2002)	21 MNCs in the semiconductor industry	The superiority of MNCs stems from their ability to use multiple mechanisms of knowledge transfer flexibly and simultaneously.
Cummings and Teng (2003)	69 HQs in US	Knowledge transfer success was associated with the extent of interactions.
Foss and Pedersen (2002)	2107 general subsidiaries in Aust, Denmark, FL, G, NW, SWE and UK	MNC management can influence knowledge flows through choices regarding control, motivation, and context.
Minbaeva et al (2003)	169 general subsidiaries in US, Russia and China	Interaction of ability and motivation facilitates knowledge flows.

In most of the studies mentioned above, it can be seen that when referring to the knowledge transfer context, the notion of knowledge flow is measured only vertically between HQs and subsidiaries without giving any detailed emphasis on what and how the flows of knowledge occur inside one subsidiary. In other words, most of the studies indicated above and most of those that adopt the knowledge-based view, focus on the macro aspect of knowledge flow and that micro aspects are given very few attention.

The micro-setting of an MNC subsidiary, in contrast, will provide a deeper understanding on how knowledge flows inside an MNC subsidiary, covering various units and running projects simultaneously, knowledge transfer, hierarchical layers, relations, the role of organisational members as well as the mechanisms, medium and processes related to the transfer involved.

The MNC makes a useful contextual setting for any investigation of knowledge flow since over the last two decades, there has been a widespread interest among scholars in knowledge management in firms, particularly in multinational corporations (eg. Ghoshal & Bartlett, 1988; Zander & Kogut, 1995; Szulanski, 1996; Gupta & Govindarajan, 2000; Eisenhardt & Santos, 2002; Birkinshaw et al, 2004) where there are numerous projects involving various flows of knowledge. The project as a means of knowledge transfer is in itself an interesting phenomenon which is part of this study's investigation. Indeed, the project context is seen as a place where most knowledge is created, shared and transferred (Bresnen et al, 2003; Koskinen et al, 2003), not least because the presence of such knowledge can reduce project time, improve quality, and enhance customer satisfaction.

Additionally, there are a few other dimensions that need exploration in ascertaining how knowledge is transferred within and between projects, and how that knowledge can be embedded in individual members, in the organisation's rules, routines, cultures, structures and technologies (McGrath & Argote, 2001). The problems and factors involved in these respects are more readily identified by using projects as cases.

In another aspect, their exploratory study of project-based learning, Scarborough, Swan, and Preston (1999) found two major processes in evidence, these being ‘learning-by-absorption’ and ‘learning-by-reflection’. The former, ‘learning-by-absorption’ is closely connected with the concept of ‘absorptive capacity’, that being a dynamic ability to recognise the value of new information, assimilate it and apply it both technically and organisationally to facilitate the transfer of knowledge within groups (Cohen & Levithal, 1990; Zahra & George, 2002). The latter, ‘learning-by-reflection’ entails individuals and groups making their prior implicit knowledge explicit (Scarborough, Swan, & Preston, 1999). The importance to ponder on transfer of knowledge amongst individuals makes the micro perspective approach much more needed.

2.5 Replication and Adaptation

One important established way to differentiate between knowledge transfers is to consider the extent of the exact copying of knowledge in other parts of the organisation, and whether precise replication is observed, or whether there is merely adaptation (Szulanski, 1996). This is an issue which is closely related to this study. Replication refers to those knowledge transfers where a particular practice is copied in as detailed and precise a manner as possible. Adaptation, on the other hand, allows the receiving unit to adapt knowledge and make changes according to the idiosyncrasies of its context (Szulanski et al, 2002; Williams, 2003). Both replication and adaptation are now defined in more detail.

When knowledge is copied or reproduced, the term replication is used, to indicate that it is a copy of the original source. Adaptation of knowledge on the other hand, occurs when one makes adjustments to the knowledge. The significance of adaptation is that while it is sensible that the subsidiary, and hence the transferred practices that it uses, to aim for an effective fit with the local environment, a focus solely on fit creates a potential dilemma. As a result, even with experience, neither the 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).

Winter and Szulanski (2001) further suggest that firms need to focus on replication if they wish to obtain the best leverage of knowledge (Szulanski et al, 2002). Empirical work by Williams (2007) found that investments in both replication and adaptation have positive impacts on knowledge transfer. Such investments require an understanding of the conditions required to effect replication and adaptation, in which respect, Grant and Gregory (1997) observed that in respect of the adaptation of manufacturing processes for international transfer, there are at least two main constructs which pertain to local host conditions, and the ability to transfer, these being: appropriateness and robustness.

Williams (2003) has outlined that in terms of replication and adaptation, a number of main criteria that need to be examined. Among others, the roles played by the ownership of the knowledge, mechanisms of transfer, relationships among the knowledge transfer line, tools and understanding levels, are identified. However, Williams (2003) like most other researchers, considers knowledge transfer from the macro perspective, and hence, a detailed inductive qualitative research exercise is required, as proposed by the present study.

Another area of literature is concerned with the communication flow in organisational projects, and how this flow supports or hinders knowledge transfer. In this respect, Hansen et al (1999) have suggested two strategies, these being codification vs. personalisation, which basically refer to knowledge explicated in databases or handbooks, as opposed to knowledge communicated through face-to-face contact between organisational members.

The communication flow is also closely related to the contextualisation and decontextualisation of knowledge, in which respect, there has been some attempt at exploration from the perspective of transporting, and transmitting an objectified package of knowledge (Nielsen, 1999), with the finding that the way knowledge flow changes according to different contexts is an outcome of the different processes used within these contexts.

This is very important as there are differences in the type of 'place' or 'instrument' or 'application' related to knowledge transfer, and some more than others are more effective. The different processes involving the 'visualisation' of procedures in transferring knowledge provide evidence of the importance of this area. Additionally, the roles of the people involved in the knowledge transfer are also worth examining.

All these various views are taken into account in refining and shaping the focus of this study, leading towards the potential for opening up new insights and gaps, not only with regard to how the different knowledge flow processes have different impacts, but also in terms of how the processes are involved and occur.

As Davenport and Prusak (1998) argue that the transfer of knowledge involves both the transmission of information to a recipient, and the absorption and transformation by that recipient such that it becomes 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 & Fish, 2000).

Knowledge transfer is not considered to be just a mere communication; rather the process is more complex since (1) knowledge resides in organisational members, tools, tasks, and their sub-networks (Argote & Ingram, 2000), and (2) much knowledge in organisations is tacit or hard to articulate (Nonaka & Takeuchi, 1995). Hence, this specific approach is taken, in order to understand how the total process occurs within MNC subsidiaries, and project-based oriented cases provide a perfect vehicle for this.

Furthermore, the elaboration of knowledge transfer from this position could possibly explain what and how processes are transferred and implemented in Japanese MNCs which involved looking into the diffusion of knowledge among the team-members in the projects.

Indeed, 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 in 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 (Alias et al., 2008).

Some of the general characteristics of Japanese MNCs as mentioned earlier include: the sense of belongingness is much higher compared with that of Western MNCs, they appoint less local personnel to their boards of directors, senior executives and top management, and they control their overseas subsidiaries much stronger than their Western counterparts (Urakami, 2000). Consequently this study provides a good contextual setting, which will obtain detailed insights on how a Japanese parent MNC transfers knowledge to its subsidiaries, and how those subsidiaries manage the operations and incorporate the knowledge.

2.6 Actors and Roles

Another important established way to differentiate between knowledge transfers is to consider the extent of the exact copying of knowledge in other parts of the organisations, that the actors and the roles that involved in the knowledge transfer process. As within the practice-based view, it is required that people at the local level to translate knowledge into practice, and therefore it is of interest to look into who are the key actors, what are their positions within the organisation, as well as how do they come to be involved in the knowledge transfer process.

Moreover, it is of great interest to know what are their incentives and motivations to be involved in the transfer of knowledge and whether there is a strong command structure in which they are told what to do. Also, do they have autonomy to work things out for themselves and are they receptive to change; how are they able to incorporate and adopt new working practices; does the nature and level of existing knowledge and experience or 'knowledge stock' (Gupta & Govindarajan, 2000) affect the ability of individuals and groups to participate; and what are the new knowledge that is required e.g. know-what, know-how and others. The different type of learning required in adopting new working practices, e.g. learning by doing, learning by reflection, or learning by absorption and whether absorptive capacity varies between actors and groups are also interesting questions. Is the transfer process adapted to suit different learning styles, or whether the actors required adapting their learning to incorporate different practices and whether they have any tacit assumptions about what is required and do these needs to change. The question of whether there are any changes in behaviour or routines required and whether these people have formal or informal roles within a job description or just with any informal roles involved.

2.7 Communication Processes and Channels

Another important predictable facet to include is that through which process of communication and channels of transfer of knowledge that would be applied to make its transfer possible. As understood, codification of knowledge as information as mentioned by Cowan and Foray (1997) defines as "the process of conversion of knowledge into messages which can then be transferred as information." Whether the information is decodified or acted upon as the codifier intended depends upon the similarity of the receiver's translation and interpretation of the codes used (Hall, 2006). Furthermore, some knowledge is tacit and can never be fully codified (Szulanski's reference to incomplete codification, which they call knowledge stickiness, which refers to the difficulties experienced by both the transferor and transferee (recipient) in the knowledge transfer process; which suggests the condition of the knowledge itself being difficult to imitate by the recipient, and when transferred, requires time for the recipient to acquire and adjust to it). Therefore, the questions of how codification and decodification of information affect the transferability of knowledge and how does the receiver interpret and make sense of the codes, symbols or pictures used in the transfer processes are important aspects to look into. Do both sides share similar knowledge, assumptions and language necessary for knowledge to be transferred also requires exploration in search of its answers.

Next, it is necessary to investigate the channels and media that are used to carry information and whether the medium affect the message, as well as the richness of communication either affected by the medium or channel; place and space in which the communication takes place.

2.8 Embeddedness of Knowledge

Another important feature in examining transfer of knowledge is the aspect of embeddedness of knowledge whether in the organisational routines, processes and technology (Blackler, 1995; Szulanski 1996). In the view of highly standardized environment of MNC, knowledge from the parent company is embedded in the new or modified practices which they are seeking to transfer. Does the nature of embeddedness or 'stickiness' differ according to what the parent is seeking to transfer (whether new routines, processes or technology) is an important quest to explore. And from this we can see whether the ability of the subsidiary to incorporate the practice differ according to the nature of the new working practice.

Szulanski identifies 'replication' as a way in which parent companies seek to transfer practices to their subsidiaries. However Szulanksi also finds that in certain conditions and circumstances there is a need for 'adaptation' of practices to suit local conditions (Szulanski, 1996: 2000). This raises the question, on what are these conditions and circumstances that need to be fulfilled. Following the practice-based view, is it possible for knowledge to be perfectly replicated across contexts, or is a degree of adaptation inevitable when knowledge is put into practice within a different context, and therefore what processes and mechanisms are involved in the ability of local actors to replicate or adapt their knowledge of working practices at the subsidiary level in the MNC. Drawing upon Szulanski's identification of replication and adaptation as key concepts in the transferability of knowledge, this research explores the actual processes by which working practices introduced by a parent company are adopted within a subsidiary.

The research gaps and the resultant research objectives are provided in Table 2.2, and the conceptual frameworks are illustrated in Figure 2.1.

Table 2.2: Research Opportunities and Objectives

Research Opportunities (Gaps)	**Research Objectives**
Need to empirically place and define the micro foundation of knowledge transfer in MNCs.	To explore how knowledge is transferred within a subsidiary of an MNC subsidiary and how it is developed within the context of organisational projects
Previous studies have overlooked and failed to determine the dimensions, categories and characteristics of replication and adaptation in knowledge transfer.	To further understand the significant circumstances that make knowledge transfer possible.

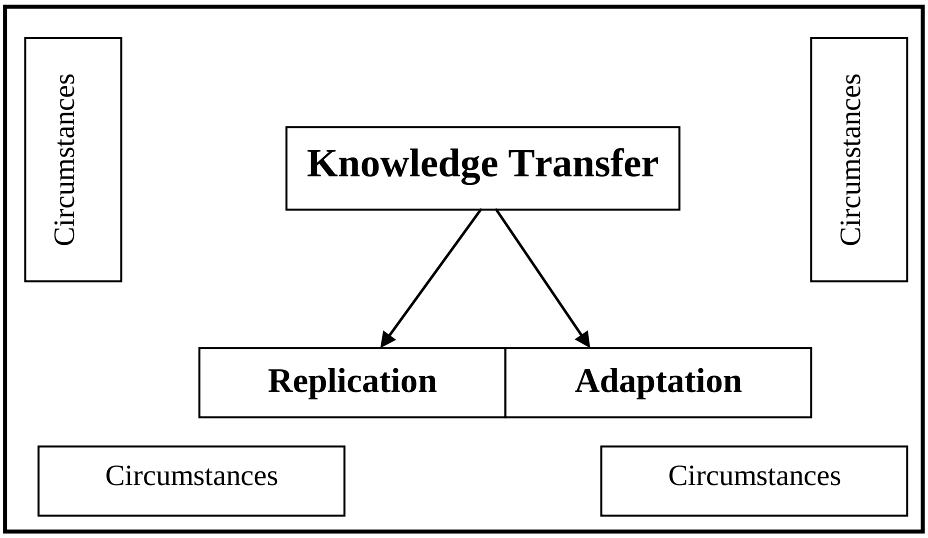

Figure 2.1: Conceptual Framework of the Study: Approaches to and Circumstances of the Process of Knowledge Transfer

As shown in Figure 2.1, the study conceptualizes knowledge transfer as a process of moving the knowledge from the parent company to the subsidiary, as well as within the subsidiary, through approaches of replication and adaptation. The replication and adaptation of knowledge is triggered by significant circumstances. Thus this study is to explore and understand further the approaches and circumstances involved in knowledge transfer within a subsidiary of an MNC.

2.9 Chapter Summary

In summary, it can be seen that the literature reviewed emphasises the significance of knowledge transfer in MNCs, suggesting it is important to recognise the foundation of knowledge, and the role it plays in creating the wider picture of MNCs. In particular, it has been shown that knowledge transfer in the area of manufacturing is absolutely essential for MNCs to flourish. Firstly, in order to establish and understand the benefit of transferring knowledge in respect to manufacturing practices in MNCs, the concepts of manufacturing and MNCs need to be well appreciated. Japanisation of manufacturing practices through the vehicle of Toyotism as currently accepted throughout the world is chosen as the focus for the study. Secondly, it is important to understand the different forms and perspectives in respect to the transfer of knowledge across MNCs. Consequently, the approach is to focus on Intra-MNC knowledge transfer and in particular on the transfer from a parent to its subsidiary.

The second part of the review emphasises the importance of knowledge transfer from a micro perspective, particularly detailing how knowledge of manufacturing practices is transferred within the subsidiary. The literature on knowledge transfer highlights the importance of distinguishing replication and adaptation, and what circumstances involved. Overall, the chapter provides bedrock for the empirical work of this study. Having identified the complexity of replication and adaptation in a subsidiary of an MNC, a qualitative case study will be used. The next chapter will illustrate the context of the study.

Chapter Three

Research Methodology

3.0 Introduction

Research methodology can also be referred to as a "procedural framework" in which a research is organised and conducted (Remenyi et al, 1998) that navigates overall processes for the project (Palvia et al, 2003). A methodology also provides a guideline for interpretation of findings, and the evaluation of facts towards drawing assumptions and conclusions (Eldabi et al, 2002) with an appropriate scientific method (Amaratunga et al, 2002). In other words, a well-developed research methodology can offer an understanding of the results and practices of a scientific enquiry (Kaplan, 1973 cited in Eldabi et al, 2002).

In pursuing this study, the researcher is aware that in order to select the appropriate research methodology, there is a need to understand the various research approaches, as well as their strengths and weaknesses which will help the researcher in deciding the most appropriate method and techniques. As no specific method or practice is privileged over each other (Denzin & Lincoln, 2000), the choice depends closely on the topic area and the research question as well as the researcher's background (Palvia et al, 2003).

This chapter highlights the research paradigms to establish the epistemological and ontological perspectives which would lead towards selecting the methodology.

3.1 Research Paradigm

In order for a researcher to embark into his or her study, one has to have an own way of looking into the world and reality, which in the area of management research is known as 'research paradigm'. The word paradigm which originated from a Greek word 'paradeigma' means "show side by side" and an 'example or pattern' (Berthon et al, 2003) conveys a broader meaning.

Understanding philosophical issues such as paradigm in attempting a research is very useful as in accordance with Smith et al (1997), the knowledge of philosophy can help to clarify research design, recognise which designs will work and also suggesting new design to face.

Moreover, Berthon et al (2003) stated that a paradigm consists of a set of basic beliefs or assumptions that involve fundamental aspects of ontological, epistemological, methodological and axiological assumptions which their ultimate truthfulness cannot be clearly recognized.

In other words, Khazanchi and Munkvold (2003) explain paradigm with the following key characteristics; ontology which refers to the theory or study of existential being, for instance ontological assumptions in the process of inquiry within a paradigm might specifically characterize the nature of reality, epistemology relates to a theory of knowledge that deals with the nature of knowledge, its areas, and offers a set of criteria for evaluating knowledge claims and establishing whether such claims are warranted, and methodology speaks about a procedure by which knowledge is to be developed.

In short, according to Filstead (1979) cited in Deshpande (1983), a paradigm:

a. serves as a guide to the professionals in a discipline for it to indicate what are the important problems and issues confronting the discipline;
b. goes about developing an explanatory scheme (models and theories) which can place these issues and problems in a framework that will allow practitioners to try and solve them;
c. establishes the criteria for the appropriate 'tools' to be used in solving the disciplinary puzzles;

d. provides an epistemology in which the preceding tasks can be viewed as organizing principles to carry out the “normal work” of the discipline; and
e. allows a discipline to ‘make sense’ of different kinds of phenomena, and identified them as existing.

Generally, there are two main research paradigms or philosophies known as positivist and phenomenological paradigm. However both names are also known with others as mentioned by Hussey and Hussey (1997) who stated that positivistic paradigm is also known as quantitative, objectivist, scientific, experimentalist, and traditionalist; while phenomenological paradigm is also known as qualitative, subjectivist, humanistic, and interpretivist. These two paradigms have their own features and characteristics.

3.1.1 Positivist paradigm

The main idea of positivism is the way it views the social world objectively from outside (Smith et al, 1997) and usually comprehending a philosophical approach of science by applying the natural sciences methods (Delanty, 1997). It also generally applies quantitative approach among variables to uncover the truth (Gephart, 1999). The positivist researcher believes that the observer is independent and science is value free. The research should also focus on facts by looking for causality and reducing phenomena to the simplest elements that normally come with hypotheses testing from large samples.

The positivistic paradigm originated from natural scientific method that commonly believes certain universal laws needs to be obeyed, and that knowledge could be generalized from accumulated data and quantifiable techniques and methods are observed (Berthon et al, 2003).

In short, Hussey and Hussey (1997) summed up that on ontological assumption, positivistic approach considers the world is objective and external to the researcher; epistemologically, positivists believe that only phenomena which are observable and measurable can be validly regarded as knowledge and in axiological assumption, they believe that science and the process of research is value-free and detached from what they are researching, while methodologically wise, positivists are likely to be concerned with ensuring that any concepts are operationalised by usually formulating hypotheses and analysing for causality.

Among the advantages in adapting this paradigm is its objectivity, application of proper empirical methods, as well as validity and reliability from hypotheses testing that could lead towards consideration of public knowledge (Smith et al, 1997; Babbie, 1993; Walker & Evers, 1999; Borg & Gall, 1996 in Kim, 2003). In the positivist's view, validity is understood as accurate findings about the world without interference from researcher and reliability is getting the proof of the truth to be repeated (Walker & Evers, 1999).

On the other hand, there are some generally acceptable disadvantages in taking up this paradigm. According to Kim (2003), undoubted truth (blind faith) in the positivistic approach can potentially harm the accuracy of research in social sciences by being rather inflexible, artificial and not very effective in understanding processes as well as not very helpful in generating new theories (Smith et al,1997).

3.1.2 Phenomenologist paradigm

The second paradigm to be discussed is phenomenologist. In some literatures, the authors prefer to use the term interpretivist rather than phenomenological because it suggests a broader philosophical perspective and prevents confusion with a methodology known as phenomenology (Collis & Hussey, 2003). Opposite to positivism, phenomenologist believes that the world is subjective and socially constructed, while the observer is regarded as part of what being observed and that science is determined by human interest (Smith, 1991). Phenomenologist researchers focus on deriving meanings and attempting to understand what is happening by looking at the totality of each situation from ideas developed through understanding of data. Usually multiple methods to find out different views of phenomena is applied and small in-depth samples which are examine over time is preferred.

In its application, phenomenology can be closely portrayed as qualitative research techniques that try to get the understanding of human meanings and experiences (Atkinson, 1972). Therefore, phenomenology is the study of conscious phenomena that show themselves. The term “phenomena” is derived from the Greek verb, which means to show oneself or to appear (Sanders, 1982). Phenomenology seeks to make explicit the implicit structure and meaning of human experiences in the search for ‘real meaning’ that cannot be exposed by ordinary observation. It is the science of important structures of consciousness or experience.

A good summary given by Hussey and Hussey (1997) is that on ontological assumption, phenomenological approach considers the world is socially constructed and only understood by examining the sensitivity of the human actions. Epistemologically, phenomenologists attempt to minimise the gap between the researcher and the subject by highly involved and in axiological assumption, they consider that researchers have values and these values determine what are recognised as facts and the interpretations which are drawn from them, while methodologically wise, phenomenologists are likely to be examining small samples possibly over a period of time.

As phenomenology is highly related with qualitative research method, it strives to investigate the live experience of the individuals who are being investigated. Thus, among the advantages in adapting this paradigm is their immediate concern of an occurrence as they present themselves to one’s realization (Sanders, 1982). Another advantage of this qualitative approach is that it stresses the subjective aspects of human activity by focusing on the meaning, not the measurement, of social phenomena (Hussey & Hussey, 1997). Other strengths of this paradigm are that the ability to look at change processes over time, understanding people’s sense, adjusts to new issues and ideas as they appear, and contribute to the evolution of new theories (Smith et al, 1997).

Among the advantage of taking the phenomenology paradigm is that the research being subjective in nature; the results are aimed at understanding the content of the research in its context. This could be further realised by discovering the problem and trying to understand the phenomenon in detail through in-depth exploration of a small number of sample.

In contrast, there are some generally acceptable disadvantages in adopting this paradigm. According to Sanders (1982), it is quite difficult to perform descriptive investigations either subjectively or objectively, and one has to be aware of technical terminologies and jargons. There is also a lock of established procedures which can be held up as the solid phenomenological method. Other weaknesses according to Smith et al (1997) are that the data collection process can take a great deal of time and the data may be difficult to interpret.

3.1.3 Paradigm of choice

Based on the literatures and explanations on the paradigms given above and based on the research question which is exploratory in nature and that knowledge transfer area is relatively new, the most suitable paradigm to engage in this study is phenomenology.

As Sanders (1982) stated that phenomenology looks for making explicit the implicit structure and meaning of human experiences, thus by searching these 'real meaning', a phenomenologist has to place before his own eyes to bring these to complete clearness to grasp what is momentarily perceived in conceptual expressions in some way evidently understood. Moreover, this is closely related to 'reflexivity', the way of reflecting critically on the researcher's self (Guba & Lincoln, 1994) and as mentioned by Goulding (1999) that the basic assumption is that a person's life is a make up of social experiences.

3.2 Selecting a Research Methodology

Research methodology is the inclusive procedure guiding the entire research project (Palvia et al, 2003). Methodology refers to the general approach to the research process, from the theoretical foundation to the gathering and analysis of data. The debate on qualitative and quantitative approaches started since early 1960s when the social sciences began to have doubts as to whether quantitative approaches, originated from the natural sciences, could provide critical perspectives on phenomena in society or providing solutions to the problems they faced (Schulze, 2003).

Research methods are the root of the construction of knowledge in any given field as “Research methods shape the language we use to describe the world, and language shapes how we think about the world” (Benbasat & Weber, 1996 cited in Dube & Pare, 2003).

Two main approaches to research are qualitative and quantitative methodologies. In an important work by Creswell (1994), the quantitative methodology is termed as the traditional, the positivist, the experimental, or the empiricist paradigm and the qualitative methodology is termed as the constructivist approach or naturalistic, interpretative approach or the postpositivist or postmodern perspective.

Qualitative research uses inductive reasoning, begins with an intention to explore a particular area, followed by collecting data, and then generating ideas; while quantitative research normally initiates with an idea expressed as a hypothesis, which through measurement of data that allows conclusion to be figured out (Bogdan & Taylor, cited in Choudhuri et al, 2004).
In order to capture the general features of both qualitative and quantitative approaches; the following explanations from Halfpenny (1979) cited in Silverman (2000) and characteristics from Larsen-Freeman and Long (1991) quoted in Lazaraton (2002) in which the researcher put in a form of a simple table below provides a brief description:

Table 3. 1: Research Method Comparison

Qualitative Research Method	**Quantitative Research Method**
Soft and Flexible	Hard and Fixed
Naturalistic and Observational	Controlled and Experimental
Subjective and Descriptive	Objective and Inferential
Value-laden	Value-free
Process oriented	Outcome oriented
Speculative and Grounded	Hypothetical and Abstract
Case Study is dominant	Survey is dominant
Prone to be Holistic	Prone to be Particularistic

Claimed to be more valid	Claimed to be more reliable
Real, Rich Deep data	Hard, Replicable data

3.3 Research Design

Research design is the science and art of arranging procedures for conducting studies in order to get the most valid findings (Vogt, 1993) and determining a research design will provide a detailed plan to guide the research.

Rowler (2002) explains that "research design is the logic that links the data to be collected and the conclusions to be drawn to the initial questions of a study" that ensure coherenceness. It is also an action plan in moving from the questions to the conclusions. It consists of the components of the research including the research questions, propositions, units of analysis, linkage of data and the criteria for interpreting findings (Rowler, 2002).

This research adopts triangulation of multiple sources of data; including interviews, moderate observations and documentation.

Basically, triangulation is a mixed method that contains elements of both qualitative and quantitative approaches (Rocco et al, 2003). In another words, it is a combination of methodologies in the study of the same phenomenon (Denzin, 1978 quoted in Jick, 1979). It has vital strengths, encourages productive research, enhances qualitative methods allows the complementing use of quantitative methods (Denzin, 1970 in Hussey & Hussey, 1997).

In other words, the term triangulation is used by Jick (1979) to mean not only investigating the similar phenomenon from various perspectives but also increasing understanding when deeper or new insight emerges. Moreover triangulation is the use of multiple observations or perceptions to provide clarification in meaning or verification.

Undeniably, the usage of multiple methodologies which allows triangulation is gaining wider acceptance, leading to greater confidence in the findings

(Palvia et al, 2003). Triangulation could reduce the likelihood of misinterpretation in which the researchers employ various procedures, commonly being redundancy of data gathering and procedural explanations that should lead to greater validity and reliability (Denzin & Lincoln, 2000). It is a process of using multiple perceptions to clarify meanings and verify interpretations in different ways the phenomenon is seen (Flick, 1998).

Indeed, as mentioned by Das (1983) cited by Amaratunga et al (2002) "although qualitative and quantitative methodologies are divergent and focus on different dimensions on the phenomenon, the underlying unity may become visible in deeper penetration", which in short brings the meaning that triangulation is the combination of studies in the same phenomenon.

This triangulation could also enable corroboration between the two methodologies with providing richer details and initiating new lines of thinking for better insights (Rossman & Wilson, 1991 cited in Amaratunga et al, 2002) and a fruitful improvement of understanding of phenomena can be achieved (Davies, 2003).

In this study, the exploratory case study methodology was selected and research interviews, researcher observations, and analysis of company documents, are utilized as the approach for data gathering (Yin, 1994; Creswell, 1994; Martinsuo, 2001). In this regard, the this study does not utilized "triangulation of methodology", in which more than one methodological stance is embraced, rather, it utilized a "triangulation of data", in which its data sources encompassed a combination of in-depth interviews in the case-study setting, observations, and analysis of company documents, to produce a more comprehensive understanding of the processes of knowledge transfer. The use of this multiple source of evidence, help overcome the limitations of a specific types of gathered data (Amaratunga et al, 2002).

Case study is therefore, useful when an occurrence is broad and complex, when a holistic, in-depth, enquiry is needed, and when an occurrence cannot be studied outside its own context (Yin, 1994). Case study typically combines several qualitative data compilation methods such as interviews, documentation, and observations, and quantitative data such as questionnaires and time-series (Dube & Pare, 2003). This method of data triangulation in this area of research could also be a contribution towards enrichment of new findings.

3.3.1 Qualitative Approach

Qualitative research offers prospects to understand dimensions of social connections that traditional research methods do not address. This approach provides insights into the scope of why and how of an experience, adds significantly to the wholeness of answers provided by research.

A good summary of this approach is summed up by Amaratunga et al (2002) who says that qualitative approach "concentrates on words and observations to express reality and attempts to describe people in natural situations". King (1994) cited in Amaratunga et al (2002) provided a comprehensive features of this approach; among others, he mentions that "the inquiry of this research is from the inside by attempting to take account of differences between subjects with an aim to flexibly allow theories and concepts to proceed in line with each other". The results are said to be theoretically generalized which are "deep, rich and meaningful" while the approach is inductive in researching the social world that involves aspects of cultural and behavioural of individuals and society (King, 1994; in Amaratunga et al, 2002). Indeed, qualitative data are a supply of well-grounded, rich images and descriptions of processes in local contexts (Miles & Huberman, 1994).

Within the qualitative approach, there are several alternative research strategies to be selected including exploratory, holistic, case study, individual interviews and analysis of company documentation, researcher interpretations, and respondent remarks (Yin, 1994; Creswell, 1994; Martinsuo, 2001).

In this exploratory study, the research involves conducting an inductive case study and an in-depth interview to find the answers. Both of these methods are qualitative which are conducted through a strong contact with life situation or a field (Amaratunga et al, 2002) in which the situations are seems normal and resembling of daily life of individuals, groups, societies and organizations (Miles & Huberman, 1994).

A case study is an empirical inquiry that investigates an up to date phenomenon within its real-life situation (Yin, 1984), which has its important features, happenings, relationships and situations (Denzin & Lincoln, 2000).

Among the strengths of qualitative method are the data gathering method is seen more natural than artificial and the researcher is able to look at change processes over time (Smith et al, 1991). The qualitative method tries to understand people's meaning and is capable to adjust to new ideas and issues towards contributing to a new theory generation (Smith et al, 1991).

A qualitative method is also conducted through "an intense contact with the field or life situation" and reflective to everyday life of the subjects (Miles & Huberman, 1994). Indeed, the focus of the natural setting in real life makes this method rich and holistic, leading to a "ring of truth" (Amaratunga et al, 2002). Other main strengths of qualitative method are that it is claimed as the best method in discovering and exploring new area and very useful to validate quantitative data (ibid). Moreover, words, especially organized into events or stories, have a concrete, dramatic, meaningful essence that often proves far more convincing to a reader (Miles & Huberman, 1994).

Among other strengths of qualitative approach according to Yauch & Steudel (2003) are its ability to query for original values, philosophies and assumptions and its inquiry is broad and open-ended, permitting the participants to raise issue that matters most to them.

Applying a case study in this research will increase "propositional and experiential" knowledge (Polanyi, 1962 in Denzin & Lincoln, 2000) and conducting an interview will give the researcher an in-depth understanding in which the focus of it has proved to be "moving from answering how's to answering what's" (Denzin & Lincoln, 2000).

3.3.2 Inductive Case Study using Eisendhart (1989) 8 steps procedures in using the case study methodology to develop new theories

A 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" (Yin, 1984). Case studies normally combine data collection modes such as archival explorations, interviews, questionnaires, and observation (Eisenhardt, 1989).

In general, case studies are the favoured strategy when the investigator has little control over events and when the focus is on an existing phenomenon within real-life context and its generalizability is determined by the strength of the explanation of the context (Yin, 1984).

Moreover, case studies as a research method, although traditionally viewed as lack of objectivity contrasted with other social research methods, are broadly used because they may propose explanations that other approaches might not offer (Rowler, 2002).

According to Eisenhardt (1989), case studies are suitable for examining new research areas, involving contemporary events, and when the researcher is not able to manipulate behaviours, which are some of the characteristics of the study. Eisenhardt (1989) presents a guide for generating theories from the case study methodology, which comprises eight steps : 1) getting started, 2) choosing cases, 3) developing instruments and protocols, 4) entering the field, 5) analysing data, 6) shaping hypotheses, 7) re-iterating with literature, and 8) getting closure. She emphasises that the case study methodology is a full-fledged research strategy and not only a method that gives prescriptions on data collections, which Yin (1989) and Markus (1989) also agree. Stake (2005) reports some of other characteristics of qualitative case study including; researchers spending extended time on site, being personally in contact with activities and procedures of the case, reflecting, and revising descriptions and findings.

Indeed, a case study is a real life empirical investigation when the lines between phenomenon and context are not clearly marked that can also be divided into holistic or embedded studies (Rowler, 2002). Holistic case studies look at the case as one unit, focusing on broad issues of organizational culture or strategy, while embedded case studies identify a number of sub-units (e.g., meetings, roles and even locations), each of which is explored separately; while results from these units are drawn together to get the overall picture.

One of the strong points of case studies is that proofs and evidences can be gathered from multiple sources. Triangulation uses evidence from different sources to agree with the same findings. Other strengths of case studies are they are often used to illustrate problems or indicate good customs with each study pays explicit attention to sampling and selection issues, and used a range of data collection techniques, including interviews, observation and documents (Blaxter et al, 2002).

However, perhaps the biggest criticism of the case study is that being subjective and strongly influenced by the researcher, and the research findings are based on the interpretation by the researcher. In case studies, the researcher will influence the study based on access factor and pre-understanding factor. Access refers to the capability of getting close to the object study while pre-understanding refers researcher's knowledge, insights, and experience before he / she employs in a research project (Gummesson, 1993).

Precisely, Blaxter et al (2002) have outlined the advantages and disadvantages of the case study methodology. Some of the advantages of the methodology are:

a. Case study data are generated from people's experiences and practices which seen to be strong in reality.
b. Case studies allow for generalizations from a specific instance to a more common issue.
c. Case studies allow the researcher to confine the complexity of social life, as good case studies build on this to explore different meanings and connotations.
d. Case studies can provide a data source and archives for further analysis and research work.

e. As case studies are built on real practices and experiences, they can be linked to action and their insights contribute to changing practice.
f. Case studies can be more persuasive since the data contained are close to people's experiences.

Some of the disadvantages of the case study methodology are:

a. the density of a case can make analysis not easy. This is due to the holistic nature of case study where the researcher is often aware of the relations between various events, variables and outcomes that consequently, everything seems relevant. It is not, however, required for a researcher to write up a case that makes a good research.
b. While the contextualization of features of the case make the research stronger, it is sometimes difficult to identify where the 'context' starts and finishes.

In short, Anselm et al (2001) have provided useful rules of thumb for constructing case studies; which are:

a. collect data, analyze, and building theory around core category / ies
b. construct a working model of the case study, clearly specifying all the theoretical elements and their connections with each other
a. then, build in illustrative data, through careful selection and choose the data carefully to bring out many theoretical aspects that need supplementation by illustration.

3.3.3 Selection of the Study Context

In recent decades there has been rapid development of MNCs, and research efforts that have considered economic and investment issues together with general developmental matters, but it has only been since the 1990s that the aspect of knowledge with MNCs has been explored (Gupta & Govindarajan, 1991; 2000). This more recent concern has emerged since knowledge is known to comprise a major source of competitive advantage in many industries, and therefore a consideration of the various aspects of managing knowledge is important (e.g., Grant, 1996; Kogut & Zander, 1992; Nonaka & Takeuchi, 1995; Prahalad & Hamel, 1990).

During this same period, Japanisation processes that have gained in reputation with the growth in Japanese MNCs, have also expanded their horizons. Increasing globalisation leads towards market incorporation and escalation of capital and also entails Foreign Direct Investments (FDI) that provide a way to gain exclusive tangible and intangible features and industrial competencies on a large-scale globally, through the transfer of knowledge from headquarters to affiliates (Vernon 1966; Caves 1974).

In respect of Malaysia, there is a large number of FDI inward sources, and data on the foreign involvement to the equity of the majority-foreign companies are available by major industry that show manufacturing to account for more than seventy percents of inward flows (MiDA, 2000). Additionally the data suggests that among the largest inward investors to Malaysia from 1991 to 1999 was Japan, which comprised a total of 18% of all investments. Moreover, the manufacturing sector expanded by 3.1% in 2007 and sustained to rise by 6.9% in 2008, providing 32% of Malaysia's gross domestic product (GDP). This is an attractive proposition for MNCs looking for competitive edge since Malaysia offers political and economic stability environment, with sturdy economic fundamentals, pro-business government with liberal investment policies, well-developed infrastructure and harmonious industrial relations, as well as a trainable and educated English-proficient workforce.

Additionally, recent study has focused on MNCs and their subsidiaries, mainly on parent-subsidiary relationships, subsidiary responsibilities and tactics, subsidiary network relationship, and subsidiary resources and capabilities. However, we still have an inadequate understanding of how MNCs manage knowledge transfer since whilst much has been written about the process of transferring Japanese manufacturing techniques, 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.

As this research takes the perspective within the subsidiary in examining how 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 this knowledge into their working practices. The followings sub-sections explain the research context, which are important deliberations in a qualitative study.

3.3.4 Overview of Gambatte Corporation History and Structure

Gambatte is a one of the leading supplier of superior automotive technology, systems and components for major automakers in the world. It operates in 32 countries and regions with more than 112,000 employees who are active in various portions of the automotive business; sales, product generating and design, as well as manufacturing, and "it works in co-operation with regional car manufacturers and suppliers to provide the most suitable solutions to regional requirements with global consolidated sales totalling US $30.6 billion for the fiscal year ending March 31, 2007" ('Gambatte' Annual Report, 2007). For the purpose of this thesis, the company is known as 'Gambatte' to safeguard company confidentiality.

The main head-quarters of Gambatte are situated in Aichi, Japan, about 160 miles west of Tokyo, near the city of Nagoya on the main island of Honshu. Gambatte has been a long-standing collaborator of Toyota in developing both automobile technologies as well as lean manufacturing systems (namely TPS). Initially originated from a well-established and original part of the electrical and electronic sections of Toyota Motor Corporation, the Gambatte Corporation is Japan's leading producer of vehicle components and among the global biggest. As the second-largest member of the Toyota Group, more than half of Gambatte's products go to the Toyota Motor Corporation (TMC), and Gambatte also provides to nearly all major Japanese automakers as well as numerous US manufacturers, including Ford, General Motors, and Chrysler, and major European auto manufacturers such as Volvo, BMW, and Fiat. Gambatte is always regarded as a top-ranked manufacturer of car electronics and electrical parts.

Historically, Gambatte began its operations in 1949 after autonomously divided from Toyota with a diverse business strategy catering for Toyota and other car manufacturers. The company was awarded the Deming Prize in 1961 because of its quality control systems and began to have a global presence in the 1970s. Since then it has continued to grow in size and range of operations. In 1996, Gambatte received the ISO 14001 certification, an international standard of environmental management systems and in 2002, achieved its goal of zero emissions in all its 14 operations in Japan ('Gambatte' Annual Report, 2007)

Gambatte's management principles are focused on the provision of customer satisfaction through quality merchandises and services, worldwide growth through expectation of changes, environmental conservation and harmony with people, corporate vitality and respect for individualism. Each Gambatte associate (employee) is inculcated with the Gambatte spirit so as to be creative in thinking, balanced in action, co-operative, pioneering, and responsible through constant self-improvement.

Gambatte has its very own vision 2015 that aims for "consideration" and "fulfilment" in achieving the cultivation of foresight, credibility, and collaboration in promoting the globalisation of management, human resources, R&D, and *mono-zukuri* (making things) in order to become a well-respected company in the world.

3.3.5 Gambatte Malaysia

As a leading manufacturer of advanced automotive technology, systems and components for all the world's major automakers, Gambatte Malaysia was established in 1980 and since then it has become the largest automotive components manufacturer in Malaysia today, and a major automotive components supplier to the Malaysian national car projects as well as for Japanese cars built in Malaysia ('Gambatte', 2008). Gambatte began to invest in Malaysia during the manufacturing era in the industrialisation period of 1980s, under the leadership of Prime Minister Mahathir.

Situated in the richest state of Malaysia, Selangor, Gambatte (M) is located in Bangi Industrial Park, a high-tech industrialised area about 45 minutes drive from the capital city of Malaysia, Kuala Lumpur. Gambatte Malaysia strives to become a manufacturer of innovative components that is eager to go ahead of all prospects, while keeping in line with product functionality and high quality ('Gambatte', 2008).

By taking into account the environment in which its products will be used, Gambatte is able to provide the worldwide market with supreme components for every appliance such as car air-conditioners, radiators and engine electrical control units, with emphasis placed on technical improvement, quality control and environmental preservation.

These consistent efforts joined with a conscientious mindset, bear testimony to Gambatte's ideals which are uncompromised product quality, watchful conservation of the environment and keen concentration to customer satisfaction. Furthermore, the company has constantly made its key moves based on continuous anticipation of future development. This is accomplished by placing trust in its associates (employees), welcoming advice from the customers, and constantly seeking to provide products that fulfill and surpass the customers' needs and expectations.

Directly associated with quality, Gambatte continuously chooses and implements improvement hard works that have the maximum impact on the key business plans and goals and this is done by always focusing on achieving high quality and productivity, by optimising product design, reducing waste, reducing product development and production lead time, and implementing continual improvement in the manufacturing process

Gambatte Malaysia has always taken inventive actions in front of time. It is among the first in the Gambatte Group of Companies that has been awarded the prestigious ISO/TS 16949 by the SIRIM and "International Automotive Task Force (IATF)", a body that embodies car-makers and suppliers worldwide. Additionally, the company is certified in the ISO 14001 Environmental Management System which recognises the company's commitment and effort in maintaining the environment.

In brief, the time-line of the success of Gambatte Malaysia as follows:

1980 – Establishment of Gambatte, firstly known as NipponGambatte

1983 – Start of production (supply mainly to Toyota Malaysia and others)

1987 – Start supply to Proton (Malaysian National Car developer)

1987 – Start of exports

1992 – Completion of Automotive Plant (also in Bangi – next to the initial plant)

1994 – Start supply to Perodua (Malaysian 2nd National Car developer)

1994 – ISO 9002 Certification from SIRIM

1996 – Completion of Electronics Plant (also in Bangi – next to the current plants)

1996 – Changed corporate name to "Gambatte" Malaysia

2000 – ISO 14001 Certification from SIRIM

2003 – ISO / TS 16949 Certification from SIRIM

2004 – G9 Manufacturing Summit

2006 – Gambatte Group President Award

2006 – Achieved Zero Emission

2007 – Appointed as TPS Model Company by MAJAICO

2007 – Environment Award from Selangor Government

2007 – Quality Management Award from MITI

2008 – ISO 9001:2000 Certification from SIRIM

2008 – OHSAS 18001/MS 1722 Certification from SIRIM

2009 – Prime Minister Hibiscus Award and Challenge Trophy

Figure 3.1: History of Gambatte Malaysia (2010)

With more than 1,300 associates (employees) and several on-going projects, the company provided an excellent case study opportunity for the researcher, who was granted direct access to its premises and to three main projects related to the main manufacturing practices namely Toyota Production System (TPS), Total Productive Maintainence (TPM) and TS 16949. Gambatte Malaysia represents a very suitable research context because of the availability of various projects that are on-going across the plant.

Moreover, the researcher's close contact with the gatekeeper and the approval to research within the work site, facilitate some detailed observation of the activities within the projects.

The researcher was granted to observe and conduct research including interviews and observations in the plant. The layout of Gambatte Malaysia plant as follows:

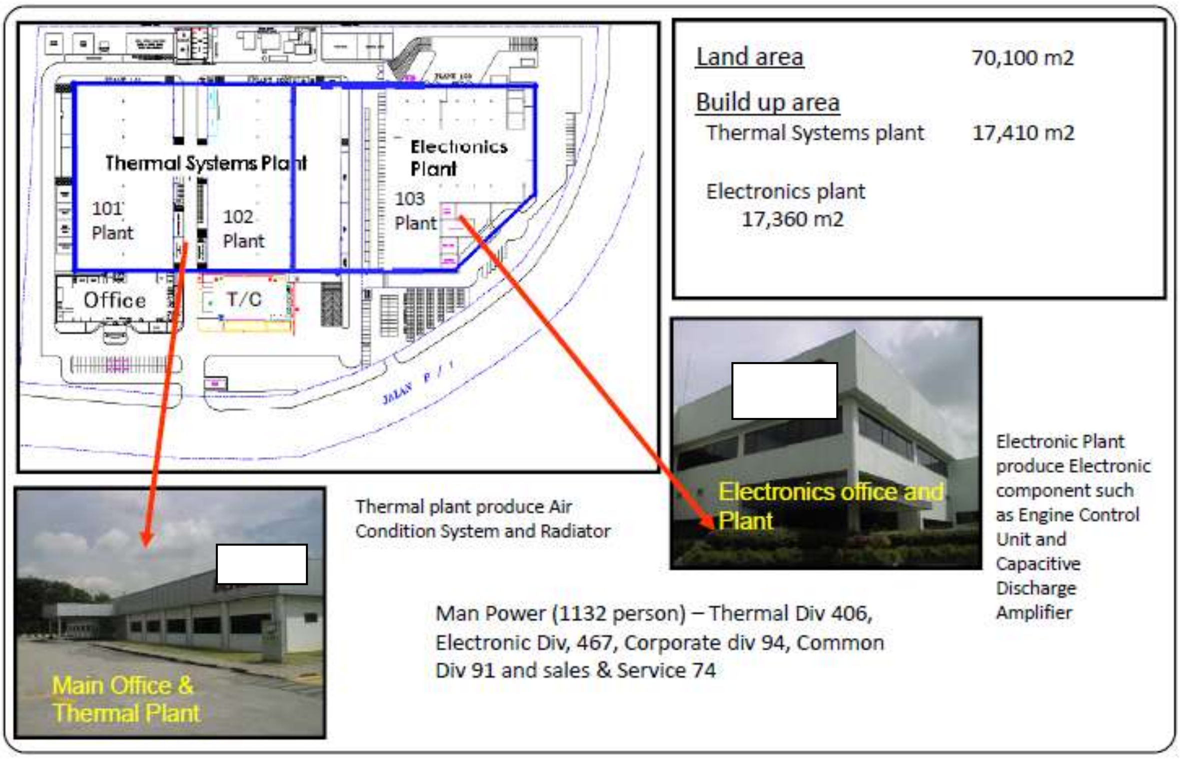

Figure 3.2: Plant Layout of Gambatte Malaysia.

Basically there are three plants integrated in the whole complex of Gambatte Malaysia; namely Plant 101, 102 and 103. Plant 101 are allocated for Thermal System which produced main parts of air-conditioning system and radiator for automotive, while Plant 103 is specified for manufacture of electronic automotive related products.

Some of the photos detailing the place are shown below:

Figure 3.3: Gambatte Malaysia from Bangi Interchange

Figure 3.4: The Researcher arriving at Gambatte Malaysia.

As the plant facilities are highly confidential area, access is quite limited. Most of the photos inside the production plant are taken with the help of Quality Director, who is also the gatekeeper for the researcher in using the company as the study's setting. Below is the researcher with the gatekeeper, The Quality Director, Mr.Nasser

Figure 3.5: The Researcher with the Quality Director, Mr Nasser.

Figure 3.6: The Researcher at the lobby near entrance point of the plant.

3.3.5.1 Gambatte TPS (Toyota Production System) Project

The history of Gambatte TPS goes back to 1973 at Gambatte Japan – the head-quarters of Gambatte Corporation. The system was originated from Kaizen Activity instructed by the Toyota Motor Corporation, which designed this TPS system, and hence its name - Toyota Production System (TPS). Since then, TPS has become a worldwide recognisable established manufacturing standard especially in the automotive sector.

However, Gambatte, as a world leading automotive supplier, initially having Toyota as its main customer (since the 1970s), developed its own TPS system for use with its products and manufacturing processes. Therefore, starting from Japan, Gambatte spread this TPS worldwide to its subsidiaries and in 1996, with the direction to achieve 'Efficient Factory' in the overseas operation including Gambatte Malaysia, the system was implemented in Malaysia.

After having long processes and tough time, Gambatte Malaysia and their customers are enjoying effective and satisfactory processes through small lot production and frequent delivery to customers. The efficiency of Gambatte TPS was acknowledged in 2007, when Gambatte Malaysia gained the prestigious award of TPS Model Company by 'Malaysia Japan Automotive Industries Co-operation' (MAJAICO).

The Toyota Production System (TPS) combines management philosophy and practices to form an incorporated socio-technical system at Toyota which originally called as "Just In Time Production," and created by founder of Toyota, Sakichi Toyoda, his son Kiichiro Toyoda, and the engineer Taiichi Ohno. Initially way back before it, these founders of Toyota abstracted the idea from studying manufacturing systems at Ford Motor Company and visiting manufacturing facilities in the US.

The main goals of the TPS are to get rid of overburden, inconsistencies and eliminate waste. These three are called *muri, mura* and *muda* in Japanese terms. In TPS there are 7 kinds of *muda* which need to be eliminated; that are over-production, motion or moving (of operator or machine), waiting time (of operator or machine), conveyance (in belts or machines), the processing itself, inventory of raw material, and the need for correction including rework and scrap. This has become the important approach for TPS. TPS is sometimes highly associated with lean manufacturing as both seem to share some similar concepts such as pull processing, perfect first-time quality, waste minimization, continuous improvement, elasticity and flexibility, building and maintaining relationship with suppliers, autonomation, load levelling and production flow and visual control.

3.3.5.2 Gambatte TPM (Total Productive Maintenance) Project

TPM stands for Total Productive Maintenance. The history of Gambatte's TPM Project goes back 40 years to Gambatte Japan - the head-quarters of the Gambatte Corporation. In Gambatte Malaysia, TPM involves the management of machines, how machines are kept and maintained in general. It emphasises how to improve machine maintenance, and how to enhance machine knowledge, both of which involve education and training.

TPM in Gambatte Malaysia involves the implementation and co-ordination of all these activities providing a unique focus on maintenance management including autonomous maintenance by the operators. It is a proactive approach that essentially aims to prevent any kind of slack before it occurs. This technique was introduced in 1950s where Gambatte in its head-quarters, often required maintenance help for its highly automatic machines. Thus the management came up with the idea that the operators themselves have some kind of responsibilities to look after the machines.

The main five goals of TPM are; maximizing apparatus effectiveness, developing a system of productive protection for the life of the apparatus or equipment, involving all departments that plan, design, apply, or uphold equipment towards implementing TPM, actively involve with all employees, and promoting TPM through motivational management.

3.3.5.3 Gambatte TS16949 Project

TS16949 is a new international quality system, tailored for automobile productions, which replaced earlier systems including QS9000 and ISO9002, which were previously implemented by Gambatte. TS16949 is an ISO technical specification aiming to the development of a quality management system towards continual improvement that emphasizes defect prevention and the reduction waste in manufacturing throughout the supply chain. It is based on the previous ISO 9001 and the first edition was published in March 2002 as ISO/TS 16949:2002. ISO/TS 16949 was developed by the International Automotive Task Force (IATF), in cooperation with the International Standards Organisation (ISO). The aim of this standard is to provide harmonised quality systems within the automotive supply chain, resulting in a focused and consistent approach.

A key requirement of ISO / TS 16949:2009 is the fulfilment of customer-specific requirements which set up by the automobile manufacturer on top of the quality management system of their suppliers and this decisively have contributed to the worldwide recognition of the TS by many manufacturers. To contrast, QS-9000 and TS 16949:1999 require a documented process for measuring customer satisfaction which includes the documentation of trends of data. But additionally, TS 16949:2002 specifies that companies should determine a method for monitoring customer perception as to whether requirements have been met, evaluate data continuously, demonstrate compliance with customer requirements and efficiency of process. Furthermore, QS-9000 makes no reference to employee motivation whilst TS 16949:1999 requires that companies develop a process for the measurement of employee satisfaction.

It applies to the design development, production as well as when relevant, installation and servicing of automotive-related products. For Gambatte Malaysia, obtaining the ISO/TS 16949 certifications represents a significant prospect for standardisation and enhancement of its manufacturing facilities and product development.

3.3.6 In-depth Interview

A research interview is based on the conversation of daily life and is a professional conversation, in contrast to a conversation which is a basic mode of human interaction. In a research setting, a semi-structured life world interview is an interview whose purpose is to capture images of the life world of the interviewee with respect to understanding the meaning of the described phenomena (Kvale, 1997). A research interview goes beyond the spontaneous switch over of views as in daily dialogue, and becomes a careful inquiring and listening approach with the purpose of attaining thoroughly tested knowledge (Kvale, 1997).

Information about social worlds is achievable through in-depth interviewing, which provides a way of creating empirical data of the social world by enquiring people to talk about their lives. In this respect, interviews are exceptional forms of dialogue. While these dialogues may vary from semi-formal guided conversations and free-flowing informational exchanges, all interviews are interactional. The narratives that are shaped may be as condensed as forced-choice survey response or as complex as oral life accounts, but are all assembled as a product of the talk between interview participants (Silverman, 1997). Basically, if the interviewer asks questions properly, the respondent will give out the desired information.

In this research, 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, Gambatte Corporation, involving three main manufacturing initiatives (or philosophies), namely 'TPS' (Toyota Production System), 'TPM' (Total Productive Maintenance) and 'TS' (TS16949). The case data were derived from 52 in-depth interviews with project members, moderate-participant observations, and analysis of company documents. The 52 interviews came from 4 key personnel including the gatekeeper, and supported by other project team members. The interviews were conducted in February through April 2006 and were followed up by cross validation of the multiple sources of data and follow-up contacts, through email communications and phone conversations, with the respondents, when necessary.

Initial steps were taken to get access to the three case projects before the interviews were conducted. These include communicating with the gatekeeper and conducting a pilot interview with three team members in the projects, as a part of the procedure to refine the interview questions.

The whole data comprises 52 interviews of 60-90 minutes each, observation data on 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 gathering was time consuming, which included a series of followup e-mails and telephone conversations. The interview and observation 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, as well as from the observations notes.

To further elaborate the understanding of the knowledge transfer processes and to get the overall picture of the situations, sixteen (16) episodes provided detailing the knowledge transfer phenomena in the actual setting.

Data collection and analysis are intermingled in qualitative research. Once coding was finished, the codes that had common essentials were combined to form categories and the coded sections of data were located in these categories. The categorised data were then printed and stocked manually in files with the name of every category. The categories derived from each data compilation 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 through iteration with the extent literature, and on some occasions by asking the interviewees for feedback, thus making the thematic analysis much more concrete. The qualitative data were also analysed using a constant-comparative method where the saturated points were achieved through validating the findings in hand by the emergent findings. This process was instrumental in getting the answers to the research questions.

Where events or dialogues had been recorded in more than one of the methods used (for example, in observation and interviews), both transcripts were reviewed together after first coding. Then journal entries were reviewed to confirm if there was any substantiation of extraneous circumstances influencing the researcher's interpretation of events, or impinging on the event being recorded, and to review any other explanations that were apparent at the time.

After a series of pilot interviews were conducted among the first five early transcripts, a detailed refined interview questions were derived and they are presented below:

Questions for the in-depth Interview:

Please tell me about yourself:

Name:
Gender – Age:
Position – Department: Job Descriptions…
Experience: How long have you been working here:
Academic qualification:

(1) Please tell me about your project:
What are the processes involved?
When did it start?
When will it finish or has it finished?
What is it about?
What do you mean by….

(2) On the company and knowledge transfer initiatives:
Could you tell me about the project?
What aspects of knowledge are transferred?
How does the knowledge transferred?

(3) On the knowledge transfer and project:
What is your position/role in this project?
Please elaborate your role / function in the project?

How many people are involved in the project? What are their functions?

How many people are in the Management team? What are their functions?

How many people are in the Implementation team? What are their functions?

(4) How the process process of "knowledge" transfer is done? From TPS, TPM and TS?
Please explain more…

Could you elaborate more on this?
How did you feel at that time about this project?
How do you feel at this time about this project?
How will you feel at future time about this project?
What are the project's achievements so far?

(5) How do you gather the knowledge to implement the project?

If training…how, where, how frequent?
Describe the level of your knowledge about the project?

Please provide examples: do you think you know more now, than before

How is it going? Who knows more

- is it easy to get him/her to help you and others in the team?

What do you mean by…
Could you explain more?
How do you perform the steps in the process?
How do you see your role and others (roles)?
Why did they do that….
What are the examples of these roles
Are the people in the team willing to share knowledge? How does it done?

(6) What approaches of knowledge transfer are utilized?

How is knowledge transferred...

Examples.....

(7) What kind of knowledge is transferred here?

Specific – generic…

Others...

(8) What is the medium of the transfer of knowledge?

Is it more through rich media communication (face-to-face) or any other aided media?
How do these processes take place and what tools are involved?

(9) What is the channel of transmission?

On-job-training / documentation / teaching?
How do these processes take place and what tools are involved?
How can the new knowledge become institutionalized?
What are the process involved? Formal / informal?
Meetings? How do the team members meet? How often? How long – medium?
Trainings? Frequency and how?
Do you think that it is much easier to work with known team member… how well do you know your team members? What is your relationship to them?
How do you describe the teamwork within the project team?

(10) How long does it takes to transfer from one person to another? ...from HQ to Subsidiary?

(11) What circumstances or conditions or situations are involved in the transfer of knowledge?
What circumstances or conditions or situations that make transfer easier or hard?

(12) What factors are involved in the transfer process?
Individual factors?
(Personal)
How frequent do you and your team contacted (informally) one another in a week?
How well do you know your team-members?
How do you describe the relationship with them? The teamwork? If close…. If more experiences…
Have you been involved with the other members in other teams?
(Knowledge)
On the knowledge in yourself?....
Do you think you have knowledge related to the projects beforehand? And do others have it as well?
Eg: have anyone approach you (asking about the projects) / want to know from you?
Where to go, who, when, etc on...
Understanding the new knowledge
Mission, themes, objectives, visions, all team members aware & understand?
Language, jargons.. how the leader / consultant tell about the projects? (story, vocabulary….etc)

Organizational factors?
The office / Gambatte culture / environment?
Teamwork spirit vs individual conflict?

Environmental factors?
Factory environment?
Climatic environment?
Political environment?

Other factors?

(13) What are the problems?
Is there any tension between the eam?

How do you mean by that?
Could you please elaborate more?

(14) What are the effects on the knowledge transfer…
What do you mean…

(15) Could you tell me about your other projects…?
How many times were you for training? ....in house & overseas?
Have you ever worked with any of the team members in any other project?

3.3.7 Observation

A research observation is important and makes it possible to describe what actually goes on, who and what involved as well as when things happen, as well as how and why the particular things and situations take place (Jorgensen, 1989). In this study, observations are based on nine meetings; including formal and ad-hoc meetings, one open seminar, two staff training sessions, seven plant tours, five meals and informal functions.. The findings from the observations are further illustrated in the 16 episodes that are presented based from the data gathered.

The illustrations in term of observations are crucial as they show the places where most knowledge is created, shared and transferred in real life. Thus, the process of knowledge transfer can be clearly observed and understood, enabling the validity and accuracy of presentation of how the knowledge transfer occurs in a real context.

In getting access to Gambatte Malaysia, this study received a great assistance from the gate-keeper. The main gate-keeper is Mr Nasser, the Quality Assurance (Total Plant) Director. Being among the pioneers in Gambatte Malaysia, with more than 28 years experiences in Gambatte Corp, coupled for being a Quality Director himself that could lead towards multiple access in the shop-floors and productions lines in all departments, Mr Nasser was very helpful in lending support to the researcher.

For the full period on the site, the researcher managed to access all situations as described in Chapter Six (the episodes) with great details on top of the 52 interviews that took place in between the period.

Not only that, the process of getting into the site started way before the field-work. Nine months before entering the plant, a series of emails and phone calls were made between the researcher and Mr Nasser to get background information about the company and to decide the best time frame to conduct this study. The period of Feb to May 2006 was selected because during that period, there was the least number of public holidays, and the business and production calendar are most preferable time to conduct the study. As annual business calendar for the company ends in March, a clear progress of the company could be observed and this means that most visits and officers coming on site happens between these times.

The demographic information on the interviewees and observations performed as below:

Table 3.2: Demographic information on interviewees and observations

Case	Position	No of interviews	Job Tenure	Gender	Other events (data) involved
TS	Director / General Mgr	3	20	M	3 meetings, 1 seminar, 1 plant tour
	Manager	3	18	M	
	Executives	5	15	M & F	
	Supervisors	4	12	M	
	Operators	2	8	M & F	
TPM	Director / General Mgr	2	20	M	3 meetings, 1 training, 1 plant tour
	Manager	2	17	M	
	Executives	6	15	M	
	Supervisors	5	12	M & F	
	Operators	2	7	M & F	
TPS	Director / General Mgr	1	20	M	3 meetings, 1 training, 1 plant tour
	Manager	1	16	M	
	Executives	5	12	M & F	
	Supervisors	6	13	M & F	
	Operators	4	9	M & F	
Overall	Managing Director	1	29	M	
	Director / General Mgr	52 interviews	9 meetings including formal and ad-hoc meetings, 1 seminar, 2 trainings, 3 plant tours and 5 meals (+ informal functions). Also related documentations, modules and project materials.		
	Manager				
	Executives				
	Supervisors				
	Operators				

3.2.5 Episodic Approach to Data Presentation

The use of episodes approach in this study is valuable because the technique provides a clear interpretation of the process of the knowledge transfer since the respondents give an account of what actually happens during the process. Expressed in terms of story-telling by the researcher, the episodes are offered in acknowledgement of the known importance of placing stories in organisational research which has become recognised in leadership and management, as well as in the area of medical, psychology and education that would bring out the real life situations into pictures and words (Polkinghorne, 1995; Braun & Clarke, 2006; Juniper, 2006; Denning, 2007; Boydell et al, 2010). Through providing the overall picture of how the knowledge of manufacturing practices is transferred, highlighting the exact reality of the context, the episodic analysis support answering the research objective of finding the 'circumstances' in transferring the knowledge such that it is possible to distinguish between replication and adaptation. The categories are derived inductively from the episodes of the data collected on the Gambatte site via the researcher's exploration of the three projects.

The layout of episodes are fundamental in this study as it illustrates the places, situations, and occurrences where most knowledge is created, shared and transferred in real life. Thus, the process of knowledge transfer can be clearly observed and understood, enabling the presentation to have high validity and originality of how the knowledge transfer occurs in a real context. This represents a novelty feature of this research.

An episode represents the recollection of scenes of the knowledge transfer process captured as it happens according to what and how the knowledge is transferred. Its actual length varies from 15 minutes to one hour accordingly. These episodes are important in gaining an understanding of the process of the knowledge transfer, and they highlight that each process has its uniqueness, as well as show how the subsidiary acquires the knowledge and subsequently incorporates the manufacturing techniques in its daily function.

Each episode consists of the scene, the discussions and a summary. A scene is the core of the episode and this provides details of the action. The discussion then describes a better exploration from the raw data in attempt to answer the research question, while the summary provides a wrap up of the whole episode.

There are altogether 16 selected episodes which should cover all the plants and the philosophies (manufacturing) involved. There are some words (terms) which are referring to specific meaning in the episodes. The word “plant” in the episodes means Gambatte (Malaysia) factory plant. A detailed encounter of the episodes will be elaborated in Chapter Four and Five.

Chapter Four provides the findings of the qualitative data in this study presented in episodic format that includes the raw nature of all 16 episode scenes in context of the situations. The scenes are illustrated in detail and reader friendly to follow. Chapter Five then presents the discussions of the 16 episodes towards deriving the understanding of different approaches of knowledge transfer occurs in context. At the end discussion parts of each episode, a summary of table explaining the activities involved in the episode is provided with the related approaches of knowledge transfer involved. This supplies insights that enable readers to follow the discussion and assist their understanding on the underlying stories, within each episode.

3.2.6 Coding Scheme of Boyatsis

The empirical data gathered in this study are analysed using the Boyatsis thematic analysis approach. Boyatsis (1998) outlines three important stages for developing thematic analysis that includes the importance of (1) deciding on sampling and design issues, (2) developing themes and codes, and (3) validating and using the codes. Within the second stage of developing themes, three different ways to develop a thematic code are emphasized; that are (a) theory driven, (b) prior data or prior research driven, and (c) inductive which is raw data driven.

A theory driven started from a theory and then proceeds into developing of themes and codes that consistent with the theory (Boyatsis, 1998), while inductively driven code consists of five further steps involving (1) reducing the raw information, (2) identifying themes within subsamples, (3) comparing themes across subsamples, (4) creating a code, and (5) determining the reliability of the code (Boyatsis, 1998).

In the step of reducing the raw information, the researcher reads, listens, and watches raw material from the analysis, then paraphrase and summarise each piece of data of information (Boyatsis, 1998). The raw data comes from the transcriptions gathered from the interviews and the episodes observations. Through this process, the researcher is entering the phase of processing the information to form a synopsis.

Next, the process follows with the step of identifying themes within samples; which involves comparing the summaries to determine similarities among the pieces of information within each sub-sample separately, until the themes are identifiably emerged. In creating the code, the process of writing, rewriting, or constructing a set of statements that differentiate the groups, or sub-samples are applied. This set of preliminary themes that must be revisited, reread, and reconstructed is a code (Boyatsis, 1998). A sample of coding extraction and how the themes are emerged are illustrated in the following page:

Table 3.3: Samples of developing code, sub-category, category and themes

Interview	Code	Sub-Categories	Categories	Theme
"…copying at work from what the super-operator and line leader do, and following exactly the tasks in the production line make me understand more about the new manufacturing practices…" [*Sodiqin* - TPS]	Copy at work Follow exactly	Copy	**Mirroring**	**Replication**
"...when any new knowledge come to our production line, one of the easy way to implement it is through following what the line leader do and doing it simultaneously with her. This would even give maximum impact, we just copy what and how our line leader does. This leads to improvement in the productivity and maintenance functions…." [*Abin* - TPM]	Do it together	Together		
"…to ensure that the job finishes effectively, we have to work in the same pattern and to synchronise our actions…." [*May* - TPM]	work synchronise	Together		
"…in order to accomplish the task, we always follow the way our supervisor and line leader are doing it…" [*Shima* - TPS]	Follow leader	Follow		
"…to make the new operators understand the new knowledge of this new system is easy, we just ask them to follow and do what we do…." [*Aileen* - TS]	Follow what we do	Follow		

3.5 Chapter Summary

This chapter discusses the research methodology applied by the researcher in his study. Detailed questions of the interview together with the demographic allocation of the interviewees are also described. This study further deliberates on the use of episodic nature in bringing up the reality observed in which the exact snapshots of the knowledge transfer events are clearly presented with detail elaborations and quotations coupled up with additional interview data. Therefore, this research would unfold the micro perspective of knowledge transfer using qualitative research method that would provide significant contribution in understanding the phenomenon. Explanation of approach to analysis and a sample analysis (figure 4.3) based on Boyatsis close the chapter. Next chapter will illustrate the Episodes in details.

Chapter Four

Episodes of the Cases

4.0 Introduction

This chapter presents the raw qualitative data that are collected in this study in episodic format. The episodes are illustrated in detail and supported by excerpts from related interview transcripts, observations, and snapshots of the actual situations.

As described briefly in Chapter Four, Gambatte (M) has three plants altogether within its site, which are coded as Plant 101, Plant 102 and Plant 103. Therefore, it is wise to present the episodes based on "the plant times across the lines" (ie; the production plant times (X) lines) of the production facilities across the three philosophies of Japanese Manufacturing Initiatives (TPS, TPM and TS); as this presentation will represent a more equally distributed and holistic illustration of the whole case can be achieved throughout the entire episodes.

The presentation of the episodes and its descriptions are also written from the viewpoints of the subjects (the personnel involved). Further interviews are combined with observations to strengthen and enrich data collected from interviews, hence contribute to data reliability and validity.

The layout – the arrangement of the plants and lines are as follows:

Table 4.1: Arrangement of the Plants and Lines across Episodes

Gambatte (M)		**Philosophies / Manufacturing Systems**		
Plant	Lines	TPS	TPM	TS
101	Condenser	Ep 2		
	Evaporator		Ep 8	
	Piping	Ep 3		
	Compressor	Ep 9		Ep 14
	Training Room	Ep 10		
	Maintenance Office		Ep 16	
102	Ventilator & Heater	Ep 11	Ep 5	
	Cooling Unit & Blower			Ep 4
	Radiator			Ep 1
	Meeting Room	Ep 12		
	Maintenance Room		Ep 15	
103	ECU (Engine Control Unit)			Ep 6
	CDI Amplifier		Ep 7	
	AC Amplifier & Controller			Ep 13
Total of Episodes per Manuf Systems		**Six**	**Five**	**Five**

The representation of the episodes is listed below, with the numbers indicating where the episodes are located within the production lines according to Table 4.1.

There are 16 selected episodes that should cover all the plants and the philosophies (manufacturing) involved namely;

Episode 1: Gemba & Abnormalities Treatment
Episode 2: TPS Activity Board
Episode 3: Champion
Episode 4: Super-Operator & Visualisation
Episode 5: Training – theory and practical
Episode 6: Charts with different Colours of Pen
Episode 7: Daily Maintenance and Five Ss
Episode 8: TPM Corner & WWA – “Why Why Analysis”
Episode 9: Kanban Card System
Episode 10: Production Line Simulation
Episode 11: Gambatte Culture of Ownership & TPS Layout in action
Episode 12: Asean Jeshuken
Episode 13: Customer Complaint
Episode 14: Process Control at Production Line
Episode 15: Control of Machine Spare Parts
Episode 16: Preventive Maintenance

4.1 Episodes of Knowledge Transfer in each Cases

An episode represents the recollection of scenes of the knowledge transfer process captured as it happens according to what and how the knowledge is transferred. It could be presented as in the 5-15 minutes snap-shots of a movie or documentary. The actual length of each episode varies from 15 minutes to one hour accordingly. These episodes are important in gaining an understanding of the knowledge transfer process, as well as showing how the subsidiary acquires the knowledge and subsequently incorporates the manufacturing techniques into daily operation. Other related information of knowledge transfer, such as its medium, mechanism, and the roles of the actors involved are also illustrated in each episode.

In this chapter, the main section of the **scene** of the episodes which illustrates the actual incident of each knowledge transfer in details from all 16 episodes are presented here as the gist of raw data (study's findings), from which the conclusions of the study are generated.

4.1.1 The Scene of the Episode

The *Scene* is the highlight of the episode which provides details of 'a part of a process or an action'. It is similar to a 5 to 15 minutes movie trailer except that the details are elaborated in words, rather than visuals.

Each of the "actual situations" in the scenes is 'telecast' to show the detailed contents of the episode illustrated. In order to ensure the storyline of each scene flow eloquently, the sub-contents of the scene are blended together with real actors, shots of situations, and surroundings to provide clear understanding and logical knowledge transfer scenario.

All the 16 scenes of the episodes are presented one after another, and in the next chapter (Chapter Five), the discussions of the episodes are provided.

4.2 Episode Number 1: GEMBA & ABNORMALITIES TREATMENT

In this episode, the following detail are involved:

Location	Radiator Line
Time	a sunny Monday morning, 20th March 2006
Personnel	Siti, Sodiqin, Eddie, Muqarabin, and Fadhil
Machines	Inj.R-04 mould injection – radiator frame moulding machine
Terminologies	Gemba = to deal at the place itself
	Inj.R-04 = Injection Moulding machine for Radiator, machine no 4
	TPS36/06 = Gemba Code for this incident

4.2.1 The Scene of Episode 1

It was a sunny Monday morning. The place was a production line called "Radiator Line", which is one of the production lines in Gambatte Malaysia. Everything seemed to be running smoothly that morning, until *Siti*, a production operator suddenly noticed a series of cracks and tiny chips on the sides of the products coming out from a moulding machine, Inj.R-04. The clock showed 9.33am and the products produced three continuous rejection units, which resulted in the machine having brought to a halt.

Siti claimed:

> "I was running the Inj.R-04 machine just now when I noticed the rejected products apperared with tiny foreign material and following the production procedures for abnormality, after three consecutive rejected units, the machine needed to be stopped" [*Siti*]

Consequently, *Siti* stopped the machine, and instantly informed her supervisor, *Sodiqin* (a production line supervisor), who quickly responded by calling *Eddie* (an engineer from the engineering department), *Fadhil* (the Champion), and *Muqarabbin* (a technical specialist from the maintenance department) to look into this matter promptly. The five of them gathered near the Inj.R-04 machine exactly at 9.44am and a minute later, *Fadhil* mentioned, "Right, we need to make a quick one now. I stated here that this is gemba TPS36/06 held at machine Inj.R-04 Radiator Line". He continued writing up the report during the meeting.

The discussion then took place smoothly and actively. *Siti* was first to mention about her findings of the rejections from the machine output. *Eddie* next checked the details concerning the material used as the source input of the radiator moulding machine Inj.R-04,

> "Right, Siti.., how do we know about the units must be rejected?" [*Muqarabbin*]
> "I followed one of the regulations of the standard operation material produced from this machine which stated that when any foreign material

amalgamated continuously for three consecutive units, we need to stop the production" [*Siti*]

"Siti, how were you able to confirm they are rejected units?" [*Sodiqin*]

"Well, based on my 16 years working experience here and also referring to the visual verification criteria in SOP " [*Siti*]

"Right, *Eddie*, any concern for the rejected product?" [*Sodiqin*]

"It is found that the product material was from batch 04356 and carrying the code number, *PP-x32* which from this info I can follow up with the supplier if necessary" [*Eddie*]

Sodiqin later complimented his subordinate, *Siti* for her quick respond and asked her if anything unusual encounterd by the machine while she was attending it.

"Was there anything odd or abnormal that you found while working when this reject units occurred?" [*Sodiqin*]
"No", [*Siti*]

And then, *Muqarabbin* (a technical specialist) added:
"Siti, I would like you to remember if there was any unusual sound or appearance or any sort of problems that could be noticed from the machine in your perspective (user perspective) as you know this machine best; please try to recall and remember any problems arisen from this machine …" [*Muqarabbin*]

"*Siti* later after giving a second thought;

"Yes, now I can remember…..I believed I heard there was like a "ticking" sound once coming out from the middle part of the machine where tank radiator is assembled…. [*Siti*]

“Are you positive, this middle part area here?” asked *Eddie*, the engineer while pointing at the middle-part of the machine.

“Yes, affirmative” [*Siti*]

All the details were carefully noted by *Fadhil*, the Champion in this report. Later, *Muqarabbin*. *Eddie* and *Fadhil*, with the help of *Sodiqin* and *Siti* looked into the middle part of the Inj.R-04 machine exactly near the place where *Siti* had indicated the ticking sound.

After 3 minutes:

“I think this could be the source of the problem…!” [*Muqarabbin*]

“What is it?” [*Sodiqin*]

“It is an external tiny portion of foreign materials, probably part of the machine stuck at the column, exactly 5 cm away from the location *Siti* mentioned the funny sound she heard coming out from. The waste which was like a leftover piece of the post-moulding foreign material that carries the same colour and texture of the machine output exactly shows that this tiny chip stucked into the machine causing imperfect moulding” [*Muqarabbin*]

“Right, based on our knowledge of this machine and from what we have observed here, this must be the caused of the crisis” [*Eddie*]

“OK, so can we resolve this matter?, and put the machine up and running again?” [*Sodiqin*]

“I would recommend that in today’s problem, we just remove this waste, but for long-term measures, a much more sensitive sensor need to be installed” [*Eddie*]

“Yes, I totally agree with that” [*Muqarabbin*]

Later, the machine was assembled and switched back on, at exactly 10.03, it was functioning again.

Muqarabbin, Eddie and *Sodiqin* examined the first 5 dummy units that came out, and after confirming with *Siti* and concluding that they were all perfectly produced, the Inj.R-04 was up and running again for production. *Fadhil* later summarised:

> "Right, let me sum-up here. This gemba TPS36/06 was successful, we managed to solve this rejected units malfunction of TPSmR-04 machine, specifically regarding the middle part of which we are grateful for the quick and sharp instantaneous problem recognition from *Siti*. We are also very grateful with the prompt response from the engineering, *Eddie*, and the technical department, *Muqarabbin*, and also from the close monitor and authorization of *Sodiqin*. This gemba, again proves that by dealing with the problem at its very source immediately, really benefit us with fast solution that eliminate time consumption while ensuring our productivity rate maintains high. This is very much different from our old practice that needed *Siti* to inform *Sodiqin* about the problem, and with a formal report, then only the other engineering and technical departments would be notified about the matter. Well, this is excellent, and I shall further extend this report copy to our managerial level. Before we dismiss, could everyone please place your signature here, so that we can use this report as a reference and template for any similar incident in the future, thank you." [*Fadhil*]

This ends the scene of Episode 1. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.3 Episode Number 2: TPS ACTIVITY BOARD

In this episode, the following particulars are involved:

Location	Thermal System Plant, Plant 101
Time	Thursday morning, 23rd March 2006
Personnel	Chee, Ikhsan, Fadhil, Latifa
Terminologies	ECU = Engine Control Unit
	TPS Board = TPS activity updates board

4.3.1 The Scene of Episode 2

The clock struck just 15 minutes to 11.00am. All production line employees had returned from their morning tea break-time. This was the time when management personnel would randomly walk around the factory to check the production lines on their way back to their offices.

Chee, a manager from the ECU Line (Engine Control Unit), and *Ikhsan*, a General Manager from the Total Plant Maintenance (Central), took the sidewalk of the 'Thermal Plant' on their way to a meeting at the main office. As part of the Gambatte (M) instructions to all the staff, particularly the managerial ranks, they must possess a clear up-to-date understanding of the TPS initiative fundamentals that are being developed and implemented within the factory plant.

Chee said to *Ikhsan*;

> "Ikhsan, lets look at this board for a while, we still have 15 minutes before our meeting starts" [*Chee*]
>
> "Right, ….good idea, furthermore, we could know more about TPS in this factory plant !" [*Ikhsan*]

While they were looking at the TPS Board, *Fadhil*, the TPS Champion signalled and called an operator named *Latifa*, to explain the TPS development in the Thermal Plant to the two managers.

“Ok, I am *Chee* and this is *Ikhsan*, please could you tell me what is the development of the TPS activity here in this line of the plant, particularly” [*Chee*]

“Welcome to our line, Mr *Chee* and Mr *Ikhsan*, I am *Latifa*, the Line Leader for this Condenser line, of the Thermal Plant and this is *Fadhil*, the TPS Champion. I will explain to both of you, and *Fadhil* will add anything that I might miss out or any questions that I can’t answer” [*Latifa*]

“Sounds good” [*Ikhsan*]

“Right, first of all, this is the TPS Activity Board that portrays the mapping of the activities occupied in this line, and generally the Thermal plant at large; on how we progress and develop the TPS into practice, more specifically, where and what are our milestones in this process”, said the 13 years experienced *Latifa* to both of the managers.

“As you can see, there are several charts, figures and information that surrounds the whole TPS Board. I will describe and explain to you the main important parts so that you would get the general idea and understand the gist of this project” [*Latifa*]

“Right” [*Chee*]

“Ok, now, if you could look at the board…….”[*Latifa*]

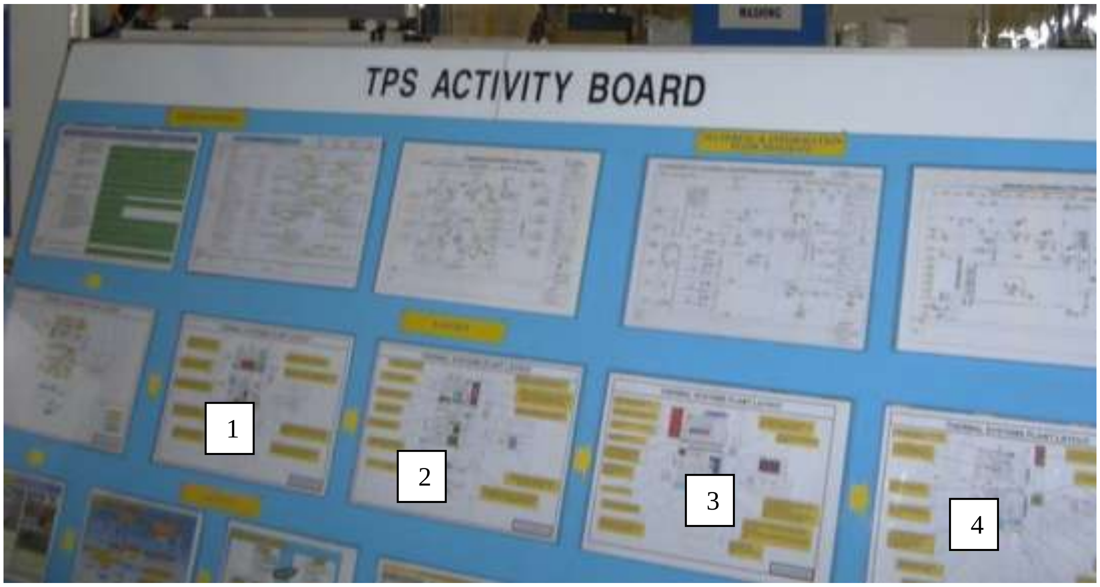

Figure 4.1: TPS Activity Board – Thermal Plant

> "The first upper row of the board shows us what machineries and processes we are using in this line, and each machine and process has its own role to complete the tasks, and on some machines that requires routine and upgrading maintenances. The main component that we can improve is the layout and enhancement of the machinery arrangements, in which the locations of the shoots, stacks and the operator stations (employees)....this relay out and arrangements can be further improved..! In this board there are four diagrams that I will further explain" [*Latifa*] while pointing toward the diagrams mentioned.

Then, *Fadhil* said:

> "As you must have understood, the main objective of TPS is to eliminate waste and minimize any non-value added activities, which even by the difference of a friction minutes or seconds, the initiative to improve this under TPS can always be done. These are the main points that we are doing now, and let us pay attention to what *Latifa* will explain on the four diagrams she referred" [*Fadhil*]

> "Great, please continue Latifa..." [*Ikhsan* and *Chee*]

"Ok, first let's have a look at this first diagram..." [*Latifa*]

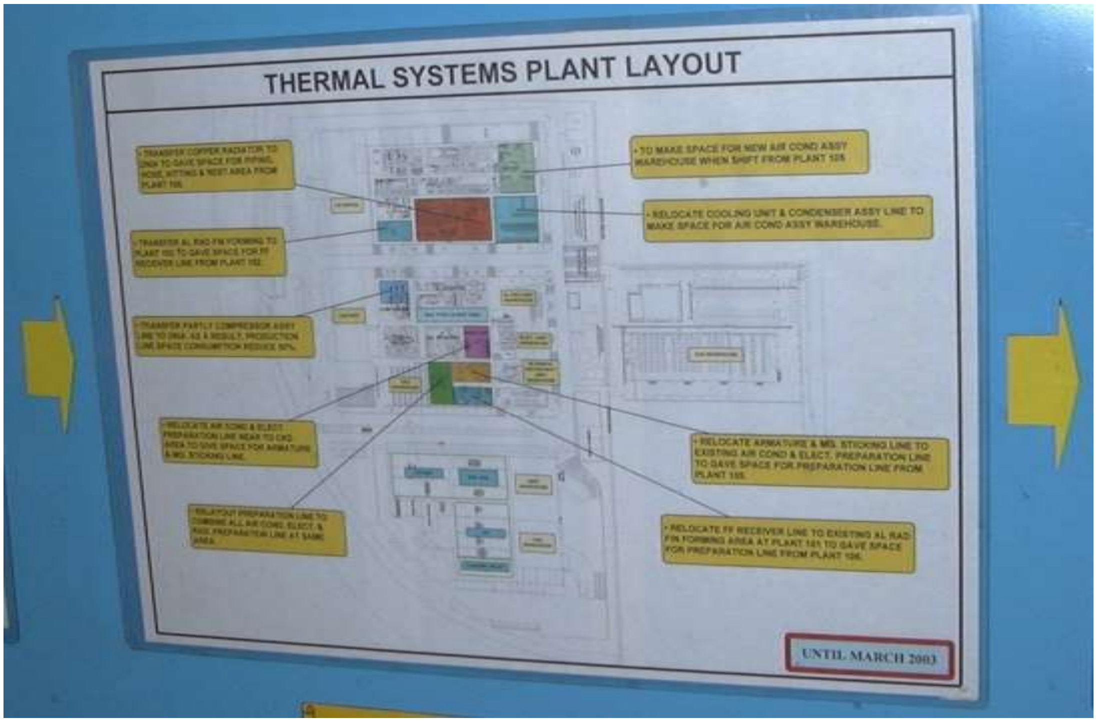

Figure 4.2: Thermal System Plant Layout 1

"This diagram (Figure 4.2) is shows the layout of the thermal plant as in 2003, basically what the plant looks like by March 2003, in which the layout was on what were being there and also the planning that took place in the same year. We can see that there are arrows pointing on some activities being conducted on that year, which we could see the progress or enhancement of activities involving the layouts. As any space we possess must also be countable as cost for the production, thus, from this diagram we can see that a few major relocations and transfer of physical lines took place and relay out is being performed that same year. There was one copper radiator sub-line which was shifted to DNIA (Gambatte Indonesia) as the cost and resources are much cheaper over there, then there was another relocation of a cooling condenser unit to make space for other assembly line such as the air-conditon line, a relay out for preparations in the optimising the stations and number of operators involved in the jobs and tasks, all these are basically managed also to minimise insufficient energy lost, heat and power as these lines are now trying to be arranged according to these minimum savings measures" [*Latifa*]

"As in March 2004, the layout of the Thermal Plant looks like this…" [*Latifa*]

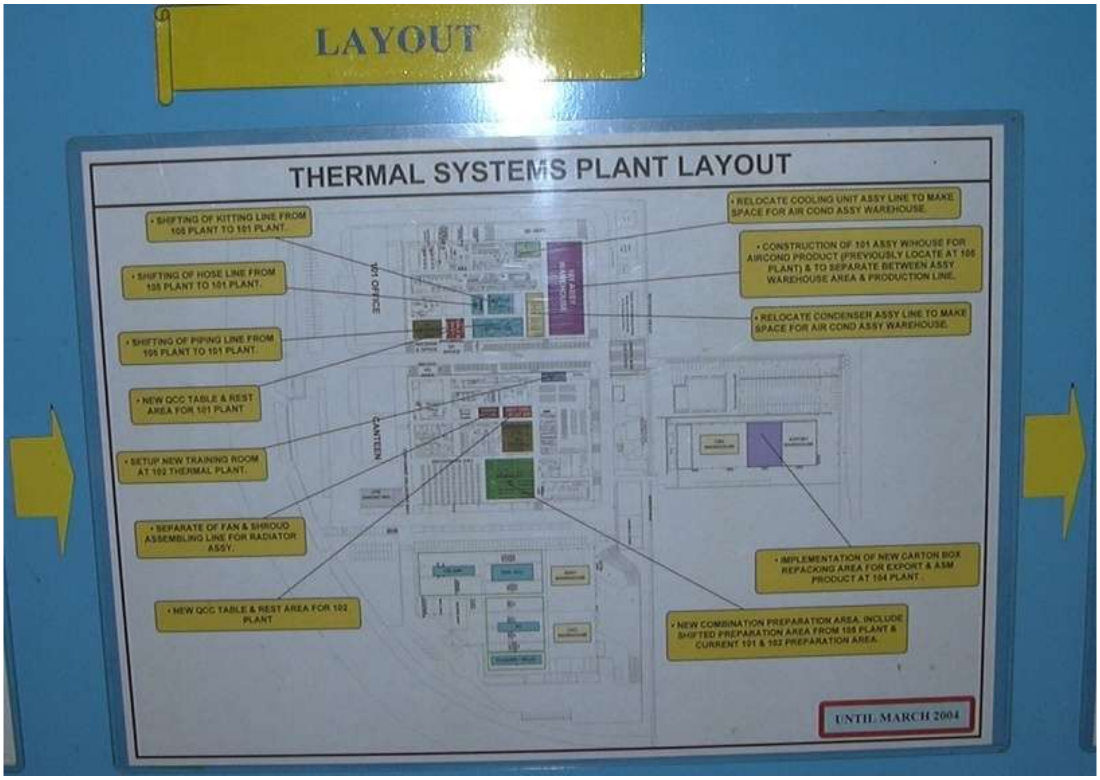

Figure 4.3: Thermal System Plant Layout 2

"This second layout (Figure 4.3) provides us the layout of March 2004 that certain improvements on the thermal plant happened; which involved the combining of Quality Control Inspection (QC) at the end of the line and also an amalgamation of a carton box area for pre-departure outgoing products at the beginning of the stock-pile areas, to ensure both processes become efficient and closer by incorporating the processes together at the production line, and also by the optimum space exercise, therefore even a small unoccupied area was used for short training purposes." [*Latifa*]

"Next, let us have a look at what exercise are organized up till March 2005, there were some major development as well" [*Latifa*]

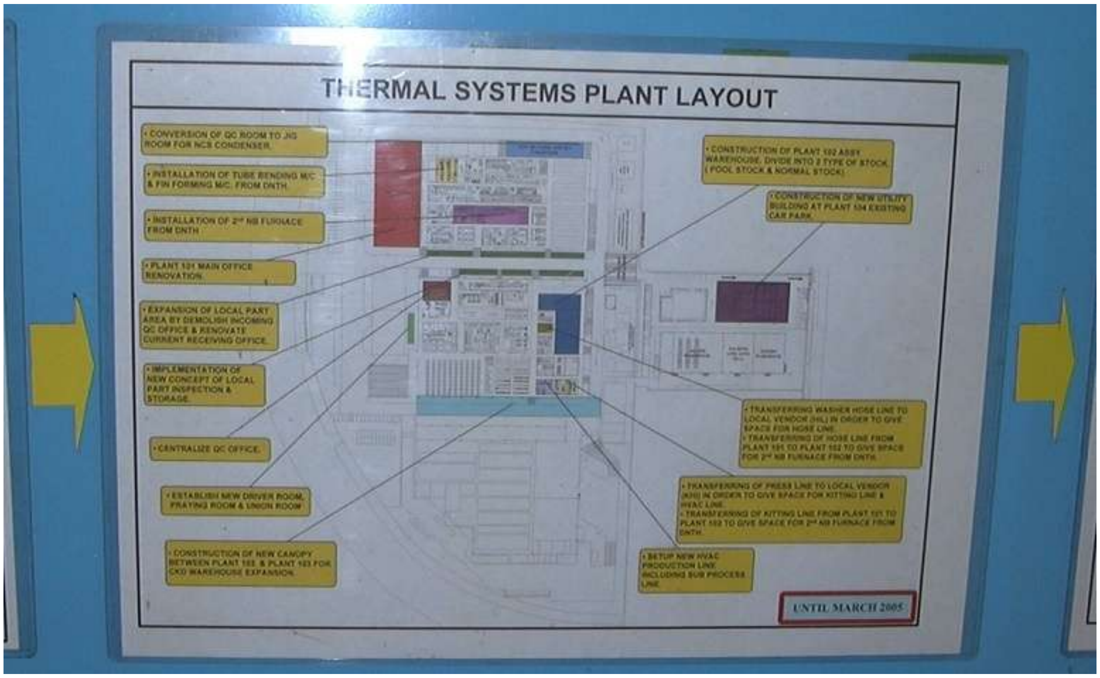

Figure 4.4: Thermal System Plant Layout 3

> "In 2005, a major centralisation of QC Office involve the rebuilt of it due to the space provided from the efficiency of producing minimal waste and optimum machineries and sources. Furthermore, a strict regulation stating not exceed more that 2.5 day stocks also contributed towards more positive results of this relay out plan." [*Latifa*]

Latifa continued to explain the last part of the diagram, which was the current (until March 2006) layout which indicated good results for the time being. It was 5 minutes to 11.00am and Chee and Ikhsan were very happy with the explanations.

> "Right, now let us look at the recent Plant Layout, up until March 2006 of this Thermal Plant" [*Latifa*]

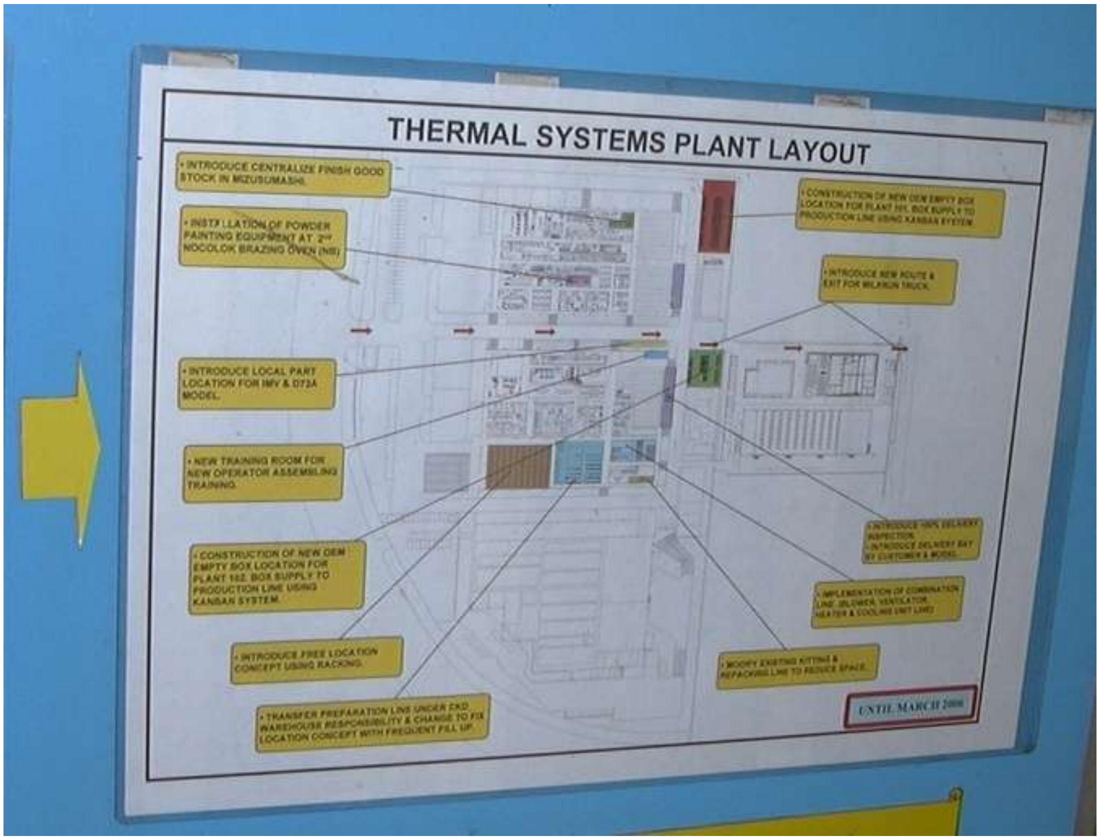

Figure 4.5: Thermal System Plant Layout 4

"We can see here that there has been another major development involved here, which is the introduction of centralised finished good products in *mizusumashi* (an electric three-wheeler scooter) that are ready to be delivered to the logistic points for pick-ups. An introduction of racking and shoots are also included in the major development here, as we have no need to place finished items waiting for *mizusumashi** in boxes. This increases the work efficiency, an average of 25 seconds per finished unit compared to the need for boxing as practiced before. The energy consumption and time previously needed for the packaging operators are also optimally utilised in other value-added tasks, as they are now replaced by *mizusumashi*." [*Latifa*]

"We can also understand what processes are involved and what are the operators doing in their operation line by referring to the layout of this diagram" [*Latifa*]

"All in all, the results here as we can see that is a major improvement of what actually can be achieved in term of the stocks for finished good inventory that was shrinking from 3.5 days from 2002 and till now we managed to have only 2.5 days of inventory....Remember, any stocks kept is like our money being stuck here...so we need to move and make them into profit, right...! Also we have managed to save working areas in which currently we only use 82% of the existing spaces compared to 2002. This will give us more opened space to offer better opportunities in the future, and by implementing the new layouts, we have managed to shorten the lead time of productions from 5.75 days in 2002 to now we have achieved a remarkable 3.4 days, which surpassed our 4 days target. These are really good achievement for us so far" [*Latifa*]

Figure 4.6: Thermal System Plant Layout 5

"And the most significant improvement we have succeeded is the utilization of only 267 operators compared to 540 operators in 2001. Just imagine how much we have saved on this overhead cost" [*Fadhil*]

"Very intriguing indeed….but just a short recommendation for Fadhil, especially, the last remark, if we need to brief the operators, we also may need to add that this is how we can increase their basic minimum pay and also give increments of over-time rates, because we actually intend to share what we have saved from the reduced cost of over-head with the operators…" [*Ikhsan*]

"I believe the operators also would agree to this….is it right, *Latifa*?" [*Fadhil*]

"Yes, we have the same thinking… and that's also another reason we like to give suggestions on the line improvement, because every suggestions will be rewarded in monetary gain…." [*Latifa*]

"OK, many thanks for your time, we need to go now… keep up the good job guys!" [*Ikhsan*]

"Yes, thank you very much, indeed, see you later" [*Chee*]

This ends the scene of Episode 2. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.4 Episode Number 3: CHAMPION

This episode covers a series of interviews and observations during the month of March 2006 with related personnels. The focal interview was conducted with *Fadhil,* the Champion for TPS in the Malaysian Gambatte plant.

Location	Piping Line, Plant 101, which is one of the production lines that covers TPS implementation
Time	Dates of observations and interview sessions = 6,8 and 10 March (Mon, Wed, Fri)
Personnel	Fadhil, Zaidi, Joseph, Zack, Seema, Kumari and Alisya
Terminologies	JIT = Just In Time WFC = Work Flow Chart

4.4.1 The Scene of Episode 3

This happened at the front line of the Piping Line. *Fadhil*, the TPS Champion, was explaining and stressing the importance of complying closely to all the TPS philosophies, and he was particularly emphasising the broadening of take-time (the time taken to produce a unit – literally, the available period or production per customer demand), which happens in all production lines, which is timing inefficient.

After two days of increased and prolonged takt-time, production time increased and *Fadhil,* using his authority as the Champion of the TPS, called for an important short briefing by the side of the Piping Line.

> "Thank you for coming to this short briefing", started the TPS Champion, *Fadhil*.
>
> "Sorry, I had just finished another meeting and came here quickly", said *Zack*, the product engineer of plant 101. He looked as if he was short of breath, possibly due to walking quickly to this meeting.

"Right, as we are all here, along the three operators whom just came back from their break, I would like to express again my appreciation, especially to *Joseph*, *Zaidi* and *Zack*, as they have spared some of their time to drop by, with the short notice", started Fadhil.

"Also I wish to thank *Seema*, *Kumari* and *Alisya* for coming back from a quick break joining us right now". And the three operators smiled and nodded their heads.

"Right, I call this briefing under my capacity of the TPS Champion, and as you all know that I always monitor our production rate, yield and quality with great details", started *Fadhil*.

"I just noticed from last week's production data, that this piping line has increased slightly in the figure of takt-tine, and this lead to lower production yield. The figure became more alarming since yesterday as it dropped quite significantly compared to the day before. Although we managed to meet the demands from our customers all this while, I need to stress that among the main principle of TPS we all upholding now is to minimize waste, and achieve efficiency in productivity." [*Fadhil*]

Further *Fadhil* added;

"Therefore I wish to have all your attention that we must be aware that this increasing of takt-time is actually an element of waste or *mouda*, and with that we are facing difficulty to achieve *kaizen* (is the continuous improvement and efficiency build-up in productivity)".

"Well, *Fadhil*, as a champion, what can you suggest to solve this problem in our piping line?", asked *Joseph*. "Right, especially from the insights that you have collected from your previous Japanese trainings", said *Zack*.

"We must have a continuous awareness on the importance of this TPS. We need to uphold, practise and implement it thoroughly. Increased takt-time means increased waste, thus lowering productivity.", *Fadhil* added..

"To make us embrace the importance and understand TPS, it has to become apart of our working culture, right. Yes, that is the way it should be. This is what I was trained in Japan, and this understanding, feeling and attitude needed to always be cultivated in our hearts", added *Fadhil*.

"As for the JIT here as we understood, our aim is to make the lot size (size of customer order) as smaller as possible up to 1 unit per lot as we have targeted". [*Fadhil*]

"That's why upon starting TPS here, I started recruiting and developing the ranking positions of super-operators, which refers to an operator that can run multiple machines and multi-task as well…just like we have *Seema* and *Alisya* here in this piping line"[*Fadhil*]

Seema and *Alisya* smiled upon hearing their names mentioned. They continued to listen attentively.

"Therefore, please update me on any progress, not just positive production yields, but also any updates on the abnormalities of the production qualities and speed", said *Fadhil*.

"It is very important that any signs of malfunctioning must be tackled in their early stage, not to wait until they are alarming" said *Fadhil*.

"I am responsible for this TPS. Please help me to help you, and all of us; but most importantly help Gambatte and our customers. As you all may know I am also responsible for *gemba*, hence any problems that may need to refer back to the notes of *gemba* series we have, please do not hesitate to call me. And for any new systems to be implemented, please call me for further clarifications. If I am not available, I can be reached via pager. My pager numbers are all written clearly on all TPS Boards. Please page me, and I will call back any caller on the double", *Fadhil* the Champion, further added.

“For all operators, please use our Suggestion Slip system. This is very vital as in TPS here, the machine and line actually belongs to the operators; that is our approach…the ranking of the operators should make them feel superior to their supervisor or manager, thus the implementation of these slots in the board really give the opportunity for the operators to provide feedbacks, suggestions and requests to improve the line,”, reminded *Fadhil.*

“OK, Mr *Fadhil*, we got you”, answered *Seema*, *Kumari* and *Alisya* simultaneously.

“All the slips will be directed straight to me, and I shall always be in contact with your superiors”, continue *Fadhil*.

“Also please let your superiors Mr *Joseph*, Mr *Zaidi* and Mr *Zack* know everything they have to be acquainted with, OK?” [*Fadhil*]

“Yes,” replied the operators again simultaneously.

“I would also like to stress that the success factors for this TPS project is, clear awareness and understanding from all walks of staff levels. As always mentioned by our MD, taking this TPS into our daily practice is like transferring DNA into our blood.” [*Fadhil*]

“Well, that is all for now, the three operators can continue with their production job. I would like *Joseph*, *Zaidi* and *Zack* to stay as we need to discuss further on this takt-time productivity issue. Thank you.”

Later on, *Fadhil* got together with the three key person of the production line to further tackle the increasing takt-time problem.

“I would also like to stress that for this TPS project, we must be ready to transform from one line production into a cell production. With that being

> said, we must be ready to implement the smallest lot of demand production using the cell production format." [*Fadhil*]

Fadhil added more;

> "I wish to inform that this cell production has already been approved by the top managements and I have showed them our cell line production capability." [*Fadhil*]

Again before leaving the line, Fadhil reminded the pillars of TPS to ensure that the operators take them whole-heartedly as he has.

This ends the scene of Episode 3. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.5 Episode Number 4: SUPER-OPERATOR & VISUALISATION

In this episode, the followings are involved:

Location	Cooling Unit and Blower Line (CUB), Plant 101
Time	A close observation on Tuesday, 04 April 2006
Personnel	Suzie, Saras and Fara

4.5.1 The Scene of Episode 4

In any normal shop-floor of any factory, each operator is typically assigned to run one piece of machinery, and a machine that is certified to be run by a particular operator is usually marked with, or has the operator's name on it. Thus, a machine that is being run by a number of operators normally has a list of names attached to it, thereby showing that certain operators are certified and qualified to run it. This works the same across all production lines, and has been enforced in the Gambatte Malaysia production line since the start of its operation. Just like the practice prior to the implementation of multi-skilled operator, one operator is assigned or certified to run the machine, as can be seen from Figure 4.7 below:

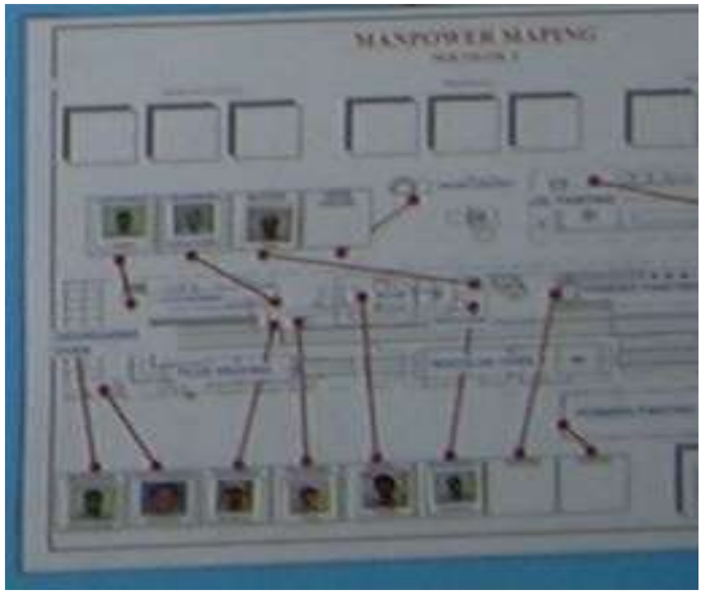

Figure 4.7: Photo showing manpower mapping (operator vs machine)

Using Figure 4.7, *Suzie*, a production operator in CUB explained the previous practice in Gambatte to me, that being each operator would normally be assigned to one specific machine.

> "At that time, if I could go down back my recollections, when I started working here (in Gambatte) in 1993, everybody can only operate one machine. Of course at that time, the machine was also bulky and had to be handled manually, if I could say…." [*Suzie*]
>
> Another operator, *Saras* also gave a feedback with similar points, "Yes, I can still remember when I started work in 1998, well a bit later than *Suzie*, …at that moment, there was 15 of us for the one production line itself. That time I believe there were at least 16 machines along the single production line which I worked, and all 15 of us need to cater and take care of the machines."

> "Maybe *Fara* found a bit different when she joint the company, as she is among the junior here. *Fara*, care to share some input?," asked *Suzie* while smiling to *Fara*, a younger junior production operator.
>
> "Thanks, *Suzie*, ...right, when I started, I remember that during my first day, I was sent to *Saras* line, and at that time, I think the number of operators was only around 9 or 10. That was in 2001. If I am not mistaken, some of the operators have started to operate two machines at that time...."[*Fara*]

As shown by the discussion among the three operators, this way of operation has remained the same during Gambatte Malaysia's early days. However, when TPS and TS are implemented in Gambatte, a change occurred. According to *them (the operators)*:

> " I was first introduced to this TPS, particularly in this CUB Line last year, and prior to joining this line, at that time I have already certified to run two machines, the *Ishi general mould* and *Fujitsu auto cutting* machine. After one year of staying in this line, with the TPS programme, I am now certified with another four machines which certifies me to run six machines at any time. The other machines are *the piping machine, compressor machine, and md1, md2* which both are special moulding and fabrication machines" [*Suzie*]
>
> " For me, I started joining TPS after been selected since last year about the same time with Suzie, and when I joint, initially I just knew how to operate Ishi mould, but now I can manage four other machines as well; ie *the piping machine, compressor machine 1, compressor machine 2* and *the marking machine*." [*Saras*]
>
> " I am a bit more lucky to join this super team, I started with only one machine certified to handle since I am among the youngest and junior in the team, then *Suzie* and *Saras* trained me on the job basis to run the other machines, and now I am certified to run three others.", says [*Fara*] referring to the on job training she has experienced at the CUB line.

> “So, in short, currently, *Suzie* the most senior super-operator here could run a total of six machines, *Saras* five machines and myself four machines,” claimed *Fara* with a smile.

> “…so three of us here are certified super-operators under this project,” further exclaimed *Saras* enthusiastically.

Later on, when discussing how they acquired the knowledge and certification to run the different machines, they said the following:

> “ Here in Gambatte, particularly in the TS system of certifications, we are encouraged to be certified to run as many machines, as possible. The more machines we can run, the better. But this also depends on our capability to absorb the skills, knowledge and also the stress and pressure that we could face. We are encouraged and are arranged to be involved not only with job rotation, but also job enlargement and job enrichment. As you would understand, job rotation is about working on other machine with similar task, job enrichment is managing or understanding the operation of other machines involved in our production line, while job enlargement is far out-reaching to understand and training of other machine operations from the next or neighbouring line” [*Saras*]

> “Yes, and that is very interesting about our line here, not only that we are trained and allocated to different machines so that one day we will be certified to use all of them (job rotation), but also from time to time we are needed to understand the different machines used for moulding processes in our line for instance (job enrichment), and sometimes when the production rate is stagnant, we are ordered to exchange jobs with the next line in order to master different machines and later on be certified on them as well (job enlargement).” [*Suzie*]

When asked how the training and TS certification was conducted, *Fara* answered:

> “Basically, we need to be with our trainer, which is the ‘certified owner’ or the operator that runs a particular machine, and we must learn from her for a total of 40 hours, this 40 hours could be a total of 5 days (shifts) of working or a separation of hours which could be brought into the accumulation totalled to be 40 hours. If the original owner of the machine is satisfied with our training and that he or she has confirmed that we can operate the machine, of course with certain tests, then only we are certified. To be a trainer on the other hand, we first need to be certified and working for a total of 400 hours in a particular machine, and after taking a special practical and theoretical test with some questions asked (on-job test), the operator could then become a certified owner (and/ or trainer) of that particular machine. A total of 4 or more machines that we are entitled to under our name, in which we are certified to run and also later could train others, will entitle the person to be crowned as a “super-operator”! and all these checking will be assisted by the TS system of quality” [Suzie]

Further questions on what are the advantages of being a super-operator;

> “Being a super-operator, not only allows the line to become more flexible to operate, but we can also help in running the production line to become very smooth. For instance, if some of the other operators went to recesses, or involved in ‘gemba’ sessions or other forms of training or even if there is any sudden absentees or inevitable ‘no show’ due to whatever reasons, which means not coming to work situations, we can still operate the machines, and production would progress well with delays. The TS system will ensure that only certified operators are running the allocated machines” [*Saras*]
>
> “Furthermore, being a super-operator, one is entitled for a special remuneration which is the monthly extra allowance pay (for the super-operators) to be payable directly into the monthly salary. This is really a very good incentive for us.” [*Fara*]

When asked which mediums and mechanisms help in the process of knowledge transfer with respect to the new manufacturing practices and in becoming the super-operators, the three of them elaborated as follow:

"All the process happened on the shop-floor, which means that the process of transferring the new knowledge of operating the new machines and how to work the specific jobs with the machines. What I can see here, the important element that really helps is the use of explaination via visualization. ." [*Saras*]

"Yes, everything has to be fast, and our senses must grasp the important elements, while our hands are working at the same time, so visual aids really help in term of assisting the operators to be trained and involved. From this, we can increase our working rate to finish up the tasks. For instance, if we need to look into a certain aspects of operating a machine, the reminders to start up, run and even maintain the machines are all put into labels and visualization that are easily captured by our eyes….And if we have to find and look into the things without any visual aids of certain signs and colours, then our pace will become slow," added *Suzie*.

"…and I can still remember when I was in the process of certification for the fourth machines, sometimes Suzie and Saras would ask and check further at random on the previous machines, ie the three certified machines that I have owned, just to ensure that we are still on track with all the machines we are claimed to be certified..," *Fara* gave account on her experiences.

"….by that only we would dare to call ourselves as super-operators, this title is earned…," reminded *Suzie*, while *Saras* and *Fara* nodded agreeing on that note.

When asked to further elaborate what happened during the certification process;

"….after we are certified with multiple numbers of running machines, and after we have mastered all process and systems, we might be sent to other production line…," explained *Suzie*.

"…meaning here that we are eligible to be seconded to other production lines that are about to launch or practise TPS and TS in their systems…..," added *Saras*.

"..yes, and from there, we could later explain and preach about the TPS and TS systems of work through practicing the elements, and perhaps explaining the TPS board, involved in gemba and so forth. All of these come together along the process…," concluded the most junior among them, *Fara*.

This ends the scene of Episode 4. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.6 Episode Number 5: TRAINING – THEORY & PRACTICAL

This episode took place on a Wednesday at the Ventilator and Heater Line, in Plant 102.

Location	The training room of plant 102, adjacent to Vent & Heater Line that covers TPM implementations.
Time	Wednesday, 15 March 2006
Personnel	Zack and Operators on training
Terminologies	5 senses = the major five senses in human

4.6.1 The Scene of Episode 5

The training sessions are among key events to make sure knowledge is transferred. A classroom venue cum lecture arena or also known as training room in Gambatte Malaysia is normally used to conduct theory sessions, while a training simulation bay for the practical training located beside the classroom is among the key mechanisms of securing knowledge to be entirely transferred as required.

Zack, the trainer who conducted training on that day was ready in the training room of plant 102, adjacent to Vent & Heater Line. The training that day covers philosophy (manufacturing systems) of TPM. A total of eight (8) operators from various production lines attended the half-day training session. The training was scheduled from 2.00pm till 5.30pm.

The researcher has been granted by *Zack* himself to observe the training session from the back seat of the training room, and further appointment to interview were held with him, thus most of the responses here were mostly from *Zack's* behalf, however, the researcher managed to obtain some additional inputs and responses from the attended operators.

The training was divided into two parts, first was the theory session (first half) which consisted of theoretical parts of TPM and later on after a 30 minute tea-break, the training continued covering the practical part (second half) of the TPM implementation. Both halves were 90 minutes session each.

The number of class members (participants) according to *Zack* should be in an optimum figure, within the range participant number of 6 to 12 which is a good optimum number. The 8 participants today include 6 production operators, three of them are from Ventilator and Heater Line One and Two respectively, a Technical Assistance from the Maintenance Department and Machine Tooling, and a Quality Control Operator/Tester from the QC Department.

The researcher positioned himself at the last seat of the training room and let *Zack* started the training session. As observed form the back, *Zack* shared leisure stories to catch the attention of participants, and it was noticeable that Zack also possess adequate 'humour skills' to break the ice among the participants. His method got full attention from the operators (participants). This initial process continued for 5 minutes.

Next, he started the theoretical session by giving a sheet of pre-training quiz regarding "what do we understand of TPM". Most of the questions are straight forward and leading towards asking the meaning and elements of TPM. The quiz was to be answered individually based on current understanding of the participants. This 10 minutes quiz really made them put their thinking hats on. Some participants answered confidently while others grinned at the question paper.

Zack then continued with the main materials explaining TPM, the TPM concepts and pillars, its elements and how to put them into practice in the production line. From time to time, he had to control the situation, and made sure that he could grab the attention from the operators, by providing the appropriate samples and examples highly related to them.

He further explained that the ultimate purpose of that training is for the participants to be able to develop skills of using their 5 senses effectively. Thus what *Zack* was doing involved transferring knowledge which involved developing the skills among the participants.

A good explanation of how to make one realise the condition of the machine before further inspecting is by using their 5 senses:

> "…to understand and get the essence understanding of TPM, one need to always use the 5 senses in their daily work, especially near their machines," added *Zack*
>
> "We need to use our sights to see the problems, be it physical defect of any parts of a machine or any chip from the part of our workstation that looks out of place…," explained the smiling face *Zack*.
>
> "We also need to use our sense of smell to sniff for any abnormal smell on the parts (of the machines), such as oil burning that could be caused by any circuits breaks further leading towards much danger effects…," added the round-face trainer.

> “…and we also have to use our hearing to listen and detect any weird sound coming from the machine that might indicate some parts not tighten up properly…,” further *Zack*.

> “…and in term of touching, we must be able to feel, touch and recognise different machine and parts surface types, be it smooth, soar or uneven and oily and so forth…,” added him.

> “..we could not taste our machines with our taste bud, but we must always be close with our machines as if we own them, and that we must take great care of them, and know what is wrong with them just from our basic sense…,” said *Zack*.

And *Zack* concluded the series of examples using the following analogy:

> “….right, just like we can remember easily, for instance when we cook our meals at home, our nose could catch the smell of the food being cooked, also are able to catch any foul smell of overcooked meal and bad smell if there is. Our eyes could see the color change of the meal we are preparing so that we would pick them up from the pot before it turned brown and black. Our ears are ready to pick and soak up any fried fish or chicken when the sizzling sound of frying oil becoming less audible. Lastly our mouth and lips would be able to taste the delicacy of the food while our hand, whether it is bare hand or by spoon and fork will know the tenderness of the meal that we have prepared…..,” concluded *Zack*.

Below (Figure 4.8) is a picture that showed the training session in session which the researcher had an opportunity to observe, Zack (standing up front) is the trainer who conducted the training session. The first photo is captured during the training session. The upper part of the first photo was the first-half (theory) session while the lower part was the second-half (practical) session:

Figure 4.8: Training session in TPM

While the second picture (Figure 4.9 below) is captured from the training room simulation apparatus, which showed how training for stimulating different senses were conducted in the training:

Figure 4.9: Simulation Machines in TPM Training

This ends the scene of Episode 5. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.7 Episode Number 6: CHARTS WITH DIFFERENT COLOURS OF PEN

In this episode, the followings details are involved:

Location	ECU Line, one of the production lines in Plant 103
Time	Thursday 13 April 2006
Personnel	Sally, Asma and Lee
Terminologies	ECU = Engine Control Unit
	ICAR = Internal Corrective Action Request
	QC = Quality Control
	QC Gate = Place where the inspection of product by the QC took place
	WIP = Work In Progress

4.7.1 The Scene of Episode 6

Sally was working at her machine at the ECU line in Plant 103. Suddenly her production supervisor, *Asma* called her saying that *Lee*, their section head would like to see both of them.

> "Hello *Sally*, *Asma*," greeted *Lee* "I wanted to see both of you as we have just received an ICAR from the QC."
>
> "An ICAR? On what reason, *Lee*?" replied *Asma*.
>
> "It says that the charts contain inconsistent colour in the markings of the charts entries and that the production of the finished units are doubtfully and suspiciously could be missmatched based on the mixed info from the charts." Said *Lee*.

Asma quickly glance through the ICAR. ICAR is 'Internal Corrective Action Request' which is normally issued by the QC (quality control) for any near-reject, rejected, and wrongly produced products based on the criteria and procedures fixed by the standards.

> "Right, let me have a look at the ICAR report *Lee*, ….here is the report, according to the corrective request, the machine from which the chart came out was ran by *Sally*, ….*Sally*, do you have something to say?" asked *Asma*.
>
> "Well, I could not remember which day was it, but yes, I am sorry that possibly I have just used blue and red coloured ink on one of the days this week, most probably on this day that this ICAR was given, as the green colour pen that day has some problem with its ink," mentioned *Sally*.
>
> "So, that is the problem then, we have found its source. Now, please always remember that it is very important to follow the colour coding of the charts. Remember, green marker means "Passed through our area

and sent for checking (QC)", blue marker means the product need to further refine on some aspects of the products, while red marker means the product need to undergo major improvement of the product, according to the specs," emphasised *Lee*.

Asma and *Sally* nodded as *Lee* continued to explain. Their production line very seldom receives ICAR notification. They really are concern on the mistakes and brainstorm on how to answer the ICAR as the notification must be answered and the corresponding corrective measure must be under taken.

"However, as this ICAR notification must to be responded, I am giving your team, ….from now till tomorrow to answer and give a good suggestion on how to improve the problem, OK?," said *Lee*.

Then *Lee* left *Asma* and *Sally* alone so that they could quickly consulted each other on this issue.

"…We need to think what are the corrective measures that we have to take…," said *Asma*.

"I am terribly sorry, it must be my fault…," *Sally* was trembling and her voice was shaking.

"Look, there is no use to remember pass mistakes. We need to overcome it, solve it and move on….," consorted *Asma* realistically. "I know that early this week we faced very heavy demands and high WIP in our line, that could be the case…", added *Asma*.

" Yes indeed, that day the green colour pen on my machine suddenly ran out of ink, and some of my line production colleagues were on their break time, so I wrote first with the blue ink pen, thinking that after my break, I would change the chart paper and replace it with a fresh new sheet and that I would collect a green pen from the stationery room and rewrite them again into the fresh new sheet…." *Sally* started explaining the situation.

"…..Yes….. the WIP was very high that day. I must have forgotten to change the new chart and we continued with the new WIP. Later on, when the QC inspect the products, there is only one sheet of chart available which was the one without green ink, and that's how the chart reached QC….," further explained *Sally* almost in sad tone.

Then, *Asma* quickly took the ICAR form and start thinking how to answer it:

"So we know that when the pen is out of ink, we must get a new one from the stationery room, and that the green ink must be the earliest in term of running out of ink compared to the blue and red pen because it is used most frequently and most of the products should pass, right?….," stated *Asma*.

"What do you think *Sally*?, " asked *Asma*

"…taking from that point into consideration, why don't we provide more green pens and reduce the blue and red pens less? Could we do that…?" replied *Sally*.

"…and why not we attach the whole three pens together, then?", added *Asma* smiling.

"So, we could suggest that the green one is longer, which must have more ink, while blue and red pens should be shorter, is that a good suggestion…?", asked *Sally*.

"But I think we could not use the kind of pen that we have now, which is the multiple coloured ink in one pen, ….since it takes time to change colours and that like we have agreed,, when the green colour ink finish first we need to throw them all as it come in a multi-coloured single pen…", explained *Asma*.

Sally took some time thinking and then said:

"Let us go back to the basic. Why not we use the regular individual blue, red and green coloured pens. We put them together and tie them with a rubber-band and hang them beside the charts by the machine….how about that?" [*Sally*]

"That is brilliant…!", added *Asma*, "and we make one end of the pen to have red inked pen while the other end is blue so that when we tie them in that such a way, when we use the green ink pen for instance, we will not mistakenly be using the blue and red ink because they are on the opposite sides…" [*Asma*]

"..and we will not lose any pens again as they will be tied together. If the green ink pen finishes, we just replace it with a new one and tie them together again," added *Sally*.

"And why not we even have some extra green pens near our machines, so that we could quickly change them ….." [*Sally*]

"That is a very good suggestion……Let us put all these answers and suggestions in this ICAR form then," said *Asma* finishing the conversation.

Then, *Asma* and *Sally* wrote down the ICAR answer and put them into words to be signed and checked by *Lee* before sending back the form to the QC Department. They should implement the new adjustments in the next day.

Typical examples of colour coded charts in Gambatte as follows (Figure 4.10 - 4.12):

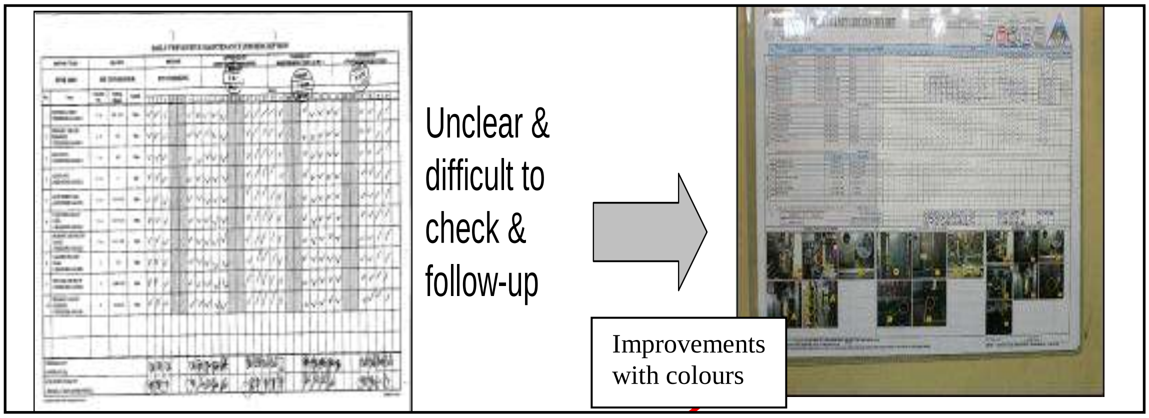

Figure 4.10: Charts in Gambatte Production Line

Figure 4.11: Chart in Gambatte Production Line with the Colours used

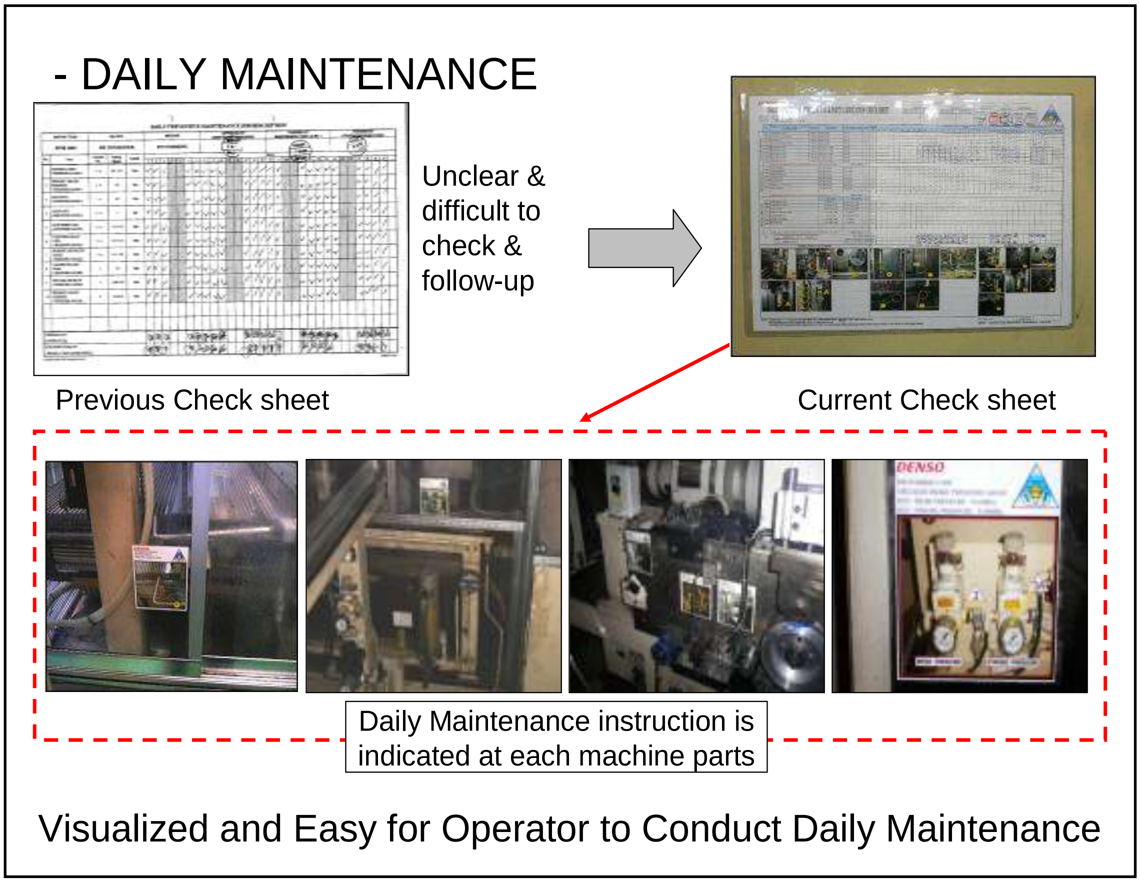

Figure 4.12: Chart in Gambatte Production Line with the visualization

This ends the scene of Episode 6. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.8 Episode Number 7: DAILY MAINTENANCE & FIVE Ss

This practice took place at 4.30pm, daily. The researcher managed to observe this episode closely on Tuesday, 18 April 2006

Location	CDI Amplifier Line, which is one of the production lines that covers TPM implementation
Time	4.30pm, Tuesday, 18 April 2006
Personnel	Neeta, Aisya, Lisa, and Lan
Terminologies	CDI = 'Capacitor Discharge Ignition'
	5S = 1) Seiri = Sort
	2) Seiton = Set in Order
	3) Seiso = Shine
	4) Seiketsu = Standardization
	5) Shitsuke = Sustain in Discipline
	SOP = Standard Operating Procedure
	PM = Preventive Maintenance

4.8.1 The Scene of Episode 7

That Tuesday afternoon was a normal running production day as usual. Everybody was focusing their own tasks. The researcher had the opportunity to observe the production line of CDI Amplifier at Plant 103, ie the Gambatte Engineering Section of the Plant. 103. CDI is short for '*Capacitor Discharge Ignition*'. Three operators were observed in this episode, together with their Supervisor and a Technical Specialist from the Maintenance Department.

The big clock showed 4.28pm. The researcher enthusiastically waited for the moment. At 4.30pm sharp, the whole shop-floor was suddenly filled with a break-through of sound. It was a sound full of refreshing music, not for entertainment, but for a special purpose that for some seems to be waiting for, yet for some maybe the atmosphere seems a bit disrupting. Most of them are still in their production lines. It is the music signal for the 5S TPM session.

Neeta, a line-leader quickly ensured a stoppage for the ordinary lots of productions, while any expedite urgent lots would continue to run under close monitoring. She had a short conversation with *Aisya*, a fellow colleague operator in the production line;

> "Here comes the music..! Let's do 5S now" [*Neeta*]

> "Yes, let me call *Lisa* and make sure she knows what to do" [*Aisya*]

> "Right, smart thinking, *Aisya*.....Good job !" [*Neeta*]

Understood what the music is all about and heard the reminder from *Neeta*, *Aisya* quickly noticed *Lisa* still at her machine, and walked towards her;

> "Come *Lisa*, follow me, this is the time for our 5S", said *Aisya* to *Lisa* who was still confused what to do and where to start.

This is her second day here as she just reported for duty the day before, and basically this is her first day at the shop-floor as yesterday she was busy with the administrative procedures at the general office.

> "Basically, when you hear the sound of music, it tells us to do 5S. Let us do this together and I shall explain 5S along with the help and guidance from our line-leader, *Neeta*", said *Aisya*.

The rhythm and tune of the music seems inspirational and motivational for the associates to perform their 5S activity.

> "Right Lisa, first thing we need to do is sort out our work place. We must ensure that the items are at the right place. In the original 5S we call it Seiri, this means sorting or organise ourselves" [*Aisya*]

> "OK, Seiri or 'Sort', our first S !", said Lisa following *Aisya* attentively.

Then Lisa organise her two-coloured ball-pens, her worksheet, her test-pen driver, and her small personal screw drivers and Allen-key set. Those are personal starter gadgets that are equipped for the associates in Gambatte. She put all of them in front of her on the work area next to her machine.

> "Remember also in Seiri, whatever non equipments including visible rubbish or waste need to be quickly thrown away", remind *Neeta*.
>
> "Like this leftover palate shield, old plastic cover of the work-sheets and extra pieces of production frames left beside the machine like this, we must quickly throw them, *Lisa*", showed *Aisya*.

Lisa followed and threw them away into the dustbin.

> "It is easier to collect the wastes and tidy up when we stop the machine for a while!", claim *Lisa*.
>
> "That is absolutely true, which is why we need ten minutes of 5S sessions every day !", confirmed *Aisya*.
>
> "OK, the second S is Seiton" [*Aisya*]
>
> "Seiton", follow *Lisa*… "what is it?"
>
> "Seiton is 'Set in Order', or simply Organisation", continued *Aisya*. "This basically means that everything we possess, after we sort them out which are the ones we need to use, we organise them for easy access and easier for us to use. In short, we organise them to be make our work more efficient."
>
> "*Lisa*, see how *Neeta* and I place our personal equipments. And please follow.." [*Aisya*]

"Alright, I slot my screw drivers and Allen-key set into my arm slot, my ball-pens into my pen pocket up here, my anti-static velo-strap to my left wrist and clip it onto this machine here", said *Lisa*.

"Very good, and this work-sheet board just place it in front of you here, a little bit right since you are right-handed so that you can easily grab it when you need to jot the production yields later", add *Aisya*.

"Now I understand why the worksheets on *Neeta's* workplace are all towards her left side. Exactly, since *Neeta* is left-handed!", said *Lisa*.

"Yes, you are right. You know *Lisa*, when we have our stuff ready and always by our us, our work speed is better thus our production rate will increase!", acclaimed *Aisya*.

"Well, the third S is Seiso, or we translate it as 'Shine'," said *Aisya* while looking into her watch. "We have gone through this session for 5 minutes now, and need to be a bit faster…but it is OK, you are doing fine", said *Aisya*.

"OK, Seiso…Shine, I guess this is about cleaning", answered *Lisa*.

"Exactly, when we do our 5S, after we sort, and set things in order, we need to make sure that they are all cleaned properly. This includes our work area. Our tools need to be wiped, and our machines wherever necessary need to be oiled and cleaned", continue *Aisya*. "We have been supplied with a bottle each of this mechanical super oil and anti-static wipe cloths, those are meant for this 'Shine' activity, and not for other else", affirmed *Aisya*.

"OK, understood…..I need to ensure my tools are cleaned and my machineries parts are sparkling and lubricated. But what do you mean this shining activity are not for other else?" further asked *Lisa*.

"Right *Lisa*, this super oil is a very good quality oil aimed to ensure the mechanical parts of our machines in this production line is performing optimum, thus we should apply them to our machines generously, but yet some of our previous associates saved the oil and brought them home instead, as it is very good for machines like the sewing machine, for instance", added *Aisya*.

"Perhaps they are really fond of sewing and take great care of their sewing machine", laughed *Lisa*.

At that moment, *Neeta* stepped in to see how *Lisa* and *Aisya* were coping. The music has been vibrating the atmosphere for six minutes now, and *Neeta* actually has over heard the conversation between *Lisa* and *Aisya* before. She smiled at *Lisa's* response and further explained:

"That is the problem; first of all, although the oil is prescribed individually for each of us and we can refill them weekly, but it is not meant to be used for our own benefit…. It is still the company's property; Secondly, as how we really like and love our personal machines at home, that kind of attitude should also be portrayed towards our production machine here. The machines are very important for us here. If the machines run well, our production will be smooth, and we could achieve our productivity targets" [*Neeta*]

"It is all about taking ownership and feeling the responsibility entrusted by what we are given. If we can bring in the feeling and attitude of owning the machine in the production line as how we own our own personal sewing machine, that will be great," added *Aisya*, while fooling back the oiled anti-static cloth and giving it back to *Lisa*.

"I understand now… taking care of our machines as how we are taking care as if they are ours", responded *Lisa*.

"Exactly, this is also the essence of Preventive Maintenance or PM in our TPM approach. We must take into account that our machines really need to function without friction and that we need to always lubricating them.

Just like a boat without friction when we push it out into the water", added *Aisya* enthusiastically.

"Good….now the forth S is 'Seiketsu' which means Standardization, making things standardized,' *Aisya* added more. At the same time *Neeta* walked and towards the line main board for further process of 5S.

"Seiketsu", followed *Lisa*, "and what to follow and how to make things standardized?", asked *Lisa* enthusiastically.

"Right, when we say standardized, we need to bear in mind that all the tools, procedures, and workflow need to be adhere and followed. We need to always refer to our shop-floor SOP, which is the Standard Operating Procedures…always wear and maintain cleanliness of our gears, tidiness of our tools – where and how we put and place them, and furthermore this 10 minutes time is also essential for us to ponder on how we have done our jobs for that day, either we have fully followed the procedures closely and each and every steps are taken accordingly", explained Aisya. She added, "all of these you can get from the procedures manuals which is located in the red folder at the front-part of every production line, for instance for our CDI line here, we can see that there is a red folder tied at the workstation near Neeta's place adjacent to the TPM corner area, if you can see where I means", said *Aisya* while pointing to the place.

"Right, I can see that file….so we can always check it from there?" asked *Lisa* further.

"Yes, but for better productivity, you can always refer and ask either Neeta as the line-leader or any of the senior associates like myself", added *Aisya*.

"Oh, thank you for helping me…", said *Lisa*, and both of them smiled.

“Basically, in the early days like what you experienced today, you can just follow what we do, and exactly copy what we perform, or as we the term we call here ‘mirroring’”, clarified *Aisya*.

“OK, the last S is ‘Shitsuke’ that means Sustain in discipline”, further elaborated *Aisya*.

“Shitsuke…”, followed *Lisa*. “Shitsuke, the fifth S”, repeated *Lisa*.

“Shitsuke is intended for us to set up a system that could secure this system to be implemented, so that we are following them with high discipline continuously”, added *Aisya*.

“Like making 5S as a routine daily like we are doing right now?”, asked *Lisa* for further understanding.

“Exactly…..you are getting it *Lisa*, well done! And did you notice how we make this 5S easy to be followed and sustained in our daily chores?....Try to think *Lisa* …!”, *Aisya* further discussed it. The time showed 4.39pm and only 1 minute left before the music ends. *Lisa* pondered on the question.

“By playing the music…?”, asked *Lisa* excitedly

“Brilliant, now you notice….This is the important, it is like conditioning ….whenever you hear to the music sound, then you know it is time for the 5S practice”, added *Aisya*.

At 4.40pm the music ends and production line resumed back as normal, with much more tidiness compare to ten minutes before.
Within the 10 minutes time frame, *Aisya* is happy as *Lisa* has understood the practice of 5S, not only what to do, but also why one needs to do it in such a way. *Lisa* was also delighted that in her early days of working in the production line, she has managed to understand and implement 5S in her duty. And *Neeta*

was very happy that the knowledge of the 5S is successfully transferred to her line (production line).

This ends the scene of Episode 7. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.9 Episode Number 8: TPM CORNER & WWA – "Why Why Analysis"

In this episode, the followings details are involved:

Location	Evaporator Line, which is one of the production lines that covers TPM implementation
Time	Wednesday morning, 29 March 2006
Personnel	Adnan, Abidin and Ghanesh
Machines	Evap3 and Evap7 – tube cutting machines for evaporator and radiator joints
Terminologies	TPM = Total Productive Maintenance 5S = The 5 S cleaning system (refer episode 7) WWA = Why Why Analysis

4.9.1 The Scene of Episode 8

On that Wednesday morning the researcher was given an opportunity to observe closely an activity related to TPM in the production line of Evaporator at Plant 101 Gambatte. A technician and an engineer from the Maintenance Department are inspecting and searching for solutions to a problem of a certain machine.

The clock at the main hall-way of the plant showed 9.13 am. The researcher keenly waited for the meeting to start. He glanced at his watch. When the wrist clock showed 9.15 am, the line leader, *Adnan*; the technician, *Abidin* and an engineer from the Maintenance, *Ghanesh* gathered together at a corner at the side of the production line for a TPM session.

The meeting area was conducted by a small table without any chairs and the three of them started their TPM meeting. The area was also marked as "TPM Corner". Although they knew each other very well, in the meeting they looked quite formal among each other since they are from various ranks of personnel.

> "First. I would like to thank *Ghanesh* from the maintenance engineering and also *Abidin* for coming to this TPM meeting," started *Adnan*.
>
> "For the TPM report today, I would like to highlight that machine *Evap3* has been slightly under-performance since yesterday afternoon, and that machine *Evap7* has been facing increasing number of stoppages lately." [*Adnan*]
>
> "Any input, *Abidin*?", asked *Ghanesh*.
>
> "Right, for the *Evap3*, I have checked it earlier this morning, and found out that one screw need to be tighten up thus, has fixed the problem. The production should be running well now!, answered *Abidin*.
>
> "...which leaves us with the *Evap7* to trouble-shoot", added *Abidin*.
>
> "Our operators tried to lubricate and check them during the 5S, still the give the same negative result....," said *Adnan*.
>
> "Right, what could it be?....", added *Ghanesh*.
>
> "...and our technician team have checked throughout the shifts, but still could not figure it out....the machine continues to stop sometimes in the middle of production by itself...," replied *Abidin* next.

The three of them continued to brain-storm and look into the problem and trying to overcome it. *Ghanesh* then continued:

> "...Let us try to analyse it step by step....in TPM what we use the term "why-why analysis"...or WWA" [*Ghanesh*]

Abidin and *Adnan* nodded almost simultaneously in excitement.

"We need to ask *why why why* until five stages…..", started *Ghanesh*

"Right, let us think together. First of all, we must ask why did the machine stop?" [*Ghanesh*]. This is *Why* number One.

"The machine stopped because one part is jammed/stuck", replied *Adnan*.

Then *Ghanesh* ask, "…why is that one part stuck?" This is *Why* number Two.

"That one component is jammed because the sensor triggers the stoppages, thus causes the machine to stop", answered *Abidin* this time.

Then *Ghanesh* further ask, "…OK, so why is the sensor triggering the stoppages?" This is *Why* number Three.

"The sensor trigger because the circuit transmitting the sensor is not working properly", replied *Adnan* and *Abidin* almost simultaneously this time, while looking into the details diagram of the *Evap7* machine circuits.

Then *Ghanesh* advance his quest, "…then,…..why is the circuit that transmits the sensor is not working?" This is *Why* number Four.

After thinking for a while, *Abidin* gave a suggestion, "…the circuit is not working properly because one component in it must be malfunctioning and it need to be replaced.".

Then *Ghanesh* replied, "Right, so this comes to a decisive point for us that is to find out which part must be replace here.., right?"

"Yes, you're exactly right," said *Adnan* attentively. *Abidin* nodded his head.

That was *Why* number Five, the last one, which is actually a '*Which*', according to *Ghanesh* the why analysis could also bring out with the questions of all 'double-yous' (Ws) and 'hedge' (H) letter (Ws and H).

Finally they got the answer for the problem and identified the machine parts needed for the replacement, and "it was dealt with and the machines was operating back again after 25 minutes. No other problems occur after that for a longer time, thus adding a longer life-span" according to Abidin.

This ends the scene of Episode 8. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.10 Episode Number 9: KANBAN CARD SYSTEM

In this episode, the followings details are involved:

Location	TPS Compressor Line which is one of the production lines that covers TPS implementation
Time	Close Observation on Tuesday, 25 April 2006
Personnel	Ghazali and Nizam
Terminologies	M133 = general order number MA447190-32520R = part number for *Kenari* (a car model) product

4.10.1 The Scene of Episode 9

It was a good breezy Tuesday afternoon. *Ghazali* and *Nizam* were at the TPS Compressor Line looking into the schedules of the productions that needed to be arranged and followed. *Ghazali* is a supervisor from the Incoming Warehouse while *Nizam* is one of the production supervisors of the line.

Before reporting this scene, the researcher was first informed by the gatekeeper that the observation and episode today is about *kanban*, an instruction card system that help to arrange and locate a product's processes and locations within the system.

The figure 4.13 below shows the production *kanban* post, and this picture was captured from the condenser line (very similar to the compressor line as in the previous episode).

Figure 4.13: Kanban post

Further conversation took place near the *kanban* post of the compressor line:

"Nizam, any problem regarding the new order for *Perodua Kenari* parts? We need to deliver the first batch of recent order by tomorrow…" [*Ghazali*]

"No problem, which product again? if you could please quote the general order number?" [*Nizam*]

"Oh yes… the general order number is M133…"[*Ghazali*]

"Very well, M 133, …Yes, here in this system it is said already in production, let us look at the line then." [*Nizam*]

Both of them walked together towards the compressor line and searched for the item. Nizam led the way looking for the *Kanban* of the current running production lot.

"Right, here it is, M133. we are now running the piping process for the parts bearing the number of MA447190-32520R, and it is for Kenari, right, *Ghazali*?" [*Nizam*]

Figure 4.14: Production kanban card

"Yes, absolutely! Very good! Now I come here to inform that another new scheduled *kanban* that need to be delivered to the customer in two weeks time. This is the new order that has just come in this morning." [*Ghazali*]

"Well, let me have a look, OK, here is its scheduled instruction *kanban* card, I shall prepare it afterwards for the production *kanban* card. No problem…" [*Nizam*]

Figure 4.15: Schedule instruction kanban card

"*Ghazali*, normally the preparations of this 1350 model product will take three days of production, so I will adjust it according to the order and customer request date. Leave it to me and do not worry about that…" [*Nizam*]

"OK then, many thanks for your help. See you later." [*Ghazali*]

This ends the scene of Episode 9. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.11 Episode Number 10: PRODUCTION LINE SIMULATION

In this episode, the followings details are involved:

Location	Training Room of Plant 101
Time	Wednesday, 12 April 2006 afternoon after a lunch break
Personnel	Bahrin, Mazlan, Chung, Nasser, Fadhil
Terminologies	super-operator = an operator certified to handle multiple machines
	chukka chukka = multiple machines handled by one operator
	WIP = Work In Progress
	TS certs = certification of TS16949
	Suggestion Slip = a slip operator writes (suggestions) for further improvement of the production line.

4.11.1 The Scene of Episode 10

It was a Wednesday afternoon, after a short lunch break, a meeting was held to discuss the production future in Plant 101 Training Room. The future of this production is based on the simulation applied in this meeting, creating and arranging small pieces of "lego™" bricks blocks. Each pieces reflect a part of the components of production line.

> "Now, first let us look into current production line. It looks like this," said *Bahrin* while arranging the blocks according to the current lay-out.
>
> "We are looking into how to minimise the space and optimise the working area of our associates. What are your thoughts, here *Mazlan*? from the perspective of our associates?", asked *Chung* who is a Section Manager of facility and planning unit of the plant.
>
> "We are now towards training and establishing our operators to becoming a super-operator, or *chukka chukka* and improving our production line with lesser WIP walking area," *Mazlan* replied

"We are also aiming towards producing smaller unit number lots so that smaller space and optimum working area in the shop-floor could be achieved", said *Bahrin* while adjusting the lego^{TM} blocks to suit in the area.

Bahrin and *Mazlan* attentively try to fit in and arrange a good layout for future suggestions of their shop-floor.

"…but we have to also remember that we need to oblige and follow the specification and compliance the TS certifications, which is mainly straight-forward. The motto applied is 'we report what we practice, and we practice what we report', meaning that we do not over-reporting in the system, and we do not do what we do not report. The lesser and the sharper the procedures and points written in the TS certifications, the better since those are the points that the certification body will come and check once a new line-up for prod line is created and approved to be functionalised…", reminded *Nasser*.

Everyone nodded and respecting this senior person idea. *Nasser* is the Director of Quality of Gambatte Malaysia. By taking a glance at his cap, firstly he wears a red cap colour indicating that he is from the Quality Department, a respected department in term of quality assurance. Secondly the Gambatte star attached on the cap with the gold-plated emblem of number 20 shows his seniority which means he has been serving for Gambatte for 20 years.

Then, the four of them continued to arrange and fix the future layout of the shop-floor plan using the lego^{TM} bricks blocks and making simulation as well at the accessibility, efficiency and effective process of the production without marginalizing the quality standards.

"…we should also by now try to make this simulation with lego blocks, and then by sate system representation…", reminded *Nasser*.

"Not to forget that I also would like to suggest that we should take into account the feedbacks and ideas suggested by our operators, based on their suggestion slips," *Mazlan* added.

"That is true. Furthermore, they are the ones who are going to run the multiple machineries," *Bahrin* further added.

"Right, in that case, we should also make a quick revision of the suggestion slips posted by our operators. These yellow slips are really important as a source of communication bottom-up", concluded *Nasser*.

Then, Fadhil, the TPS Champion came in to join the meeting.

"Sorry, I just finished from another meeting. We need to upgrade the simulation with improvement, from production line style into cell unit style of production", said *Fadhil*.

"I also recommend that we apply the "*bento*" application of arranging production cell unit and that the production will also imply on '*kawakuri*' system", added *Fadhil*.

The five of them continue the meeting attentively and the production line simulation run positively.

This ends the scene of Episode 10. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.12 Episode Number 11: GAMBATTE CULTURE OF OWNERSHIP & TPS LAYOUT IN ACTION

In this episode, the followings details are involved:

Location	Vent & Heater Line, Plant 102 covers TPS implementation
Time	Monday, 01 May 2006
Personnel	Fadhil, Alice, Meena, Arifin, Joe, Nasser and Mr Ono
Terminologies	WIP = Work In Progress Chutes = Moving stackers that help to move the materials in the WIP from one point to another. chukka chukka = multuiple machines handled by one operator Gambatte DNA = a special traits that should be firmly upheld by every Gambatte employees of Gambatte Malaysia, feeling of belongingness with Gambatte

4.12.1 The Scene of Episode 11

It was a bright day. That morning, a new layout of production line was introduced to the Vent & Heater Line. *Fadhil* called a short meeting between the operators, *Alice* and *Meena* and requested the line supervisor, *Arifin* to explain the layout orientation and also attended, a representative from Maintenance Department, *Joe*.

> "OK, as per the demand of the production, and to suit the process of the new TPS system, we are glad to introduce the new layout of our production line here. I would like to get feedbacks especially from the operators who run the machine, which in this case is *Alice* and *Meena*" [*Arifin*]

Then, *Arifin* further explained about the new layout design;

"The layout is designed to be smaller, and with less walking movement involve carefully planned for every operations in our production line. This lay-out allows you to walk less." [*Arifin*]

"Yes, this is good. Is there any machineries or instruments that has been removed?", asked *Meena* attentively.

Meena realised that this was what has been asked by the production team for some time now, a 'shorter-walking' work area will minimise movement and optimise machine handling and productivity.

"No, only that, we also made shorten the shoots so that the materials shall move freely, faster and that we need to have lesser WIP!" [*Joe*]

".That is right, not only we can save space, we can also save energy as some conveyance belts that are still in used could be totally replaced by the *chutes*...", added *Fadhil*.

Chutes refer to the moving stackers that help to move the materials in the WIP from one point to another. It normally has a slanting degree so that the movement of the materials are assisted by gravity. This also has replaced the former use of conveyance belts that use electricity to run it.

"...we want to make each and every operator feel that this is the best place to work and that the machines are theirs and to be comfortable using them in your daily usages..." [*Arifin*]

"That is good. We actually really do feel that the machines are like our own and we do not wish to see them damaged or removed unnecessarily." [*Alice*]

"Yes! We are trained to take ownership of the machines and whatever we involved in working with." [*Meena*]

These are among the response given by the operators regarding this issue. From the conversations, it is understood that handling machines in the production line is very much important similar to handling children.

> "…This is systematically aligned with our plant-wide campaign to upgrade the associates (operators) into becoming super-operators one day, certified to be super-operator and implementing *chukka chukka*,….", explained *Arifin* further.

> "….that is a great new…!", exclaimed Meena

This ends the scene of Episode 11. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.13 Episode Number 12: ASEAN JESHUKEN

In this episode, the followings details are involved:

Location	Plant 102 Meeting Room and Radiator Line, which is one of the production lines that covers TPS implementation.
Time	Thursday morning, 30 March 2006
Personnel	Fadhil, Pranthap, Sudarjo, Kim, Lina, Lily, Esah, Ghani and Malek
Terminologies	Asean Jeshuken = an important meeting between the champions of TPS for regional based plants across Gambatte in the Asia Pacific region

4.13.1 The Scene of Episode 12

It was a bright Thursday morning. That morning, a number of officers are coming from other regions of Gambatte base plants as a part of the *Asean Jeshuken* exercise. This activity involved *Fadhil* hosting three other Gambatte branches officers - Mr *Pranthap* from Gambatte (Thailand); Mr *Sudarjo* from Gambatte (Indonesia); and Mr *Kim* from Gambatte (Australia); who came along to observe and learn as well as checking the implementations of the processes being done to ensure that the same specifications, techniques and quality products are produced with the same set of rules and procedures. The episode also involved a super-operator, *Lina*; with two other operators, *Lily* and *Esah*; their supervisor, *Ghani*; and the line manager, *Malek*.

Fadhil introduced himself:

> "Welcome to Mr *Kim,* Mr *Pranthap* and Mr *Sudarjo*. We are going to visit the Radiator line today in which it is in the implementation stage for all the three systems, the TPS, the TPM and the TS quality system" [*Fadhil*]

> "As we know, the reason we are gathering here is to fulfil a part of *Asean Jeshuken* activity. This three officers will look and check our implementation of TPS and they will also ask some questions to you," said *Fadhil* to *Lina*, *Lily* and *Esah*.

Then, *Pranthap* started to check on the meaning of some terminology regarding the process involved in the machine,

> "Yes, you are right, *Lina*, we are doing the same process in Thailand for that machine"

> "What would you do if there is any abnormalities happening in the production line?", asked *Kim* to *Lily* and *Esah*.

> "Well, when there is a problem within the production process, we need to press this red button", mentioned *Lily* while pointing to the *Andon light*.

> "Right, let us try now," said *Sudarjo*.

Then, a dummy rejected unit was put into production cast and the moulding machine began noticing the abnormality, and giving the signal to the operator. *Esah* quickly press the button and the *andon light* began flashing.

> "What must you do now?" [*Kim*]

> "When the flash light flashing yellow, we need to get ready and pay attention to the machine and the product, detail observation is needed to solve this problem. When the red light appears, the production need to stop instantly and our line supervisor must be called and attended to the production line. Further notices will be extended to the maintenance department, engineering department and also the department manager". [*Lina*]

Below is the picture of *andon* lights::

This is a sample of andon light in the plant. It consist of 3 colours (green, yellow and red) mentioning the status of machinery; either stopping, call (need attention) or in progress…

Figure 4.16: Andon Lights in the plant

Figure 4.17: Cluster of Andon Lights at the top of production line

> "Well, this seems to be a universally accepted knowledge that is put into practice, which is great", said *Pranthap*.

The use of *andon light* and how to stop the production when there is any problem seems to be standardized in this episode. Next, the *Asean Jeshuken* team asked further;

> "Where do you normally meet and get most out of the new knowledge? [*Sudarjo*]

> "Normally, we have our daily morning briefing, so each shift has the same opportunity to present their updates. We gain something from there. However, most of the new knowledge on the manufacturing techniques we gathered is gained informally, mostly via interactions and discussions during our on-job trainings, placement at the machines in the production lines, and also during our coffee-breaks." [*Ghani*]

This ends the scene of Episode 12. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.14 Episode Number 13: CUSTOMER COMPLAINT

In this episode, the followings details are involved:

Location	AC & Amplifier Line, Plant 103 covers TS implementation
Time	Wednesday, 19 April 2006
Personnel	Evonne, Mahbub, Din, Sham and Hussin.
Terminologies	Customer Complaint DB – Customer Complaint Database
	CM Team – Counter measure team

4.14.1 The Scene of Episode 13

Evonne came in to the AC & Amplifier Line, Plant 103.She brought along a complaint paper from a customer and approached *Mahbub* and *Sham*. *Mahbub* is the Supervisor for the AC & Amplifier Line while *Sham* is the QC Supervisor for the section.

> "I have here a customer complaint coming from Perodua regarding AC Distributor which we have supplied to them" [*Evonne*]

Then, *Mahbub* further requested more info and gesture to his operator to call for *Din*, the Product Engineer for the Plant 103;

> "Well, we need to put this complaint in file and address it together now." [*Mahbub*]

> "Yes, that is correct. Did you bring along our Customer Complaint DB with you?", asked *Sham* to *Evonne* attentively.

Evonne showed her folder she brought along and at that time, *Din* also arrived and joined the meeting.

> "Well, here we are, the complaint is about the Distributor for Alza model of Perodua" [*Mahbub*] looking at the complaint.

> "....That is right, well, it was malfunction when arrived at their plant in Rawang Selangor. They claimed that the device could not fire up when starter ignites…", added *Din*.

The three of them, *Mahbub, Sham* and *Din* try to understand what the problems are by looking into their sample as per the same model issued to Perodua.

> "…This is our counter measure team, and I think we need to add my Line Leader as well here, *Hussin* …" [*Mahbub*] added and signal his hand calling *Hussin* to join the pack.

> "That is great. Let us work out now." [*Din*]

The four of them carried out some experiment and counter measures by cross functioning across the line.

> "…Now we know what is the problem, and we shall share this with other teams and lines...", explained *Mahbub* further.

> "….That is good…!", exclaimed *Evonne*.

Then, the counter measure ended and closed-up.

This ends the scene of Episode 13. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.15 Episode Number 14: PROCESS CONTROL AT PRODUCTION LINE

In this episode, the followings details are involved:

Location	Compressor Line, Plant 102 covers TS implementation
Time	Thursday, 06 April 2006
Personnel	*Nan, Azzem, Laili* and *Budeen*
Terminologies	FMEA = Failure Mode Evaluation Analysis
	FIFO = First In First Out

4.15.1 The Scene of Episode 14

That morning at the Compressor Line, *Nan* the section head called a short briefing with his twoe operators, *Laili* and *Budeen* and requested his line supervisor, *Azzem* to join in together.

> "Today I would like to emphasis the importance of our new production which started its operation two days ago..." [*Nan*] started.

Laili and *Budeen* listen attentively for what *Nan*, their section wanted to address.

> "For every new production line, we need to carry a study of risk defect. This is very important" mentioned [*Nan*]

> "..That is right, we need to establish a systematic statistical process control on the quality, like what we have started yesterday…", added *Azzem*.

Laili and *Budeen* showed what they have prepared and *Nan* was quite happy with their work. Then, *Nan* showed them a new feature introduced in the line to prevent any quality defect from occuring, this is widely known as *poka yoke* element. For the operation in that line, after installing all eight screws onto the compressor, then only the gasket cover could be detached from the production set, and then the item could be moved to the next sequence.

> "…Do you understand what we have discussed today?…" asked *Azzem* to *Laili* and *Budeen*.

> "Yess," answered both of them simultaneously.

Then, *Azzem* showed how to conduct final inspection of the product and how to make sure a unit which come first, will be produced and send out first.

> "…this is known as First In First Out control of production….", explained *Nan* further.

> "….We got it…!", said *Laili*

This ends the scene of Episode 14. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.16 Episode Number 15: CONTROL OF MACHINE SPARE PARTS

In this episode, the followings details are involved:

Location	Maintenance Room, Plant 102 covers TPM implementation
Time	Friday, 31 March 2006
Personnel	*Zack* and *Faisol*
Terminologies	Machine SPMS = Machines Spare Parts Management Systems

4.16.1 The Scene of Episode 15

Zack and *Faisol* are in the maintenance room in plant 102, checking the Preventive Maintenance schedules.

> "*Faisol* let us check and update this Machine SPMS " [*Zack*]

> “OK, *Zack* let me check the data structure and check our spare parts inventory” [*Faisol*]

Then, *Zack* said out from the Machine SPMS data;

> “...we need to remind all our technician teams to always order our machine spare parts based on the ordering level and store them correctly in specific conditions” [*Zack*]

> “Yes, that is correct. We also need to ask them to look at the spare parts and place them exactly based on the labels and manage them in term of stock-in stock out carefully”, added *Faisol*.

Both of them realised that with the correct management of spare parts, better preventive and troubleshooting measures could be achieved.

> “Not only that, we also need to make sure that all of our spare parts are received and disposed systematically!" [*Zack*]

This ends the scene of Episode 15. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.17 Episode Number 16: PREVENTIVE MAINTENANCE

In this episode, the followings details are involved:

Location	Maintenance Office, Plant 101 covers TPM implementation
Time	Monday, 10 April 2006
Personnel	Ghanesh, Bahrin and Radzi
Terminologies	PM = Preventive Maintenance
	PdM = Predictve Maintenance

4.17.1 The Scene of Episode 16

Ghanesh, Bahrin and *Radzi* gathered in the Maintenance of Plant 101, to establish a Preventive Maintenance schedule for plant 101. *Ghanesh* is the maintenance manager while *Bahrin* and *Radzi* are Technical Specialists.

> "OK, we have to plan out preventive maintenance of machineries of plant 101 by this week, hence I suggest we do it now" started [*Ghanesh*]

Then, *Bahrin* and *Radzi* gathered near *Ghanesh*.

> "..we can draft our schedule based on our previous maintenance items and checklist. After this we will check the real machines on the shop floor to double check the item checklists...", added *Bahrin*

> "...We will also deploy our competent maintenance team to perform the PM, and we shall conduct the PM on Sundays where there is no production during that day...", further added *Radzi*.

> "..Always treat the machines as if they are our little babies...", reminded *Ghanesh*.

> "..Remember to test run the machines after we perform the PM and get ready to perform predictive maintenance later...", reminded *Ghanesh* again.

"We shall ready the summary of the PM report by Monday!" [*Bahrin*]

The three of them adjourned and Bahrin and Radzi went out to arrange the PM schedules for the selected technicians.

This ends the scene of Episode 16. The discussion and analysis is presented in the following chapter Five, according to the episodes sequences accordingly.

4.18 Chapter Summary

To conclude this chapter, it is noticeable that by combining the elements of moderate observation by the researcher, coupled with in-depth interviews held with the respondents, made the screen-shots of the episodes much clearer so that a more dramatic, real, original and true evidence of how the processes, steps and ways of knowledge transfer are clearly crystallised in the real situations.

This is indeed a raw qualitative data of what actually happens on the shop-floor of the production lines involving the three systems of the manufacturing practices, TPS, TPM and TS in Gambatte Malaysia through episodic presentations. Further discussions on the 16 episodes are to be discussed in the following Chapter 5.

Chapter Five

Discussions of the Episodes

5.0 Introduction

This chapter presents discussions of the 16 episodes of the knowledge transfer processes and the corresponding thematic codings (Boyatzis, 1998; Miles and Huberman, 1994) to generate themes and categories as well as sub-categories of the data. To further refine the flow of the presentation, the discussions on the episodes in this chapter are explained in depth supported by excerpts from related interview transcripts.

As described briefly earlier in Chapter Four, Gambatte (M) has 3 plants altogether within its site, which are coded as Plant 101, Plant 102 and Plant 103. Therefore, it is wise to present the episodes based on "the plant times across the lines" (ie; the production plant times (X) lines) of the production facilities across the three philosophies of Japanese Manufacturing Initiatives (TPS, TPM and TS); as this presentation will represent a more equally distributed and holistic illustration of the whole case can be achieved throughout the entire episodes.

The presentation of the episodes and its descriptions are also written from the viewpoints of the subjects (the personnel involved) and are presented in details in relation to "the scene of the episodes" in the previous Chapter Four. Further interviews are combined with observations to strengthen and enrich data collected from interviews, hence contribute to data reliability and validity.

To recap, the layout of the arrangement of the plants and lines are as follows:

Table 5.1: Arrangement of the Plants and Lines across Episodes

Gambatte (M)		**Philosophies / Manufacturing Systems**		
Plant	Lines	TPS	TPM	TS
101	Condenser	Ep 2		
	Evaporator		Ep 8	
	Piping	Ep 3		
	Compressor	Ep 9		Ep 14
	Training Room	Ep 10		
	Maintenance Office		Ep 16	
102	Ventilator & Heater	Ep 11	Ep 5	
	Cooling Unit & Blower			Ep 4
	Radiator			Ep 1
	Meeting Room	Ep 12		
	Maintenance Room		Ep 15	
103	ECU (Engine Control Unit)			Ep 6
	CDI Amplifier		Ep 7	
	AC Amplifier & Controller			Ep 13
Total of Episodes per Manuf Systems		**Six**	**Five**	**Five**

A refined summary on the representation of the episodes is stated below, with the numbers indicating where the episodes are located within the production lines according to Table 5.1, and the parts on which the scenes of the episodes are covered in Chapter Four.

There are 16 selected episodes that should cover all the plants and the philosophies (manufacturing) involved namely;

Episode 1: Gemba & Abnormalities Treatment - scene of the Episode = 4.2
Episode 2: TPS Activity Board - scene of the Episode = 4.3
Episode 3: Champion - scene of the Episode = 4.4
Episode 4: Super-Operator & Visualisation - scene of the Episode = 4.5
Episode 5: Training – theory and practical - scene of the Episode = 4.6
Episode 6: Charts with different Colours of Pen - scene of the Episode = 4.7
Episode 7: Daily Maintenance and Five Ss - scene of the Episode = 4.8
Episode 8: TPM Corner & WWA – "Why Why Analysis" - scene of the Ep= 4.9
Episode 9: Kanban Card System - scene of the Episode = 4.10
Episode 10: Production Line Simulation - scene of the Episode = 4.11
Episode 11: Gambatte Culture of Ownership & TPS Layout in action - scene of the Episode = 4.12
Episode 12: Asean Jeshuken - scene of the Episode = 4.13
Episode 13: Customer Complaint - scene of the Episode = 4.14
Episode 14: Process Control at Production Line - scene of the Episode = 4.15
Episode 15: Control of Machine Spare Parts - scene of the Episode = 4.16
Episode 16: Preventive Maintenance - scene of the Episode = 4.17

5.1 The Discussions of Episodes of Knowledge Transfer

As mentioned in earlier Chapter Four, an episode represents the recollection of scenes of the knowledge transfer process captured as it happens according to what and how the knowledge is transferred. These episodes are important in gaining an understanding of the knowledge transfer process, as well as showing how the subsidiary acquires the knowledge and subsequently incorporates the manufacturing techniques into daily operation. This chapter further **discusses** the 16 episode, and provides a **summary** of all the episodes to place each individual episode into perspective.

In this section, the episode is described and discussed to better explore the raw data in an attempt to answer the research question. As each episode is illustrated in a blended storyline as mentioned in the Chapter Four earlier, this section describes in detail, the steps involved in the production facility implicated (which line/project is represented; ie TPS, TPM, or TS?), what and which product is dealt with, who are (the personnel) involved, what are the problems and how are they being solved.

This section also describe the episode by providing an early understanding of how knowledge is transferred, what techniques are occupied, what kind of knowledge is concerned, how that knowledge is acquired, whether there are any differences between actual practice (this episode) and formal practice (in the previous chapter) OR if there are any similarities in any parts , such as, for example, what are the mechanisms of the knowledge transfer involved, what are the motivating factors and the steps taken, and how do these facilitate the transfer?

A short explanation of activities and findings gathered from the episodes are also provided in 'tabular form' to recap what the episode is all about, and the new themes and findings it develops related to replication, adaptation and new approach of knowledge transfer are presented. The new approach of knowledge transfer is marked by the researcher as "innovation" to represent a new way of problem solving, and most of this revalidating process is conducted in the second round during the 'strengthening and validating' period of data.

Towards the end, The *Summary* part of the episode provides concise introduction of the scene, providing a brief insight into what the storyline would be, featuring the main 'actors' within the episode, the location, and the situation of the scene. The summary also ends up emphasising the importance of the findings from the episode in relation to knowledge transfer approaches and circumstances which took place across all three manufacturing systems of TPS, TPM and TS.

5.2 Episode Number 1: GEMBA & ABNORMALITIES TREATMENT

In this episode, the following details are involved:

Location	Radiator Line
Time	a sunny Monday morning, 20th March 2006
Personnel	Siti, Sodiqin, Eddie, Muqarabin, and Fadhil
Machines	Inj.R-04 mould injection – radiator frame moulding machine
Terminologies	Gemba = to deal at the place itself
	Inj.R-04 = Injection Moulding machine for Radiator, machine no 4
	TPS36/06 = Gemba Code for this incident

The scene of this Episode 1 was presented in Part 4.2 (Chapter Four) on page 89.

5.2.1 Discussion of Episode 1

This episode showed how the operator quickly stopped the production (to eliminate further waste via rejections), and called her supervisor (production personnel), who swiftly fetched the personnel responsible for the engineering (an engineer) and maintenance (a technical specialist). Together with the operator involved, the Champion, the supervisor, engineer, and technician, met at the prescribed machine (the problematic machine), and started to observe, explore and analyse the situation, and came out with a solution.

This episode relates to *gemba*. As mentioned previously, "*gemba*" is an ad-hoc problem-solving get-together that took place at the 'scene of the incident', basically to trouble-shoot any immediate and urgent problem.

The problem arose from this *gemba* focuses on the rejected units out-put from an instrument (Inj.R-04 machine) in the Radiator Line. The declaration for this *gemba* was announced by Fadhil, and from the scene above we might notice that the characteristics of this *gemba* enabled those in attendance to gain sufficient knowledge to assist the situation and search for a unique solution.

It is noticeable in this *gemba*, that the actors involved in this scene provided a good example of how new information is transferred. We can see that the facts of rejection identification falls on the experience of the machine operator, allowing her to eloquently explain the whole situation from her own perspective - the operator level (*Siti*) standpoint which is very important in establishing the source of the problem. After her input, the specialists involved in this scene, from the engineering (*Eddie*),technical (*Muqarabbin*), production (*Sodiqin*) side, and the new project champion itself (*Fadhil*), who was involved in the discussion.

The practice of *gemba* (ad-hoc 'on the spot' meeting) as a mechanism of knowledge transfer permits the problem to be dealt with immediately, this point which is confirmed by *Fadhil*'s remark:

> "By doing this (*Gemba*), the production stop-time is dealt with very minimum and they were able to trouble-shoot the problem much faster adding the fact that by calling them to the scene during the occurance was clearly better than the previous practices." [Fadhil]

Hence, *gemba* proves that pace and quality is very important in dealing with production problems shown here in this episode, since the machine was up and running again within a few minutes after being stopped.

This *gemba* also highlighted that the transfer of trouble-shooting knowledge is better conducted at the site of the incident itself, and that by gathering the right information from the right sources, and responding to the right place and at the right process, difficulties can be solved efficiently and productively.

The scenario resembles a medical procedure in the operation theatre, the decision call for immediate actions, and the problem has to be remedied immediately. The element of thinking critically yet quickly and remembering what was happening is also vital during the process.

> "Prior to this, we normally stop the machine and wait for the Maintenance crew to look into the problem and solve it for us." [Fadhil]

It was very different before when problems were handled by different departments in a consecutive process, starting with production personnel, followed by the maintenance experts, then the engineer, and eventually the line record. This process was time consuming and inefficient as no opportunity for knowledge sharing is created. Gemba provides the platform by bringing these different areas of expertise together, enabling the problem to be solved in less than half an hour, and offers opportunities knowledge sharing possibilities.

Moreover, the operator contributed into the information sharing activity, since in that particular instance it was her experience that led to the problem being properly identified. Hence, the operator demonstrated her possession of unspoken knowledge that facilitated the trouble-shooting exercise.

The flow of the knowledge transfer was seen to move from the operator level (*Siti*) to her upper-ranked officers (*Sodiqin*) and later on in the discussion, it was also observed how the upper-level officers (*Eddie* and *Muqarabbin*) relied and placed their trust on *Siti* to provide them with important information about the possible cause of the problem.

Siti has an extensive experience of 16 years with Gambatte and as a result she is on the right track of becoming a certified super-operator (Episode 4 relates to the 'super-operator' concept). *Sodiqin* joined Gambatte (M) in 1983 as part of the first intake of employees and his experience places him among the most senior supervisors on the plant floor. His suggestions and opinions are always sharp and direct, and taken into consideration.

Based on the evidence stated, it can be noticed that the relationship among the employees as shown in Episode 1 helped the ad-hoc meeting to proceed effectively. Both formal and informal relationships were in evidence, the formal relationship refers to job ranks and position of those involved, while informal relationship results from their respect for each other evidenced from their team effort. In addition, this episode provides evidence of the fact that mutual understanding of communication in '*gemba'* is the key to ensure better knowledge transfer.

We can also discover the factors that foster and hinder the process in this episode. Among the fostering process were: the place of the *gemba* meeting, the trust, compliance and reliance of the *gemba* meeting members. Among the factors that might have hindered the process is the availability of the required personnel since a delay in holding a *gemba* meeting may cause the main actor(s) of a problem situation to forget some aspects of the problem, although in this particular episode, there was no difficulty in obtaining the input from the right personnel.

In answering a further question on how *gemba* operated in the parent (Gambatte Japan) as compared to Gambatte Malaysia, *Fadhil* said:

> "…the *gemba* practised here, in term of solution structuring, notes recording and converting into references are pretty much the same as in Japan. The only significant difference is the way of looking and establishing the solutions of the problems, in which we dealt with our own signature…"

This episode also demonstrates conformity by the operator when she stopped the machine after noticing the rejected units, and the reliability of the engineer, technical specialist, champion and supervisor, in their willingness to respond to the call for the ad-hoc meeting (*gemba*) at very short notice. Moreover, it shows that all the related personnel placed trust in the operator.

The communication medium involved in the episode is confronted or a face-to-face meeting in which everybody involved were physically present at the *gemba* site, thereby allowing for the knowledge transfer process to occur. The activities and findings of Episode 1 in regards to the types of approaches of knowledge transfer are represented as follows:

Table 5.2: Activities in Episode 1 that represent Replication, Adaptation and Innovation

Episode 1 : GEMBA and Abnormalities Treatment				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Production unit faced abnormalities, calls for help using andon light			
2	Operator needs to stop production (after 3 units abnormal)			
3	Prod Supervisor takes action, and calls related officers immediately {Prod Sup called Eng, Tech, PE and TPS Champion}			
4	Everyone gathers near the problematic machine, and decide to practise GEMBA			
5	Operator in charge was asked in details what and how it happened			
6	Every *gemba* members tries to dig what went wrong, including asking for any funny sound / visual...			
7	The champion notes the *gemba* process neatly			
8	Source of problem found, and troubleshooting done			
9	Ad-hoc meeting conducted at the place of problem "itself" until the problem was solved.			

Finally, regarding the types of knowledge transfer involved, this episode proves that *gemba* as practiced in this episode is almost similar (replication) as that in the parent, in terms of its structure, and practicality, with only slight adaptation has been made in this situation.

5.2.2 Summary of Episode 1

This episode is concerned with an ad-hoc problem-solving gathering called to tackle the problem of rejected parts. The subjects of this episode is a Production Operator, her (the operator) Supervisor, the Champion, an Engineer, and a Technical Specialist. The meeting was held in the Radiator Line, Plant 102 which covers the philosophy (manufacturing systems) of TS. The storyline focuses on a product part that was not perfectly produced hence rejected. This situation was responded by the operator calling a number of specific personnel who arrived quickly to discuss and trouble-shoot the problem. A detailed elaboration of the episode that took place beside the affected machine added realistic to the story.

It came to a clear understanding that after the *gemba* session, a new information was generated and transferred simultaneously; among other, whenever a machine stops, production will be affected, leading to decline in productivity, thus resulting in lesser revenues. Another important point to relate is that whenever a problem triggers, it needs to be addressed immediately to counter possibilities of productivity loss. A quick snap of production line closure is better than working a defect-produced material.

This episode demonstrates the importance of places where knowledge transfer can be clearly observed and understood; enabling the validity and originality of how the knowledge transfer occurs in context be maintained.

5.3 Episode Number 2: TPS ACTIVITY BOARD

In this episode, the following particulars are involved:

Location	Thermal System Plant, Plant 101
Time	Thursday morning, 23rd March 2006
Personnel	Chee, Ikhsan, Fadhil, Latifa
Terminologies	ECU = Engine Control Unit
	TPS Board = TPS activity updates board

The scene of this Episode 2 was presented in Part 4.3 (Chapter Four) on page 94.

5.3.1 Discussion of Episode 2

The TPS Board is basically a notice board indicating the actual occurrences in the production line. This is among the TPS main devices, and should be fully understood by everybody in the production line. It should be easy to follow and comprehend so that any person walking past it on their way through the production line can completely understand what actually happens.

Episode 2 is about an unscheduled routine management check on the TPS system, particularly one that aimed to clarify the managers' appreciation of the production quality process. Despite the fact that the management have this information in their offices, it was shown in this episode that simple yet comprehensive signage (the TPS Board) could encapsulate all the necessary information, and also elaborate and explain the development stages of the production line.

The conversations that took place at the scene of the TPS between *Latifa, Fadhil, Chee* and *Ikhsan* demonstrated this fact.

As *Latifa* elaborated:

> "Anybody walking along the production line will be amazed by the simplicity of the system (board) but yet very comprehensive and easily understood.Hence, we not only knew about the current TPS line but we actually will digest on what are the enhancements that have been developed throughout the time-line." [*Latifa*]

From *Latifa's* elaboration to the two managers, understanding of the TPS activities and their development was passed on, which provided *Chee* and *Ikhsan* with a detailed understanding of the production line events, and also made *Fadhil*, the TPS Champion satisfied.

In the case where some terms might not be familiar to those not normally on the production line (as for example, the *mizusumashi*, which is an electric threewheeled scooter, used for sending and transporting materials and finished goods), photographs were provided, as shown below:

Figure 5.1: Photo of "mizusumashi" pulling trolley

A *mizusumashi* is referred here to as the Fixed Course Pick-up, derived from a literal meaning of the Japanese word meaning Water Spider, Water Strider (ongoing line-side material delivery and empty container and Kanban pick-up, literally 'whirligig' (the beetle insect) representing something that revolves rapidly or changes continuously, with the intended meaning of a water strider. Its job involves circling the production line as a carrying feeder, hence the name *mizusumashi*.

Undoubtedly, the TPS Activity Board is very important in sharing knowledge about the production line, be that person a supervisor from other departments, managers and even upper levels of management. Moreover, its self-explanatory nature indicates that production does not have to be interrupted by the need to answer questions raised by such people.

This episode shows similarities with Episode 1 in respect to knowledge transfer that was portrayed successfully by the operator (*Latifa)*. It also illustrates that the associates (operators) in the production line does not perform their duties in ignorance without understanding what is happening on the production floor.

In respect of deep understanding, the operator portrayed a great appreciation of the events on her production line and was capable of explaining the development of the production line to upper-level management staff.

She also shows great confidence in demonstrating and providing detailed clarification on progress and developmental matters relating to the line. In respect to the knowledge of the System – Know-What, the episode deals with the understanding and explanation of what TPS is about, and it shows that the master owner (the person who possesses most knowledge) is the operator who is actually running the line.

When talking about tacit vs explicit knowledge, the diagrams and charts that help develop an understanding of the TPS and line development are not alone based on the explicit knowledge that they bring out, but the gist of understanding, and ability to explain and describe the line progress development involving tacit knowledge. The knowledge transfer in this episode is realised by consulting the charts, diagrams and data placed on the TPS Board.

In short, the activities and findings of Episode 2 across approaches of knowledge transfer are represented as follows:

Table 5.3: Activities in Episode 2 that represent Replication, Adaptation and Innovation

Episode 2 : TPS Activity Board and Line Tour				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Senior manager checks the operator's production understanding in his line tour			
2	The champion give an overview of the overall TPS development			
3	The leader explain the development of TPS project that has taken place particularly in their line.			

4	The manager check by asking the leader and Sup to explain what are shown on the TPS Improvement Checklist (on the TPS Activity Board)			
5	Two way communication took place here			

Finally in the aspects of approaches of knowledge transfer, this episode proved that TPS Activity Board and Line Tour as practiced in this episode is applied more ‘innovation’ with only small amount of adaptation to the situation.

5.3.2 Summary of Episode 2

This episode concerns an ad-hoc random management verifying the production system implementation. The subjects of this episode are one Manager, one General Manager, one Production Operator, and the Champion. This episode took place at the Condenser Line, Plant 101, which covers the philosophy (manufacturing systems) of TPS. Both two managers stopping by the line, and asking (or rather checking) for details of the TPS system implementation progress within the line, hence continues to show how the Operator, with the assistance of the Champion, explained the development of the line, its progress, problems, and achievement milestones. A detailed elaboration of the episode that crop up in front of the TPS Board (of the line) brought the story to life.

It has come to a clear understanding with the random management checking sessions, a various spectrum of where and what knowledge were transferred occurred; among others the use of board to explain the whole shop-floor, its effective ways of briefing the production systems as well as understanding the productivity as a whole.

This episode reveals the importance of places, actors as well as communication systems with regard to knowledge transfer that could be clearly observed and understood, enabling the validity and originality of how the knowledge transfer occurs in context be maintained.

5.4 Episode Number 3: CHAMPION

This episode covers a series of interviews and observations during the month of March 2006 with related personnel. The focal interview was conducted with *Fadhil,* a Champion for TPS in the Malaysian Gambatte plant.

Location	Piping Line, Plant 101, which is one of the production lines that covers TPS implementation
Time	Dates of observations and interview sessions = 6,8 and 10 March (Mon, Wed, Fri)
Personnel	Fadhil, Zaidi, Joseph, Zack, Seema, Kumari and Alisya
Terminologies	JIT = Just In Time
	WFC = Work Flow Chart

The scene of this Episode 3 was presented in Part 4.4 (Chapter Four) on page 103.

5.4.1 Discussion of Episode 3

The 'Champion' is the key person who actually 'owns' a specific important project. Normally s/he is the person responsible for 'acquiring' the new techniques, process or 'knowledge' concerning a new initiative, directly from the source, and subsequently s/he acts as the main resource and central point for the project involved.

In the case of Gambatte Malaysia (DNMY), particularly Gambatte TPS as elaborated here, the champion is *Fadhil*, a young executive with a rich enthusiasm for his work. He started working with Gambatte Malaysia after graduating with an engineering degree in 1993. Since then, he has gained experience through all the disciplines and projects with Gambatte. Being a fresh graduate at the start of his employment, he has had great opportunities and experiences with Gambatte, and was party to an extensive TPS project initiative which was launched at about the same time by the parent company. He went to Gambatte Japan for a month, and received the TPS new system of production training there. Later on, he also underwent one month training in Gambatte Thailand of TPS management in shop-floor area.

The 'champion' truly is in charge of the whole project, and in *Fadhil's* case he started recruiting the selected operators, making sure that every one of them fully understood what the TPS production system is all about, started implementation straight from the grass-root (the operators) and later on ensuring that all the levels above the operators could grasp the new knowledge related to the newly-launched TPS initiative.

As *Fadhil* expressed;

> "I realised that I do not have the precious time on my side and indeed my time is very limited to stop and teach every details of TPS like what I have recieved in Japan. Even though I had my training there, I just had one month to understand and master it. The training at the Gambatte Japan HQ was very well structured, basically on the job training attached at the production lines in their plant, and following one officer (trainer) after another. Each trainer trained us for one week, and we only have one day off per week, ie the Sundays. If we do that here everyone might be leaving and our production lines would be closed, then…", [*Fadhil*]

Fadhil further elaborated the importance of TPS and its elements.

Among the main knowledge that the upper managerial levels need to possess is an appreciation that running the production with TPS system has resulted in better quality, more efficient lead time, additional work flow efficiency, and high productivity and profitability.

The TPS Champion is also the motivator in respect of cultivating the Gambatte culture on the shop-floor as well as being responsible for delivering feedbacks further up the management ranks.

In this episode, we conclude the story of how *Fadhil* as the Champion takes full responsibility as the 'owner' of Gambatte's TPS Project and how its progress is of continual concern for him. The particular example showcased in this episode, is about the takt-time, which is the maximum time per unit allowed to produce a product in order to meet a certain demand. Literally, it is taken from a German word of 'taktzeit' which translates as cycle time.

As further illustrated by *Fadhil*:

> "Takt time would set the pace for any production line. Here in Gambatte Malaysia for instance, a car radiator is assembled on a specific production line, starting from the piping line and moved on to the next line and station after a certain time - which is the "takt time." Therefore, in simple understanding, the time needed to complete the work on each station has to be less than the takt time in order for the product to be completed within the agreed time."
>
> Elaborating further by scribbling on a piece of paper, *Fadhil* later explained: "Takt Time can also be easily defined by a simple formula of T equals to Ta over Td in which T = Takt time, e.g. [minutes of work / unit produced] , Ta = Net Time available to work, e.g. [minutes of work / day] and Td = Time demand (customer demand), e.g. [units required / day] and the Net available time is the sum of time available for work to be done which excludes break times and any expected stoppage time, for instance; scheduled maintenance, team meetings and briefings and others."

From the interview, in short the researcher learned that Takt time is considered as T = Ta/Td

Fadhil later elaborated:

> "If we have a total of 8 hours (or 480 minutes) in a shift (gross time) less 30 minutes of lunch, 30 minutes for breaks (2 x 15 mins), 10 minutes for a team briefing and 10 minutes for basic maintenance checks, then the net Available Time to Work = 480 - 30 - 30 - 10 - 10 = 400 minutes, and if

> customer demand was, let say that, 200 units a day and we were running only on one shift, then our line would be required to spend a maximum of two minutes to make for each part in order to be able to keep up with the customer demand."
>
> However, continued *Fadhil*, "in reality, the manpower and machines can never uphold 100% efficiency and there may also be other stoppages for some other reasons, thus time allowances will be needed for these instances and thus, we need to set up our production line to be running at a quicker tempo."

This came to the important point of absorbing the gist of what *Fadhil* had experienced and gained from Japan. This first-hand experience was significant in developing a sound understanding of the TPS system within the production operatives, and being able to implement the system, not only in theory but also in practice.

Further elaborating on this point, *Fadhil* continued:

> "We may also choose to alter the takt time accordingly to suit the production requirements within the plant. For instance, if there is a department which feeds parts to several manufacturing lines, it often makes sense to use similar takt times on all lines to smooth out flow from the earlier station. This means that customer demand can still be met by adjusting daily working time, reducing down times on machines and so on. These all need to be monitored by me, and the charting progress have to be elaborated to all team members on the shop floor."

Indeed, takt time can be gauged on every task in any business environment. It can be used in manufacturing (moulding, casting, drilling or preparing the workplace for another task), in controlling tasks (testing of parts, adjusting the machines) or in administration (answering standard inquiries, calling centre operation). It is, however, most commonly used in production lines which move a product along a line of stations, each of which performs a set of pre-defined tasks.

As ‘champion’, *Fadhil* also needs to point out the pros and cons of applying the TPS to takt-time, and this requires him giving a detailed explanation so that the operators and production team, as well as the maintenance team able of grasping the essences of it.

> “Among the benefits of implementing takt-time are the products will be moving along a line smoothly which in turn ease the identification for any bottlenecks, secondly the stations not operated reliably will be easily identified correspondingly, next with takt-time, there is a strong motivation to eliminate all non-value-added tasks, and that most tasks are similarly performed which could lead to higher productivity, while finally we will have a general idea of whereabouts of the production lot,” [*Fadhil*]

On the other hand, there are some difficulties in applying takt-time and TPS generally, which according to *Fadhil* are:

> “Fluctuations of demands, for example if demand rises, this could relate to difficulties adjusting shorter takt-time for instance, which need to also have quite a buffer to cater any break-down along the line; however this could be rectified by the TPS element of heijunka* and kanban*. Another drawback is that when the takt-time is too short, this could lead to lowering of motivation, and possibly relate to tiredness, absenteeism and also decrease the flexibility of the system as a whole”

*heijunka and *kanban will be elaborated in Episode 9.

> “This brings the important role of ‘Champion’, I need to be ready with ideas of solution as I am always regarded as the focal point in this TPS project for the entire plant.” [*Fadhil*]

> “In short, what I hope from the production team especially the maintenance team to recognize are that TPS need to be understood before being applied in reality. We do not want operators to do their work without understanding the essence of their work.” [*Fadhil*]

> "As we can see here, takt-time can be easily understood as the net time available for production over or divide by customer demand. It should given an adjustment and suggestion of time required for running the production without blindly following it by the numbers given. Let me show you an example; if for one work shift of 8 hours and working for 5 days a week, and for a week we have a demand of 200 pieces, the calculation will be (8 times 5 times 60) minutes divide by 200 pieces, that equals to 12 minutes, right…" [*Fadhil*]

> "Now, this guideline of takt-time if we take it literally, we would say that every pieces need to be produced in 12 minutes, every two pieces in 24 minutes and so forth. However, it does not follow that rule entirely, and what is most important is that to ensure the production operators really understand it, upon finishing the week, we must produce a total of 200 pieces, and that we can arrange the scheduling of the production according to all related factors that we have in the production line. As you can notice, the line might be facing breakdown along the way in particular shift of the day, therefore we need to make a clever adjustment on the scheduling" [*Fadhil*]

> "Some would say that if we continue producing at the idle rate, we could end up manufacturing more and more products thus we could meet up with higher demands., However, that is not the essence of TPS. As we understand, TPS is about lean manufacturing practices and that producing quantities greater than required lead to high storage and higher WIP (work in progress) and we might as well face an idle time. Indeed, over production and waiting are also wastes in lean manufacturing of TPS. Both will ultimately lead to higher WIP accumulation …" [*Fadhil*]

When further elaborated on why we need to stick to the takt-time, *Fadhil* mentioned that "……takt-time will give the rhythm in which the system should operate and that the production will be able to be smoothly planned and the operations will be carried out without interruptions"

"In addition, the system is in synchrony with the requirements of the customers and therefore, adjusting schedule could be made possible. There would be no over production and no rush hours whatsoever in daily work schedules. Following the system closely also allows the WIP to be reduced hence any problems in the system will be revealed and come out into the picture. In any case where there is a fluctuating demand the takt will change continuously following the customer demand," added *Fadhil*.

The relationship between this explanation and that associated with Kanban will be explained in later episode. From this compact episode alone, however, we can understand that in transferring manufacturing knowledge, there are several themes that have emerged from the storyline.

Firstly, we identify the fact that knowledge in this episode relates quite definitely to 'know-about', and that those who need to know are the employees, whatever their job function, whether part of the production team or even the maintenance team. Clearly, they have to understand the TPS thoroughly, hence, knowledge is not only concerned with knowing-what and knowing-how, but also knowing-about. As we can see here, although the aspect of knowing-what (literal meaning) of takt-time and knowing-how (calculation) can be easily comprehended, the most vital thing is for the workforce to appreciate the concept and to understand the method of translating related knowledge into an effective shop-floor implementation.

Secondly, awareness and understanding of knowledge transfer is not only about getting to know that it happens, but also requiring the receiver of the new knowledge to be deeply aware, and be conscious of what actually happened, why it is implemented, and what it is for. Only in such circumstances can a certain project run smoothly.

Another theme that could be unearthed here is the role of the knowledge transfer implementer. In this case, the role of 'Champion' involves being a Leader, Initiator, Guider and Referral Point for relevant personnel throughout the entire plant. In this episode we witness that *Fadhil* acts as the compass of TPS in the production line of Gambatte Malaysia and that he both functions as, and is perceived to be, the main focal point to ensure the project he is championing becomes a success and reality.

We can also notice that upon transferring new knowledge, in this case, how to comply with the new system of TPS, all walks of shop-floor personnel, the Manager and the Engineer apart from the production operators, were all involved and attended the short briefing.

Considering whether knowledge transfer in this episode is characterised by Adaptation or Replication, *Fadhil*, the Champion mentioned that he always remembered how the TPS system was implemented in Gambatte Japan HQ during his training and tried to implement it here similarly (replication), but for some circumstances, it was necessary to make certain adaptations to suit the local conditions (adaptation). With certain elements, a number of adjustments were required by the Champion to ensure the production operators and team are able to understand what was being transferred and this involved ‘innovation’.

The steps and mechanisms involved in knowledge transfer as witnessed in this episode, showed how TPS was transferred from Gambatte Japan to Gambatte (M) through the vehicle of ‘champion’ who was sent to the parent (Gambatte HQ) then subsequently responsible for implementing the new knowledge back in the subsidiary. This involved a month of intensive training for the Champion in Japan, together with other ‘champions’ from other Gambatte subsidiaries elsewhere. After the training, the Champion returned home bringing with him the new knowledge including documentation materials and also the materials needed for further elaboration of the system to ensure a deep understanding among the knowledge receivers in the subsidiary, in this context, Gambatte Malaysia. In short, the activities and findings of Episode 3 across approaches of knowledge transfer are represented as follows:

Table 5.4: Activities in Episode 3 that represent Replication, Adaptation and Innovation

Episode 3 : Champion				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	The Champion emphasises the importance of TPS philosophies			
2	The Champion express concerns to lesser the prod time with better significance of quality delivery as well as flexible production demands to be in “small lots”			
3	The Champion takes (performs) his tasks and jobs all-hearted			
4	The Champion works intelligently; with the best approach available			
5	The Champion lobbies with meetings, follow ups and show/presentations in management meetings			
6	The Champion ensures that the production plan transformed from ‘one line’ system into ‘cell production’ units			
7	The Champion reminds the pillars of TPS			

Finally regarding approaches of knowledge transfer, this episode of Champion demonstrates that more ‘innovation’ is applied here in terms of knowledge transfer with only small amount of adaptation that has been made in this situation.

5.4.2 Summary of Episode 3

This episode focused on explanation and discussion session held by the Champion at the production line regarding the implementation of the TPS system. The subjects of this episode are the Champion, a Section Head, a Manager, an Engineer and three production operators. It was held at the Piping Line, Plant 101, which covers the philosophy (manufacturing systems) of TPS. The storyline is about the Champion stressing the importance of implementing total TPS system towards the line, since the system is aimed at minimising waste and achieving efficiency in productivity. A detailed elaboration of the episode that occurred at the front of this piping line after a week’s results shows an increase in takt-time and process-flow, which makes the story more realistic.

From this episode, a number of themes were further developed, these include: awareness and understanding of the system; role in knowledge transfer; compliance of the new knowledge; know-how and know-what; adaptation vs replication; modification and improvement of the system; steps in the knowledge transfer process; referral and focal point of new initiative; commitment; nature of the work; levels of authority.

It has come to an obvious description that the role of "champion" is vital in ensuring knowledge is effectively transferred and understood. This episode demonstrates the importance of actor as well as the importance of following the systems correctly to ensure that knowledge transfer can be clearly observed, understood, enabling the validity and originality of how the knowledge transfer occurs in a context be maintained..

5.5 Episode Number 4: SUPER-OPERATOR & VISUALISATION

In this episode, the followings are involved:

Location	Cooling Unit and Blower Line (CUB), Plant 101
Time	A close observation on Tuesday, 04 April 2006
Personnel	Suzie, Saras and Fara

The scene of this Episode 4 was presented in Part 4.5 (Chapter Four) on page 107.

5.5.1 Discussion of Episode 4

The notion of super-operator arose when referring to the abilities of selected operators (the working level employees on the shop-floor), particularly for multi-skilled operator project in line with TS standards. These are people particularly with the special abilities to understand, and run different processes (machinery), that in turn makes them more flexible, offer job rotation, job enrichment and job enlargement.

The benefit of developing super-operators was noticed because as they are certified to run multiple machines, they can ensure the smooth operation in the production line, even when other operators are taking a break, or involved in 'gemba' sessions, training, or even if there is any sudden absenteeism.

The super-operators not only involved in job rotation to learn which machines are related to what particular operations, but they also have increased understanding and awareness, such that they believe that through proper implementation of the systems, products will become highly profitable, available in a more timely manner, good quality consistent with TS requirements, thus help to achieve the target of zero rejects.

Therefore, ultimately after certain duration of time spent at the line, these super-operators are returned to other production lines where they will implement and help transfer knowledge to others.

The themes that could be developed from this episode are: knowledge being transferred is procedural knowledge. This means that the operators need to thoroughly understand the TS system, thus there is a necessity to understand many things at the same time, which involves multi-tasking. It is quite hard to be certified on just one particular machine, but as the super-operators has proven, it is possible to be certified with five or six machines, with the possession of systematic knowledge sharing of the procedural type.

The mechanisms and mediums of knowledge transfer in this episode are the job itself, which includes the practice of on-the-job training, job rotation, job enrichment and job enlargement. The three types of job change are clearly elaborated by the operators in this episode: job rotation involves working on other machines that perform quite similar tasks, job enrichment involves performing another extra job or task in the same production line, while job enlargement involves working a job outside the current production line, ie, in another production line.

We can also identify from this episode the fact that to transfer the manufacturing practices involved in the creation of super-operators requires both tacit and explicit knowledge. The running of machinery required many explicit aspects of knowledge transfer involving procedures, steps, and certain skills. Specifically, obtaining the experience and grasping the aptitudes on preparing and becoming the super-operators involved the transfer of tacit knowledge from senior super-operators to their junior in-company trained super-operators to-be.

Another theme that emerged here was the need for motivation to provide effective knowledge transfer. For instance, in the comments from *Fara* we can clearly see that;

> "……being a super-operator, one is entitled for a special remuneration which is the monthly extra allowance pay (for the super-operators) to be payable directly into the monthly salary. …….a very good incentive for us." [*Fara*]

This aspect of motivation is considered positive reinforcement, the more machines one are capable to be operate , there would be more incentives awarded. Additionally, it was found that in the development of super-operators, speed, accuracy and quality must not be compromised. Toleration in standards during the training of super-operators is not to be accepted, even when super-operators are running a number of machines simultaneously on the shop-floor.

When an operator wishes to become a multi-skilled super operator, the visualisation of coding for certifications information is applied.

In short, the activities and findings of Episode 4 across approaches of knowledge transfer are represented as follows:

Table 5.5: Activities in Episode 4 that represent Replication, Adaptation and Innovation

Episode 4 : Super Operator & Visualisation				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Manpower mapping – operators vs machines { skill charts black shape in round coding of expertise to show operator level }			
2	Special coding to run machines – some require certifications			
3	More machines run by an operator, much better process			
4	Up to 5 machines run by 1 operator = “super operator”			
5	Certain hours of training = certified for a certain machine and skills			

Finally regarding approaches of knowledge transfer, this episode showing Super Operator and Visualisation as practiced in this episode is applying more ‘replication’ with only small amount of adaptation which has been made to the situation.

5.5.2 Summary of Episode 4

This episode is a snap-shot on what are the genuine work and task of a super-operator in a daily operation. The subjects of this episode are two Production ‘Super-Operators’, a new trainee ‘Super-Operator’, and their Supervisors. It was held in Cooling Unit Line, Plant 102. The story-line is about two super-operators working on six (6) different machines at one time, and that the trainee super-operator was basically on-job trained to be certified soon as a super-operator. A detailed elaboration of the episode that occurred inside that very production line will make the story realistic.

The implementation of “Super-Operator” through a clear means of developing and transferring new integrated knowledge leads towards better productivity, and much more efficient ways of working. This episode demonstrates the importance of the processes taken place in order to shape and develop what and where knowledge transfer can be clearly observed and understood, enabling the validity and originality of how the knowledge transfer occurs in a real context.

5.6 Episode Number 5: TRAINING – THEORY & PRACTICAL

This episode took place on a Wednesday at the Ventilator and Heater Line, in Plant 102.

Location	The training room of plant 102, adjacent to Vent & Heater Line that covers TPM implementations.
Time	Wednesday, 15 March 2006
Personnel	Zack and Operators on training
Terminologies	5 senses = the major five senses in human

The scene of this Episode 5 was presented in Part 4.6 (Chapter Four) on page 113.

5.6.1 The Discussion of Episode 5

From the episode featured here, we could see how training is done as a part of knowledge transfer. *Zack,* the trainer of the TPM himself has originally acquired these TPM philosophies, techniques and systems when he himself was trained in the parent plant at Gambatte Japan. After he went through a comprehensive training there, *Zack* must present and bring back the knowledge that he gained and further pass them to the local operatives, in this particular episode, through the process of providing training. In the Japanese parent company, he was not only trained theoretically about TPM, but also underwent the way of implementation or indoctrinate the systems thoroughly practically which meant that he needs to bring those parts to ensure the personnel here in Gambatte Malaysia could uphold and conduct things the right way

As he mentioned:

> "…. I went to Japan to be officially trained and handed over this TPM. It took two whole months to acquire all the necessary requirements, and still I could not say that I am the expert…" [*Zack*]

On delivering the training, Zack acted not only as a teacher preaching the new knowledge of implementing the new TPM, but he also had to be playing an important role of a moderator, motivator, ice-breaker for them to easily absorb the new knowledge. This is clearly shown when Zack started the process by showing that he needed to have some kind of 'funny bones' and attention-catcher. Indeed, this was the way to get undivided participation from the operators (participants).

From this episode, we could also understand that the training was divided into two sessions, the morning session is the theoretical part and the afternoon session involved the practical portion of training. Both would complement each other to ensure a successful knowledge transfer and exercise.

During the theoretical class, it started with a good ice-breaking activity, added into it some elements of humour, lively discussions and real examples. Through this session, the trainer could develop a form of bonding with the participations and attentions gained from the audience would be optimised.

Regarding the materials of the training packages, *Zack* revealed:

> "For different levels of audience, we provide different types of materials so that they could acquire and absorb the knowledge much smoother and straight to the point intended to be passed. The materials that we collected from the Japanese parent company were adapted and some adjustment and improvement were made to suit with the audience,"[*Zack*]

When asked what he meant by "getting the adjustment and make to suit with the audiences", *Zack* elaborated:

> "Well, for today's training, the target audiences or participants are the operators from the shop-floor, and looking at their academic background,

role, status and responsibilities in the plant, and to make them understand quickly and getting the gist of the TPM system in smooth order, we need to dilute and make the materials of training much more lower academically and much more attractive in term of presentation with real down-to-earth examples that could catch their attention and understanding much faster hence make the training much more efficient…"[*Zack*]

"…Like making the examples relating the senses with cooking?," asked the researcher to *Zack*.

> "Yes, like what we have seen here, in the theoretical training we have already illustrate the examples of cooking. Then, during the practical training in the afternoon, the participants are emphasized to use the five different senses towards the machines, that is the sight, hearing, smell, taste and touch with the machines themselves and imagine what are needed to be aware with the importance of getting the senses sign for whatever that could lead to any problem…." [*Zack*]

When asked, is the story of cooking example was there in the notes of materials which are prepared for the training, *Zack* answered:

> ",,,The examples come directly from me after looking into the types of audiences. As we can see today's participants are the production operators where majority of them are women, so I made an example of cooking a meal at home to suit them. However, sometimes when the operators are mostly men, I normally use the examples of checking our motorcycles…..We need to make examples of things that are close to their heart, then only we could get their attention, participation and cooperation. There are no instructions whatsoever and processes were according to the capability of the trainer…" [*Zack*]

> " …it is very important to understand and to absorb the importance of understanding TPM, one need to always use the 5 senses in their daily work near their machines, and *Zack* gave good examples of dishes

preparation at home; that include the smell of the food being cooked and knowing also from the look and even by the smell itself, and simple touching and looking at the form of our food, all of these are stimulus taking place." [*Zack*]

"Therefore, during the second half session of the training, it was found that a sample of each stimulus from different senses was later presented and the participants were later asked to feel (touch) and understand about them. There was a machine with fired (shortages) cable, another machine that was not running smoothly which needed attention to the surface of the machine work-top, and there were samples of machine giving out part breaking sound…., which all of these need good application of the five senses." [Zack]

From this episode, the themes that could be developed, among others is that knowledge function as a know-about knowledge, which the training of TPM is about to make the participants understand TPM as well as to inculcate the awareness of its importance.

A clear theme that emerged here is the training itself; in which training is regarded as an important medium in transferring knowledge, which involves formal training that could be applied in a classroom-like environment and informal training that could take place in practical-like situation.

It is also clear that the mediums used in the training involved the presentation styles and the discussions involved. As we have noticed, the presentation should be clearly well presented so that the materials of the training could be absorbed effectively. Another theme which is also important was that a different level of understanding involves the use of different materials. This was proven by *Zack* as he said that different training book and terms are mentioned and targeted to be used towards different group of audiences with regard to different levels of understanding, academic and technical qualification as well as experiences.

Looking into the steps and processes of knowledge transfer involved, what has been carried out by *Zack* was that he tried to prepare and ensure the new knowledge is successfully transferred through various processes accordingly. Not only in the short episode of this training, but in the process of transferring the new knowledge as a whole, some steps were taken.

The first should be the initiation process. We could see how *Zack* made his way to break the ice and start the training with the operators. The next step involved the implementation and getting-along process, in which *Zack* explained about the TPM and how to implement it in the production line. Finally *Zack* showed with examples, and this is directly related to the integration with the real samples as in the production line.

Another important theme is that the role and capability of the trainer himself to be able to control and cater to the whole team and the process of the training efficiently. This is important so that an effective training could take place.

On checking the understanding and absorption of the trainings by the audiences, a post training quiz was prepared as mentioned by *Zack*;

> "….to ensure that we could check the understanding and absorption of the trainings by the participants, a post training quiz was held in the later hour after the practical session. The quiz was actually about the same list of questions asked in the early pre-training, and affirmatively, we will get better results of answers from the post-training quiz which proves that after the training session and after being involved with the details of the practical exercise, we can see better improvements and that we can be sure that the main elements of TPM knowledge was transferred here….."

Indeed, the use of pre-training quiz and post-training quiz, to ensure that they really understand what has been trained for is a good method to gauge that the training has been successful and that the knowledge has been transferred effectively.

Upon looking into the effectiveness of the training and the evidence of the transferred of manufacturing practice knowledge among the participants, the researcher managed to get a quick feedback from short interviews with the participants from the training.

When asked how did the participants find the training and how that the training could affect their work, most of the responses were as follow;

> "…the training was conducted very well, the trainer could relate with real practical examples to our daily life, and what we received was that not only understanding what TPM is, but also why it is important and ways to implement it…" [*Senah*]

> "…what I like about the trainer was that, he really involves us into the discussion and brings out real examples during simulation or practical training, I mean the second part of the training in the afternoon…." [*Ravi*]

> "…at first I felt a little bit nervous or some kind of quite boring feeling when I was asked to join the training session this morning. However the trainer started really well and made us feel very comfortable during the whole day which truly helped my understanding….." [*Mia*]

This shows that to ensure the knowledge is effectively transferred in any kind of training environment, a friendly casual initiator is the key for its success.

In finding out any barriers or problems for the knowledge that could not get through, *Zack* and the operators give their accounts as below:

> " ….for me, I can see two types of barriers,which I refer to as internal and external barrier. Internal barrier is the person that come to the training himself or herself, and external barrier relates to surrounding factors. For example, if a person who comes to the training prepared to learn with open heart and full attention and the trainer gives the maximum training effort he could provide, there would be no internal barriers at all…," said *Zack*.

"…but if there is a feeling of disliking towards the training, or dislike to be advised or showed what is wrong also feeling that the training is such a burden or just like finding one's mistakes, thus this kind of attitude would lead to bad training result…" added *Zack*.

"…for the external barrier, the surroundings, environments and materials of training play very great impacts, that is why we prepare this training room in this special setting with the equipments and facilities that could give a very conducive environment for the operators to be trained. We also ensure that the room is well-lit, the air-cond is functional and that the handouts are sufficient and easily readable and presentably prepared. We also make sure that after the first half of the session, we give them a tea-break and the second half we fill it with the practical trainings. You know that continuous talking in trainings make them bored, sleepy and will give less impact…," finished *Zack*.

In short, the activities and findings of Episode 5 across approaches of knowledge transfer are represented as follows:

Table 5.6: Activities in Episode 5 that represent Replication, Adaptation and Innovation

Episode 5 : Training: Theory & Practical				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Training in two sessions, morning lecture style and afternoon practical trainings.			
2	Early session started with ice breaking – trainer must be creative			
3	Start also with pre-training quiz and end up with post-training quiz, normally the 'same' sets of questions.			
4	Use of all 5 senses in 'sense training kit'			
5	Training with good analogy examples{boat and baby}			
6	Trainer need to know the level of trainees			
7	Steps in trainings			

Finally regarding approaches of knowledge transfer, this episode shows that Training: Theory and Practical as practiced in this episode applied more ‘adaptation’ with only small amount of innovation. Replication has been made in the situation.

Indeed from this episode, we can see the evidence that training is yet another important aspect of transferring knowledge of manufacturing practices.

5.6.2 The Summary of Episode 5

This episode focuses training which involved theoretical as well as the practical forms. The subjects of the episode are the Trainer, and eight (8) other operators. It was held in a Training Room of Plant 102, adjacent to Vent & Heater Line which covers the philosophy (manufacturing systems) of TPM. The story-line is about the trainer imparting and delivering the training to the operators on TPM. First theoretically in a class-room like section of the room and later on practically at the next section of the room with related sample apparatus involved. A detailed elaboration of the episode that occurred throughout the session made the story alive.

This episode further explores the importance of knowledge transfer that can be clearly observed and understood, in this context related to its process and mechanisms of training, enabling the validity and originality of how the knowledge transfer occurs in context be maintained.

5.7 Episode Number 6: CHARTS WITH DIFFERENT COLOURS OF PEN

In this episode, the following details are involved:

Location	ECU Line, one of the production lines in Plant 103
Time	Thursday 13 April 2006
Personnel	Sally, Asma and Lee
Terminologies	ECU = Engine Control Unit ICAR = Internal Corrective Action Request QC = Quality Control QC Gate = Place where the inspection of product by the QC took place

WIP = Work In Progress

The scene of this Episode 6 was presented in Part 4.7 (Chapter Four) on page 118.

5.7.2 The Discussion of Episode 6

The episode is about the importance of closely following instructions on the quality measures, in which there is a necessity to mark a chart with three colours of pens, and hence it must be followed.

ICAR notification issued by the QC (Quality Control) team is meant for process checking, detecting and finding defect internally within the plant by the QC testers before the items are shipped out to the customers. ICAR notification are normally issued at the ‘QC Gate’, a term referring to the quality control checking bay at the end of each plant production lines involved, which literally resembles the final gate any items must pass to be legitimate and approved for shipment out of the plant.

ICAR is a medium to check the qualities of task which the rules and procedures need to be uphold strongly before passing it out of the plant. Any deviation or forgetfulness in applying any procedures inside the production line although seems to be small, will cause an ICAR notification will be issued. When ICAR is issued, it will go straight to the Section Head of a certain production line, which later on need to be answered and reply back to the QC Department. ICAR indeed is one notification that no operators would like to receive.

In this episode, we can see how tight the standards and procedures which needed to be followed. Although the use of different colours to mark entries in the chart may seems not as important in our daily life, but in Gambatte (M) context, particularly in line with the requirements of TS and being the standard practice of TPM, different colours mean different interpretation.

Thus, in this episode, we can see that the application of codification through the colours in the charts. We can understand from this episode that the colour of a

pen resembles certain meaning; such as green, means production passed and items can be sent to QC, blue refers to further refinement and red tells us that the items need a major improvement of the product or reworking.
With this detailed colour of ink on the charts, the receiver body of the products or the next person using the machine will know the previous performance of the product and machine.

Therefore, the type of knowledge involved in this episode regards procedural knowledge, how to mark the charts and involves codification and decodification of knowledge. It is also very clear that the medium of transferring the knowledge is through visual colour-coding.

Another important aspect to ponder, is how the operators keep the pen at the location. The action of tying the pens together and later attached it near to the chart-board by the machines is remarkably smart. This exemplifies the attempt of adaptation or modify towards betterment, as *Asma* says:

> "....to buy one multi-coloured pen is good, but to come out with cheap, basic and practical three pens tied together in such a way is the best solution according to *Lee*, and he as well as all of us in the production line are very happy with this idea..." [*Asma*]

The knowledge involved was also on featuring aspects of know-what, know-how and know-about. Knowing what is ICAR, and how to answer it and knowing about getting the things in contexts. The involvement of colour coding of the charts also reflects efficiency which moves towards better productivity.

From answering ICAR as well, the important knowledge of always putting and abiding standards and processes in the shop-floor along the production line is vital. No one can make an excuse for not following the established standardised systems as stated, and nor anyone can create new system apart from what has been discussed and argued about.

This also resembles transfer of explicit knowledge across different people (in the plant), in which by looking at the colours of the pens, we know what they mean and that the new way of tying the pens together need to become standardized.

Indeed, in transferring this form of knowledge, other themes could further emerge and support the themes as follows; we can see aspect of compliance in following the procedures and standards in daily works, so that even a simple instructions of using different colours need to be adhered; next is about speed, where the urge and need to answer and rectify the problems must be dealt with quickly.

In term of whether the knowledge transferred involved replication or adaptation, a later interview with *Lee* discovered the followings:

> "…as for implementing different colours of pen on the charts, we actually copy the standards method from our parent company, where they use green, blue and red coloured pens respectively as we do here; only that the new solution of tying the three individual pens are totally new and that the way they want to tie them is quite unique…the production team, particularly *Asma* and *Sally* have put their thoughts and provide us with such a good adjustment and new way of dealing this problem especially in responding to the ICAR" [*Lee*].

In short, the activities and findings of Episode 6 across approaches of knowledge transfer are represented as follows:

Table 5.7: Activities in Episode 6 that represent Replication, Adaptation and Innovation

Episode 6 : Charts with Different Colours of Pen				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Visualisation of colour coding of inks on the charts			
2	Different colours represent different meaning regarding the productions			
3	Supervisor will check the use of colour coding			
4	If wrongly coded, corrective actions are requested			

5	Visualisation of where to perform maintenance, for instance is assisted with real photo coding			

Finally, regarding knowledge transfer approaches, this episode shows that Charts with Different Colours as practiced in this episode applied slightly more ‘replication’ than adaptation..

Thus, we can understand here that there are elements of replication in copying and using the three colours of the pen, and as well as adaptation where illustrated from the application of different individual pens tied together in threes.

5.7.3 The Summary of Episode 6

This episode emphasizes quality check on the yield production ratio. The subjects of the episode are a Production Operator Sally, her (the operator) Supervisor Asma, and the Section Head Lee. It was held in ECU Line, Plant 103 which covers the philosophy (manufacturing systems) of TPM as well as TS. The story-line is about feedbacks gathered from the Internal Quality Control Unit on a current trend of the production quality and speed of delivery. A detailed elaboration of the episode occurred by the side of the affected line showing that different colours of charts represent different meanings and making the story real and lively. This episode reveals the significance of mechanisms and processes and how doing things differently could make knowledge transfer to be clearly observed and understood, enabling the validity and originality of how the knowledge transfer occurs in a real context and provide a newness feature of this research.

5.8 Episode Number 7: DAILY MAINTENANCE & FIVE Ss

This practice took place at 4.30pm, daily. The researcher managed to observe this episode closely on Tuesday, 18 April 2006

Location	CDI Amplifier Line, which is one of the production lines that covers TPM implementation
Time	4.30pm, Tuesday, 18 April 2006
Personnel	Neeta, Aisya, Lisa, and Lan
Terminologies	CDI = 'Capacitor Discharge Ignition'
	5S = 1) Seiri = Sort
	2) Seiton = Set in Order
	3) Seiso = Shine
	4) Seiketsu = Standardization
	5) Shitsuke = Sustain in Discipline
	SOP = Standard Operating Procedure
	PM = Preventive Maintenance

The scene of this Episode 7 was presented in Part 4.8 (Chapter Four) on page 125.

5.8.1 The Discussion of Episode 7

This episode took place in the CDI Line, of Plant 103. CDI is the short form of '*Capacitor Discharge Ignition*', a key component in electrical parts that most two-wheelers use which also involve other parts such as starter motors, generators, spark plugs, ignition coils, flywheel magnetos and voltage regulators and it is one of the items produced in Gambatte Malaysia. The researcher was keen to look into a set of three operators; namely *Neeta*, a line-leader, *Aisya*, a production operator, and *Lisa*, a fresh operator that just started to work with the plant for a week. Further interviews were also conducted with the Line Supervisor, *Lan*.

The purpose of selecting these personnel as research subject was to understand how the implementation of the 5S activity through the use of music as a medium to indicate the time to perform such activity, and also to look into how this new knowledge of process passed and transferred to the new members of the operators.

We acknowledged that the practice of 5S lean more towards preventive measures and maintaining the efficiency of the machineries in the production line. The practice of 5S by using music medium is unique and actually mirroring the one that has been practiced in the head-quarters. In fact, the playing of the music to ignite 5S activity originally comes from the parent. As *Neeta* explained:

> " …initially the 5S process originated from our parent company Gambatte in Japan. They usually play a kind of Japanese marching rhythm to motivate the associates for 10 minutes everyday, at their parent plant which is 2.00pm Japanese time, and that we are applying the technique here…"
>
> "…later on we adapt and make some modification so that it suits our working environment better. Only that, here we use our local music to suit our people and environment…." [*Neeta*]

When asked how the operators understand to implement 5S, *Neeta* and *Aisya* explained that the process happened mainly through following what the seniors and with the help of the expatriates:

> "We started the 5S project by initially playing the same Japanese marching rhythm, with most of the operators could not understand the meaning at all, and did not also appreciate it…" [*Neeta*]
>
> "…then, the seniors in the production line showed to us and explain how to do 5S and we successfully did it…" [*Aisya*]

> "…not only we did what they showed us on how to conduct the 5S, but also they made us understand what are the significance of performing 5S….we do what we understand and so that we will do them whole-heartedly…" [*Neeta*]

When exploring further how the process takes place, both of them agreed that by performing 5S with high discipline and following the process closely, a much better performance of the machines could be achieved.

> "….we want the operators to be highly disciplined and provide full commitment in performing the 5S, not only responding to the music in doing it, but also having the sense of belonging and ownership for the machines that they are working with…" [*Lan*]

When asking about the type of music involved:

> "…for ten minutes, they use different types of music every day…" [*Aisya*]

> "…and for Friday, the most up-beat music that symbolise the end of the weekdays of the week is applied….", added *Neeta*.

Another important theme is that the application of performing the 5S is done through clear understanding of the process;

> "…we do not want them to just perform 5S by just doing it, but we want them to perform it with an open-heart, if you know what I mean…" [*Lan*]

> "…and not simply to memorises the name of the different Ss in the 5Ss, but understanding and applying them in work, that knowledge should always come naturally, and by following it step by step…", reminded *Lan* further.

Another unique thing is that the exercise is carried out at the same time (ie at 4.30pm) daily. When asked further, it is found out that this is also due to the way normal human body response, which is during the afternoon; we tend to become sleepier, a bit of lethargic and tired, therefore, in need of extra new charge and boost.

From the interviews, it is known that *Neeta*, the line leader in this episode has been working with Gambatte for more than 12 years. Her experiences provided an important element in the exercise, where with the amount of experiences, *Neeta* was actually a key personnel involved even in the initial planning of the exercise. When a meeting was conducted back then, 10 years ago and an opinion was thrown on which time of the day is best to perform exercise, here is what *Neeta* recollected:

> "Yes, I still can remember that when the management asked what was the time best to implement 5S, I suggested it to be held in the middle of the afternoon shift. Initially it was suggested at 1.30pm in the afternoon, but me and my colleagues were against that idea, first because 1.30 is very close to the end of the morning shift, ie 2.00pm and just over a lunch break time for the office-hours personnels, and secondly we believe that 4.30pm should be the best since for most of the operators, the afternoon shift is felt as the longest shift to work with, and also it is also good and beneficial for those working in normal hours to be involved as well. That is during this period they would tend to feel sleepy in the afternoon, thus this can be a good middle time to refreshen up for both group" [*Neeta*]

As *Neeta* and *Aisya* further explained:

> "By exercising 5S, we will make our machines less problematic, experiences less stoppages and that the production runs much smoother…" [*Aisya*]

> "…and we know the knowledge on 5S is transferred when the operators manage to perform the processes own their own and perform them the proper way…" [*Neeta*]

When looking deeper at the functionality of music, it acts like a reinforcement that the operators need to respond. Particularly, the different songs for different days also give an indication of what day is today.. In fact when looking at the way how 5S implementation has been changed ever since, it is like a real improvement; first through replication on making it as a 10 minutes machine cleaning as the Japanese parent did, then via the phase of adaptation by changing the songs played, and finally involving modification by adding the types of different songs for different days.

The reinforcement involved was through initial following of the seniors and later on by hearing the music tempo, it is like conditioning which becomes a stimulus response. Similar to the experiment of Pavlovian dog salivation, where the dog salivates when seeing a piece of meat and upon the sound of ringing of the bell paired together with the meat. Later when only the sound of the bell rang, the dog automatically salivates even without the presence of the meat.

This is what happened here. First the operators were instructed to and were given explaination about 5S, detailing the step by step implementations of the 5S to clean the machines. At that time (4.30 pm) paired with the music; after some time they do not need to give the instructions and shout about 5S, and only by playing the music, the operators all perform 5S. This reinforcement involved conditioning with stimulus and response.

When looking into the technical aspects, this also involves a mixture of 10 minutes TPS per-day to combine with the maintenance daily machineries check-ups that immerge to be practical in term of time-sharing, resources sharing as well as coherently checking and avoiding any problems that could occur in the machines across the lines. In short, it is indeed a kind modification here.

The modification of replicating the actions to perform 5Ss (Sorting, Setting in Order, Shining up, Standardizing and Sustaining) as what the parent Japanese practiced, and involved adapting with the local music with further additional on selecting specific time of the day, integrated with different types of music to mark different days as well as involving the elements of preventive maintenance of the TPM in it.

Furthermore, as *Aisya* and *Neeta* mentioned that the process of story-telling is also very much important to nurture the importance of understanding towards imparting the skills of knowledge machine care taking. As mentioned by *Aisya* earlier, one needs to take great care of the machines. This is also the essence of Preventive Maintenance (PM) as the figure below showed by them, and according to *Neeta* using analogy as a form of storytelling related to the importance of lubricating as in using the boat and the frictions it faces drifting through the water:

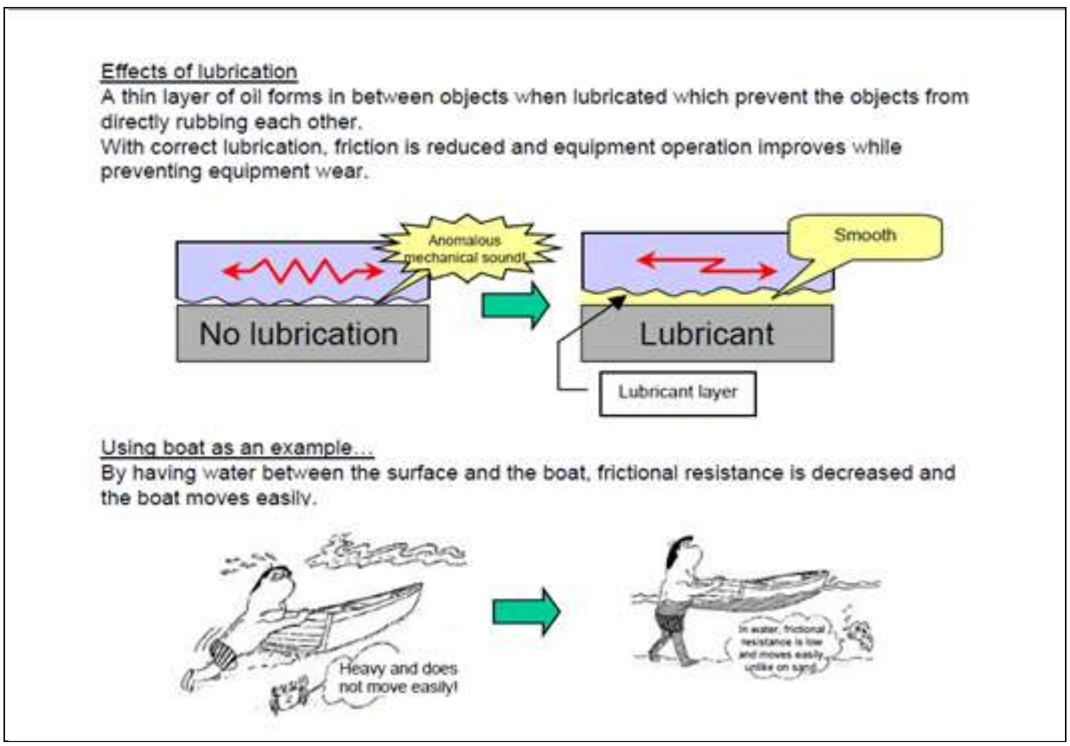

Figure 5.2: Analogy of lubrication with boat and friction

In short, the activities and findings of Episode 7 across approaches of knowledge transfer are represented as follows:

Table 5.8: Activities in Episode 7 that represent Replication, Adaptation and Innovation

Episode 7 : Daily Maintenance & 5 Ss				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	At specific time everyday 5S is implemented by operators			
2	Oiling and lubrications by operators are performed at specific intervals during the day			
3	Audio sense is used to mark a certain activity (5 S) at the shop floor			
4	On-job training by following what seniors are performing			
5	Explanation given during the 5S to the trainees			
6	Copying 5Ss via mirroring techniques			
7	Time of 5Ss applied there (Japan 2.00pm), and 4.30pm (time of the day in Malaysia)			

Finally regarding knowledge transfer approaches, this episode shows that Daily Maintenance and 5Ss in TPM as practiced in this episode is applied a little more ‘adaptation’ than replication in this situation.

5.8.2 The Summary of Episode 7

This episode is about a scheduled machine cleaning routine. The subjects of the episode are three Production Operators, and their (the operators’) Supervisor. It was held in CDI Amp Line, Plant 103 which covers the philosophy (manufacturing systems) of both TPS as well as TPM. The story-line is about an exercise routine of cleaning machines implemented by the reinforcement of music played ten (10) minutes every day at the same time. A detailed elaboration of the episode that occurred on the site of the affected production line shall make the story authentic and alive.

It has come to a clear understanding that during the 5Ss session, even the ‘sound’ of music could trigger what knowledge that could be transferred; here the operators ‘know’ what to do and what is the significance in performing the 5Ss.

Elaborations of story-telling even make the process much more fruitful and ensure that the knowledge transferred are well received to all the recipients.

This episode exhibits the magnitude of unique medium and mechanism on where-about and when knowledge transfer can be clearly observed and understood, enabling the validity and originality of how the knowledge transfer occurs in a real context be maintained.

5.9 Episode Number 8: TPM CORNER & WWA – "Why Why Analysis"

In this episode, the following details are involved:

Location	Evaporator Line, which is one of the production lines that covers TPM implementation
Time	Wednesday morning, 29 March 2006
Personnel	Adnan, Abidin and Ghanesh
Machines	Evap3 and Evap7 – tube cutting machines for evaporator and radiator joints
Terminologies	TPM = Total Productive Maintenance 5S = The 5 S cleaning system (refer episode 7) WWA = Why Why Analysis

The scene of this Episode 8 was presented in Part 4.9 (Chapter Four) on page 132.

5.9.1 The Discussion of Episode 8

This episode was about a meeting of TPM that occurred in a specific meeting area called 'TPM Corner' near the production line. The designated place consist of only a small table without any chairs which made it less official, less protocol among the members of the meeting, adequate enough to conduct a quick meeting and that it could also nurture close casual informal interaction without discounting the importance of formal respects based on the ranks. A photo of a typical TPM Corner in Gambatte Malaysia is as below:

Figure 5.3: TPM Corner

In this episode, it is notified that a TPM meeting was held among a representative of the production team, normally the line leader, *Adnan*; a technician, *Abidin* and an engineer from the Maintenance, *Ghanesh.* Apart from *Abidin* who has over eight years working experience in Gambatte, both *Adnan* and *Ghanesh* have more than ten years experience with Gambatte. Thus, their interaction was smooth and communication was quite clear.

We saw that they brainstormed to try to figure out the source of the problem on why the machines were malfunctioning. Then, *Ghanesh* suggested the WWA as in TPM should be applied, and throughout the process, they kept asking and looking deeply into the root of the problem until machine *Evap7* was operating back to normal. The way of asking five stages of “why” is to discover the deepest root of the problem.

From further interview with them, it was understood that the WhyWhy Analysis (WWA) is a method learnt from the Japanese parent. A year before that, a team of Gambatte engineers came from Gambatte Japan to demonstrate how to perform the WWA system. The important part of WWA is to develop the sense of finding the answers for the problems based on experiences held by the locals. This is the essence of the WWA method that was meant to be transfer to Gambatte Malaysia. A sample of WWA steps process provided by the parents is as follow:

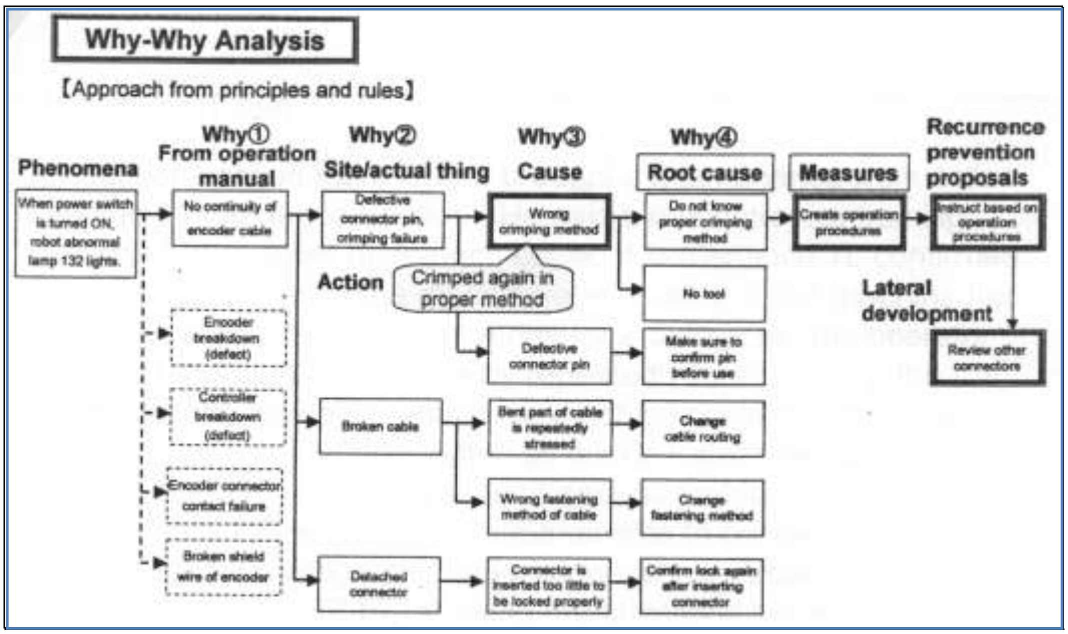

Figure 5.4: Sample flow process in WWA

We can discover a number of themes throughout the episode. First, of course in applying the WWA analysis, we can see that certain systematic steps in acquiring certain tacit knowledge is applied. This was achieved since the quests for searching the answers of the “Ws” are all from the understanding of the problems asked. Apart from that, all the answers are from what they have understood, thus are tacit. This is proven with the conversations between Ghanesh, Abidin and Adnan. Their experiences gave responses and suggestions towards betterment and continuous improvements.

We can also notice that how a simple place could be an important meeting place that provides the medium of transferring knowledge here. We could see that a basic chair-less corner with a steady table and practically located by the side of the production line, a more informal interaction with less official, less protocol meeting could be held. But this is not the case that respect is not adhered here, as we can always see that all the questions from *Ghanesh* were addressed respectively, since *Ghanesh* is an engineer and by rank, he is the highest ranked among the three.

We can also see that the meeting progressed using assertive and short statements so that the pace could be stepped up to cut any time wasted. As TPM according to the engineer, *Ghanesh* is about "looking for the solution, not discussing the problem...", and all these happened around the small table of TPM Corner. In short, a precision of time, speed and effectiveness could be achieved.

From further interviews with *Ghanesh* and *Abidin* later, this TPM meeting is actually a modification or adjustment based on what Japanese expatriates did, as they actually do not even have any table nor chairs, and thus just meet wherever and whenever needed. The following excerpts from the interviews confirmed the points:

> "….but here, we do not want the technician, line leader and whoever involved have the feeling that the TPM Meeting is not important, so that's why we create this concept of TPM Corner….", said *Ghanesh*.
>
> "…and after further discussions with the management, as we want to make the meeting more powerful as to influence the TPM to be expended throughout the plant, and to make it have a more official appearance, that is why we create a corner with the table…," added *Abidin*.
>
> "…right, and another factor is that we want to differentiate between this TPM meeting and Gemba, since TPM is also a bit new in Gambatte Malaysia. Furthermore, according to local customaries and culture, the

connotation of the term "meeting" is always associate with proper sitting meeting that also involved a bit of refreshments, which we do not want that to happen, as it will drag time and cost….", explained *Ghanesh* further.

"…and we want some important info, data and stats. to be ready at hand whenever we discuss it in our meetings, that is why we have the TPM Corner surrounded with the these important materials…", added *Ghanesh* more.

When asked further what kind of materials available near the TPM Corner and how they could help the knowledge transfer process;

"…those are the basic maintenance related *Pareto* charts that mainly show the performance of the machines in our lines, thus they really help when further inquiries are needed to be performed on the machines, especially in our TPM meetings…" [*Abidin*]

"…indeed by having the TPM Corner, a better flow of knowledge transfer could be produces with whatever materials to be discussed. We could also brainstorm and identify the root cause of the problems till the deepest root of the problems". [*Ghanesh*]

In short, the activities and findings of Episode 8 across approaches of knowledge transfer are represented as follows:

Table 5.9: Activities in Episode 8 that represent Replication, Adaptation and Innovation

Episode 8 : TPM Corner & Why Why Analysis				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	At specific time of the day, important personnel involved gather for a meeting at TPM corner			
2	Meeting place allocated with table without chairs			
3	Finding out problem via troubleshooting in group discussion			
4	Looking into why the stoppages of the production machine occurs			

5	Charts and graphs are used for assistance in the TPM meeting	■		
6	Beside charts, first hand information and abnormalities reports from operators involved are also referred		■	
7	Performing Why Why Analysis (discussion in group)		■	
8	Finally answer emerged and machine repaired and back to running condition.		■	

Finally, regarding knowledge transfer approaches, this episode shows that TPM Corner & Why Why Anaysis in TPM as practiced in this episode is applied a more 'adaptation' than replication in the situation. That is how the TPM Corner emerged and that by practicing it, the new knowledge of TPM in production maintenance could be transfer successfully.

5.9.2 The Summary of Episode 8

This episode is about a morning 'standing' meeting in order to discuss daily problems on machineries in production line. The actors involved are, *Adnan*; the technician, *Abidin* and an engineer from the Maintenance, *Ghanesh* while the line is Evaporator Line on Plant 101 which covers the philosophy (manufacturing systems) of TPM. The story-line is about a machine which was slightly under-performing and another machine that is facing increasing number of stoppages which leads to a meeting how to solve these problems. A detailed elaboration of the episode that occurred at the TPM Corner made the story alive and meaningful.

It has come to a clear understanding that after the method of implementing the meeting without a 'proper' meeting place; ie the use of TPM corner which is just a table with charts around it is a unique way of implementing new knowledge. A quick snap of how the WWA - Why Why Analysis is performed, which is truly Japanese (Gambatte HQ) origin implemented also provided a clear understanding of the process of knowledge transfer.

This episode displays the importance of places and processes where knowledge transfer can be clearly observed and understood, enabling the validity and originality of how the knowledge transfer occurs in a context be maintained.

5.10 Episode Number 9: KANBAN CARD SYSTEM

In this episode, the following details are involved:

Location	TPS Compressor Line which is one of the production lines that covers TPS implementation
Time	Close Observation on Tuesday, 25 April 2006
Personnel	Ghazali and Nizam
Terminologies	M133 = general order number MA447190-32520R = part number for *Kenari* (a car model) product

The scene of this Episode 9 was presented in Part 4.10 (Chapter Four) on page 135.

5.10.1 The Discussion of Episode 9

Kanban basically is the "card" which contains all the information of the product or merchandise that is running through the production floor. This card consist all the detailed information on what product need to be running, who is the customer, what is the job-lot size, and when is the estimated target time to finish the production. In short, information regarding the production of a certain product follows the '*kanban*' card.

A series of '*kanban*' shows that there are different job-lot products needed to be running and produced. By following the slots arrangement, the operators or whoever is running the production shall know which job-lot or which products must be produced at that exact time, so that it will arrive to the customers accordingly (following to their demands and orders).

In this episode, *Nizam* can easily know the whereabouts of the *Perodua Kenari* products in such great details based on the information on the *kanban* card. He also can know how many days of cycle time the product can come out from the assembly line. As TPS is a system that works on pulling production based on customer demand, *kanban* card really help the system operate smoothly. A number of significant themes emerge from this episode.

First, we can see here that a unique kind of knowledge needs to be mastered and transferred. The *kanban* card for example, the knowledge as a know-where-about knowledge is very important that involves locating the materials through the application of *kanban* card, an important element of the TPS system.

In order to ensure that it is easily understood and accepted, according to further interviews with Nizam and Ghazali, both very well experienced with more than 12 years in Gambatte;

> "…we need to make the whole team understand that we only need to produce according to the customer's order….which we use the term, product by demand, product by order. To make things easy, we should always refer to *kanban* card, this is because all the shop orders come from the customers, and each request is noted through order cards, which is the *kanban*…" [Ghazali]

Nizam and Ghazali later explain the importance of *kanban* through story-telling.

> "..We need to ensure that all the operators are following orders accordingly, not jumping the queue just to make things easy….. I give you an example, if the first third and sixth order in the queue are the same products, we should not make them together first, as the second and forth orders could be urgent lots…..thus, although maybe we think we could make products easier and more upfront, but what will happen if the customer who ordered the second product cancelled them? We could lost one of our business here…", explained *Nizam*.

> "…just like if we go inside any McDonalds™ outlet. If we look properly into the burger orders and productions, they are actually applying *kanban*,….For instance if there is only two BigMc™ left, and AN order came from A customer who orders ten cheese burgers, the staff need to prepare the ten cheese burgers, although if he was making extra BigMc for spares at that moment….", added *Ghazali*.

This is indeed the key substance for process and understanding of lean manufacturing, in which the production operate on the basis of pulling system and by demand request only. The storytelling approach really makes it easy to capture and that anybody listening would be able to absorb the knowledge.

The *kanban* coding system is highly standardized and very systematic that makes material searching very easy, and less hectic.

This important knowledge is vital in making sure that only the exact product needed to be running at that very moment, even though if the machines are currently set to run a different product. Meaning that what has come first in order, need to be followed sequentially.

To make the system easy to follow and consistently being obeyed, the *kanban* card must always be together with the job-lot wherever the product is and whatever the process they are engaging on. Here the high discipline of compliances and following procedures need to be adhered closely.

> "…*kanban* help smoothen the system, as each of us understands it is important to just follow and make ourselves highly compliance with it. K*anban* is also very reliable in securing our production target to become reasonably smooth. Moreover *kanban* card in Gambatte are all using QR code format…", added *Nizam*.

Ghazali continued by explaining the wisdom of levelling the intended knowledge needed to be transferred through the actual production that is running across the line;

"…by understanding it, when the line leader finds out that if there are a lot of different types of productions need to be running, here comes *Heijunka*, which is the wisdom of levelling….and this knowledge of adjusting *kanban*, and making the production smooth could only be transferred from experience, mingling, observation, analysis and understanding the scenarios of the production trend and situation at that certain time….", said *Ghazali*.

"…This is achievable only through adapting what has been learnt from the systems, coupled with the experiences in the shop-floor and all the productions data and statistics that we have….", explained further *Nizam*.

Kanban indeed is a medium through which the new knowledge of TPS system could be transferred and that the operatives need to be following closely with discipline.

"..With *kanban* also results the speed and quality of the production that should sail swiftly across the production line which translates into better productivity and higher profit in the long run…" [*Ghazali*]

In short, the activities and findings of Episode 9 across approaches of knowledge transfer are represented as follows:

Table 5.10: Activities in Episode 9 that represent Replication, Adaptation and Innovation

Episode 9 : Kanban Card System				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Use of *kanban* throughout all the production processes			
2	*Kanban* emphasizes Gambatte QR Code so that all info are in tact			
3	Only the warehouse can give (order) production *kanban* and that requested unit will ultimately arrive back at warehouse for shipment			
4	Shop order coming from the customers			
5	The (kanban) orders can be in small unit sizes (even n=1)			

Finally regarding knowledge transfer approaches, this episode shows that Kanban Card System in TPS as practiced in this episode is applying a more 'adaptation' in the situation. An element of 'innovation' and 'replication' also exist to make the situation realized.

5.10.2 The Summary of Episode 9

This episode is about an immediate need of locating, relocating and searching production parts in the production line, due to an urgent customer request. The subjects of the episode are a Warehouse Supervisor, two Production Operators, the (Operators) Supervisor and the Champion. It was held in AC Amp & Controller Line, Plant 103 which covers the philosophy (manufacturing systems) of TPS.

The story-line is about an urgent request to add quantity number to an existence expedite production lot from a regular customer, in which the personnel involved quickly try to locate it. A detailed elaboration of the episode that occurred at the production line makes the story authentic and bright.

It has come to a clear understanding that only by using a simple card system, known here as *kanban* could bring new knowledge transfer. From a previous unimproved system of production, by implementing *kanban*, a new efficient way of calling for production is visualised. A quick snap of closure of what the production line is benefitting from *kanban* system makes the episode much more effective.

This episode makes obvious the values of systems, even small in nature, but when implemented correctly and effectively, knowledge transfer can be clearly observed and understood, enabling the validity and originality of how the knowledge transfer occurs in a much realistic context and provide a novelty feature for this research.

5.11 Episode Number 10: PRODUCTION LINE SIMULATION

In this episode, the following details are involved:

Location	Training Room of Plant 101
Time	Wednesday, 12 April 2006 afternoon after a lunch break
Personnel	Bahrin, Mazlan, Chung, Nasser, Fadhil
Terminologies	super-operator = an operator certified to handle multiple machines chukka chukka = multiple machines handled by one operator WIP = Work In Progress TS certs = certification of TS16949 Suggestion Slip = a slip operator writes (suggestions) for further improvement of the production line.

The scene of this Episode 10 was presented in Part 4.11 (Chapter Four) on page 139.

5.11.1 The Discussion of Episode 10

This episode highlighted two themes that are also important in ensuring how knowledge of manufacturing practices could be transferred in a subsidiary plant of an MNC.

The first theme is simulation. We can see in this episode that to make one understand the flow of the production, the personnel involved in the meeting are using lego™ bricks blocks to visualize the settings arrangements of the line. This arrangement involves physically imagination in locating the blocks with the assigned smaller scaled production line model. All the measurements are relatively accurate according to the smaller scale, and blocks of lego™ representing the machines, workplaces, shoots and storage are placed and arranged accordingly.

The process of simulating the outlook of the production line makes the transformation of TPS implementation much easier. The future face of the shop-floor could be decide within less time constraint and could be held in a meeting room. This is the beauty of visualising the production plant usinge small bricks units of the 'lego™' bricks that really made the planning come into vision.

Secondly, the transferring of knowledge of this kind of nature requires good support and opinion so that more mutual understanding could be gained. To receive the support and acquire authoritative reviews, discipline and roles of the personnel involved should be placed as equally important.

In this episode, we can also see how the members of the meeting paid a good respect to listen to Mr *Nasser*, a very nice man who himself is the Gambatte Malaysia Plant Quality Director. Not only that his communication skill and ideas are good, but his appearances are easily codified in visualisation. *Nasser* came wearing his special red coloured cap which tells the whole plant that he is from the Quality Department, a department in charge of quality assurance, and he is also a recepient of Gambatte Star of Loyalty in symbolized by a gold-plated emblem with the number 20 attached on the cap meaning he has been serving Gambatte for 20 years. This not only shows his experiences, but also amplifies more wisdom, and gained charisma in his personality. His senior (rank) makes him respectable, his visions and comments are always sharp and straight to the point and that his suggestions proves logical, practical and effective.

Similar respect is given to young Mr *Fadhil*, who is the TPS Champion for Gambatte Malaysia. In this episode, we can also see that by using the lego™ bricks blocks, good simulation of the line is provided, and by implementing sate simulation, much better representation and understanding could be achieved.

Further simulation by "*bento*" and applying '*kawakuri*' are later used. *Bento* is a resemblance of a box-tray where we carry our meals in it, while *kawakuri* is a principle that uses 'free access energy', in which recycled energy is used for another purposes, for instance on the lower ground shop floor, gravity is beneficial there.

This episode is also related to the 'Suggestion Slips' from the Operator (Associates) Corner of the TPS Board situated at the production lines. A sample of the Suggestion Slips is shown below:

Figure 5.5: Suggestion Slip Board

Moreover, each Operator who posted a Suggestion Slip, will be paid RM5 if the suggestion is elected as ideas for improvement. Later on, for each slip that their idea is implemented, the operator who suggested it will receive RM50. This indeed, will provide a motivation for the operators.

Thus, from the above said example, a couple of other themes are further discovered an extracted. We can see that one's 'role' plays an important function in transferring knowledge. Each officer in the episode, Bahrin, Mazlan, Chung and Nasser have their own role in Gambatte Malaysia and that by adhering and playing each of their roles closely, one could transfer the knowledge much easily and effectively. Each officer in the meeting represents individual department.

Another theme that could be extracted is the power of visualisation and how knowledge is adapted and modified in the subsidiary company. As mentioned by *Mazlan*:

> "…in our parent company, they plan the production plan mainly by looking into pictures and diagram, while here we modify it by using the model blocks so that better visualized idea of production line could be attempted to be sought out…" [Mazlan]

> "..We even use multi-coloured lego™ blocks so that they could get the visualisation of the production line much more clearer…" [*Bahrin*]

In short, the activities and findings of Episode 10 across approaches of knowledge transfer are represented as follow:

Table 5.11: Activities in Episode 10 that represent Replication, Adaptation and Innovation

Episode 10 : Production Line Simulation				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Simulating production systems with toys			
2	Simulating production systems with lego blocks			
3	Simulating with 'sate' system of ordering and producing			
4	Comparison of *kanban* with fast food outlets ordering system			
5	Changing line style production into cell style production			
6	Simulating production cell by using "*bento*"			
7	Simulating and applying the principles of '*kawakuri*' in the production line			
8	Asking on-hand feedbacks from operators (kaizen plan sheet)			
9	Use of yellow suggestion slips by operators			

Finally regarding knowledge transfer approaches, this episode shows that Production Line Simulation in TPS as practiced in this episode applied more 'innovation' in this situation. The impact of making the planning via simulation also reflects high profitability. Planning of production line could be much faster without discounting the issue of quality. Teamwork is also vital and can be rewarding. Thus, here we can see that after such level of adaptation taken and done, the process of 'innovation' takes place.

5.11.2 The Summary of Episode 10

This episode is about a simulation of a problem-solving meeting on the TPS project. The subjects of the episode are the Quality Director, as well as four committee members of the TPS team which consists of one Manager, one Engineer and two Section Heads. It was held in a training room near the Piping Line, Plant 101 which covers the philosophy (manufacturing systems) of TPS. The story-line is about checking on the certifications processes and documents, rescheduling and rearrangements of new compliances on the TS system and trouble-shooting any hiccups. A detailed elaboration of the episode that occurred will make the story alive.

It has come to a clear understanding that from the simulation process, a number of processes and mechanisms were conducted and that eventually modification of knowledge transfer would take place. Empowerment and feeling of ownerships among the actors are evidently established in this event. This episode demonstrates the importance of knowledge transfer which can be clearly observed and understood. This enables the validity and originality of how the knowledge transfer occurs in a real context and provide a novelty feature of this research.

5.12 Episode Number 11: GAMBATTE CULTURE OF OWNERSHIP & TPS LAYOUT IN ACTION

In this episode, the followings details are involved:

Location	Vent & Heater Line, Plant 102 covers TPS implementation
Time	Monday, 01 May 2006
Personnel	Fadhil, Alice, Meena, Arifin, Joe, Nasser and Mr Ono
Terminologies	WIP = Work In Progress Chutes = Moving stackers that help to move the materials in the WIP from one point to another. chukka chukka = multuiple machines handled by one operator Gambatte DNA = a special traits that should be firmly upheld by every Gambatte employees of Gambatte Malaysia, feeling of belongingness with Gambatte

The scene of this Episode 11 was presented in Part 4.12 (Chapter Four) on page 142.

5.12.1 The Discussion of Episode 11

From this short episode, the operators in Gambatte Malaysia, are exposed in implementing new knowledge of TPS in the production line, in which they must feel that the production line is like a baby. The operation need to be taken with great care, for instance in this case is about the machines and other instruments in the production line.

For Gambatte employees, working in the production line requires more than understanding of the processes. It also must be felt by heart and feeling that Gambatte belong to them. Thus if one feels that Gambatte is a part of his/her own life, he or she will work whole-heartedly, and treat Gambatte as his own company. This is the unique way of showing ownership in Gambatte that strengthen the feeling of belongingness.

Referring back to the implementation of TPS system in the layout of the production line, it is found out that the operators are being handed full rights and responsibilities to handle the machines.

> "….Since most of the operators are women, thus by putting the responsibilities on them as they if they are handling and taking care of the babies when they are taking care of the machines make the sentiment grow fonder and that the responsibility of taking ownership increases…", added *Fadhil*

> "…Furthermore, it is like indoctrinating the inclination towards the organisational culture; in which the culture of Gambatte here are needed to be inclined, adopted, cultivated and adapted in daily work so that the operators will make Gambatte as a part of their life…", said *Nasser* in the following interviews.

In a further special related interview with Gambatte Malaysia Managing Director (MD), Mr *Ono*, he mentioned that;

> "…..The ultimate goal is to make and imprint of Gambatte DNA into each and every associates and employees as implanting this Gambatte DNA is very important. We wish it to happen gradually, but yet having marked in the hearts of all the employees…" [*Ono*]

And as further explained by Mr *Ono*;

> "….working with Gambatte is in our hearts, not only in our minds and pockets….here in Gambatte, always remember that we are one family, it is not only important to embrace all the joy and endure any kind of sorrow together, but also how to live and work happily and meaningfully across the two horizons…." [*Ono*]

Even Mr *Ono* himself has been working for more than 30 years with Gambatte. He gained his initial experiences during his first 10 years with Gambatte Japan and further on the past 20 years with foreign attachments, 12 years in South

America, 5 years in North America and the last three years with Gambatte Philippines, so with the massive expatriate and global experiences, he could now be known as a global Gambatte managing director without subliming the importance of the current excellent quality practiced.

In short, the activities and findings of Episode 11 across approaches of knowledge transfer are represented as follows:

Table 5.12: Activities in Episode 11 that represent Replication, Adaptation and Innovation

Episode 11 : Gambatte Culture of Ownership & TPS Layout in Action				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	The TPS Champion introduce layout of new line to operators			
2	The new layout built with less walking movement area			
3	*Chutes* are introduced shorter and less WIP involved			
4	Having / owning the machines as their (operators') babies/kids			
5	New layout aiming to develop more super-operators			
6	Making Gambatte culture as a way of working – Gambatte DNA			

Finally regarding knowledge transfer approaches, this episode amplifies that Gambatte Culture Ownership and TPS Layout in Action as practiced in this episode applied a little more 'innovation' in the situation.

5.12.2 The Summary of Episode 11

This episode is about the working environment in the affect of the new TPS Layout in the production line and the Gambatte working culture. The subjects of the episode are two Production Operators, their (the operators) Supervisor, the Champion, and one Technician. It was held in Vent & Heater Line, Plant 102 which covers the philosophy (manufacturing systems) of TPS. The story-line is about how the operators and the employees are inculcated with the Gambatte spirit and culture to feel the sense of belongingness as a part of "*Gambatte DNA*". A detailed elaboration of the episode that occurred in the production line shall make the story genuine and lively.

This episode demonstrates the significance of establishing a standard inside individuals, and that knowledge transfer can be clearly observed and understood here, enabling the validity and originality of how the knowledge transfer occurs in a real context and provide a novelty feature of this research.

5.13 Episode Number 12: ASEAN JESHUKEN

In this episode, the following details are involved:

Location	Plant 102 Meeting Room and Radiator Line, which is one of the production lines that covers TPS implementation.
Time	Thursday morning, 30 March 2006
Personnel	Fadhil, Pranthap, Sudarjo, Kim, Lina, Lily, Esah, Ghani and Malek
Terminologies	Asean Jeshuken = an important meeting between the champions of TPS for regional based plants across Gambatte in the Asia Pacific region

The scene of this Episode 12 was presented in Part 4.13 (Chapter Four) on page 144.

5.13.1 The Discussion of Episode 12

The *Asean Jeshuken* is an important twice a year meeting between the champions of TPS mainly for the Gambatte plant in the Asia Pacific region. The researcher is very lucky to have the opportunity to observe this activity which took place and that the episode occured together along with the *jidoka andon light* flashing in action.

When asked about the *Asean Jeshuken*;

> "….it is a twice a year meeting which takes place across four facilities; ie our Malaysia, Thai, Indonesia and Aussie branch, in which one of us will take turn to become the host. Normally in the series of Asean Jeshuken, most new issues of TPS are discussed, a more standardized stream lining between the TPS implementations in the four sites are compared which provides a better way of new knowledge would be transferred, compared and shared among us…" [*Fadhil*]

> "…In the series of meetings, most of us who attend this series are the champions of the TPS projects in our own plants, Every relevant knowledge, practices and systems that is being practised in our own place will be discussed by the experts and champions of the TPS itself…"[*Kim*]

Therefore, there are a number of themes that could be extracted from this episode. First, among the theme that can be clearly seen is the relationship between the Gambatte employees. Although they are from different branches through out the region, the way they communicate indicates that they have already knew each other well before hand and that this showed that the formal – informal relationship is an important factor to make the transferring of knowledge smooth. The spirit of one *Gambatte DNA* as mentioned in the previous episode seems to be working and the level of cohesiveness among the members of the *Asean Jeshuken* is great.

Next, the type of knowledge which is the procedural techniques of applying certain processes universally. It is related more to the explicit knowledge be in the form of processes, procedures, and step by step instructions; however, when coming to knowing what to do right at the right time, how to deal with problems, only then the element of tacit knowledge comes into the picture.

The background of each of the actors in this scene also plays an important role to the knowledge being transferred. *Pranthap* is the Champion of TPS at Gambatte Thailand with experience of 15 years in production with mechanical engineering degree background. *Sudarjo* is the Champion of TPS at Gambatte Indonesia. He holds experience of 14 years in the production line with technical diploma and technician and production line background before becoming the champion. *Kim* is the Champion of TPS at Gambatte Australia with experience of 13 years in production with electrical Australian engineering degree background and finally *Fadhil* as stated earlier in the episode of 'champion', is the Champion of TPS in Gambatte Malaysia with more than 13 years being with Gambatte Malaysia in production line and engineering section and who graduated with a mechanical engineering degree.

From the episode, we can also see a number of further themes that are revealed. It has been confirmed that tacit knowledge of the members of *jeshuken* is based on experiences while the explicit knowledge in books and documents related materials and implementation of the new knowledge of the manufacturing practice highly related to the speed and quality of the job done.

In terms of the flow of knowledge, it is found that the knowledge is transferred from lower operator's level to the upper levels, thus forming some sort of bottom-up knowledge movement.

We also determined here that the *Asean Jeshuken* can be used as an inspection mechanism and comparing methods between plants. This could also involve reverse knowledge transfer where the knowledge that was originally from the parent could be transferred back among the subsidiaries, in which could be discussed and put into suggestion for future research.

Another interesting theme was that the universal prescribed knowledge. Although the personnels come from different plant and countries, the original knowledge from the parent plant is applied similarly to what has been transferred from the parent. Again the theme of whether replication versus adaptation in knowledge transferred is applied, and it was discovered as stated by *Fadhil*;

> "….Initially *Jeshuken* was held among the different plants in Japan. They often meet at the main head-quarters, and later on the TPS champions among them would make a quarterly meeting and visit. That is what we are applying here among the Asean region TPS champions which we also adapt into our context to suit the environment here…" [*Fadhil*]

In short, the activities and findings of Episode 12 across approaches of knowledge transfer are represented as follows:

Table 5.13: Activities in Episode 12 that represent Replication, Adaptation and Innovation

Episode 12 : Asean Jeshuken				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	The activity of *Asean Jeshuken* involve 4 TPS teams from Asean region of Gambatte			
2	The joint team initiated with theory and concept training in a classroom environment			
3	Later the team would have simulation and role play			
4	The team conduct improvement project and activities at the site (production line)			
5	Champions of regional Gambatte (T) and (I) checking terminologies and testing the associates as per said processes			
6	The team present the project to the management of the host plant			
7	When the *jeshuken* ended, the team dispersed and went back to their own plant, and submit report to the (*Asean Jeshuken*) host.			
8	Visits among Gambatte in Asean (regional) to counter-check implementations and understandings (every 6 months)			

Finally regarding knowledge transfer approaches, this episode shows that *Asean Jeshuken* as practiced in this episode is applying a more balance between 'innovation' and 'adaptation' in that situation.

5.13.2 The Summary of Episode 12

This episode is about an important checking mechanism on the implementation of new manufacturing practices. The subjects of the episode are the Champion, three (3) officers from Gambatte regional plants, one Super-Operator, two other operators, their (the operators') Supervisor, and a Manager. It was held in the Radiator Line, Plant 102 which covers all the philosophies (manufacturing systems) of TPS, TPM and TS. The story-line is about a scheduled tour of the Champion and other member of Gambatte Regional Base inspecting the implementation of TPS, its problems and ways dealing with it. A detailed elaboration of the episode that occurred at the production line makes the story spot on and vibrant.

It has come to a clear understanding that this episode tells us that by gaining new knowledge on certain things, even as small as signal or colour of 'light', one knows the condition of the production line. Another important aspect to relate is that with a quick glance of the light, the person in charge and the operators who run the machines will know what to do, or not to do. This would lead towards better production line operation and productivity at large.

This episode demonstrates the importance of understanding even into minute details related to knowledge transfer and can be clearly observed and understood, enabling the validity and originality of how the knowledge transfer occurs in a real context and provide a novelty feature of this research.

5.14 Episode Number 13: CUSTOMER COMPLAINT

In this episode, the following details are involved:

Location	AC & Amplifier Line, Plant 103 covers TS implementation
Time	Wednesday, 19 April 2006
Personnel	Evonne, Mahbub, Din, Sham and Hussin.
Terminologies	Customer Complaint DB – Customer Complaint Database
	CM Team – Counter measure team

The scene of this Episode 13 was presented in Part 4.14 (Chapter Four) on page 148.

5.14.1 The Discussion of Episode 13

From this episode, the implementation of TS on Customer Complaint was done systematically. The customer complaint database was established correctly and received clarification promptly. The counter measure team was established on time and performed their jobs well.

The establishment of the whole process shows that at Gambatte, the issue of quality and TS related were well addressed and attended. The counter measure team, not only managed to answer and find out the solution of the complaints, but also managed to share with other teams and lines as well.

In short, the activities and findings of Episode 13 across approaches of knowledge transfer are represented as follows:

Table 5.14: Activities in Episode 13 that represent Replication, Adaptation and Innovation

Episode 13 : Customer Complaint				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Establishment of customer complaint database			
2	Receiving and clarification of complaint			
3	Investigation customer complaint			
4	Establishment of counter-measure team			
5	Carry out counter-measure through cross function			
6	Sharing counter-measure to other area team			

7	Close-up the counter-measure			

Finally regarding knowledge transfer approaches, this episode shows that Gambatte Malaysia Customer Complaint as practiced in this episode applied a little more 'replication' in the situation.

5.14.2 The Summary of Episode 13

This episode is about customer complaint received by Plant 103 Gambatte Malaysia, and a quick response with database and counter measure team was established to address the issue. This episode demonstrates the significance of following the TS quality standards and following the systems wisely; enabling the validity and originality of how the knowledge transfer occurs in a real context and provides a novelty feature of this research.

5.15 Episode Number 14: PROCESS CONTROL AT PRODUCTION LINE

In this episode, the following details are involved:

Location	Compressor Line, Plant 102 covers TS implementation
Time	Thursday, 06 April 2006
Personnel	*Nan, Azzem, Laili* and *Budeen*
Terminologies	FMEA = Failure Mode Evaluation Analysis
	FIFO = First In First Out

The scene of this Episode 14 was presented in Part 4.15 (Chapter Four) on page 150.

5.15.1 The Discussion of Episode 14

From this episode, the implementation of TS on Process control at production line was conducted steadily. The whole process was done and showed by the section head and supervisor and the operators followed thoughtfully.

The establishment of the whole process shows that at Gambatte, the issue of TS related and quality at large is paramount. The statistical control, element of *poka yoke* and implementations of FMEA and FIFO showed that Gambatte (M) upholds quality at a very high level.

In short, the activities and findings of Episode 14 across approaches of knowledge transfer are represented as follows:

Table 5.15: Activities in Episode 14 that represent Replication, Adaptation and Innovation

Episode 14 : Process Control at Production Line				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Set up new production line			
2	Study the risk of defect			
3	Establish statistical process control			
4	Introduction of *poka yoke* in the production line			
5	Establishment of final inspection			
6	Control of First In First Out			

Finally regarding knowledge transfer approaches, this episode shows that Gambatte Process control at production line as practiced in this episode applied a little more 'replication' in the situation.

5.15.2 The Summary of Episode 14

This episode is about process control in the production line in Plant 102 Gambatte Malaysia. A quick briefing was given to the operatives working on the line. This episode demonstrates the significance of following the TS quality standards and systems prudently; enabling the validity and originality of how the knowledge transfer occurs in a real context and provides a novelty feature of this research.

5.16 Episode Number 15: CONTROL OF MACHINE SPARE PARTS

In this episode, the following details are involved:

Location	Maintenance Room, Plant 102 covers TPM implementation
Time	Friday, 31 March 2006
Personnel	*Zack* and *Faisol*
Terminologies	Machine SPMS = Machines Spare Parts Management Systems

The scene of this Episode 15 was presented in Part 4.16 (Chapter Four) on page 151.

5.16.1 The Discussion of Episode 15

From this episode, Gambatte Malaysia proved that the implementation control of machine spare parts is done correctly and in line with the requirements of TPM of Gambatte Corporation.

The establishment of machine SPMS, data structure and ordering level as well as correct and clear labelling plus storage in the exact places confirmed that TPM system is well versed in Gambatte. The knowledge on how to stock in stock out and receive as well as dispose the parts further verified that Gambatte upholds a good standard of TPM.

Table 5.16: Activities in Episode 15 that represent Replication, Adaptation and Innovation

Episode 15 : Control of Machine Spare Parts				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Establishment of Machines Spare Parts Management Systems			
2	Set up the Data Structure			
3	Set up the Ordering Level			
4	Establishment of storage system condition			
5	Establishment of identification labelling system condition			
6	Managing stock-in stock-out of the parts			
7	Conduct receiving and disposal of the parts			

Finally regarding knowledge transfer approaches, this episode shows that Gambatte Malaysia Control of Machine Spare Parts as practiced in this episode applyied a little more 'adaptation' in the situation.

5.16.2 The Summary of Episode 15

This episode is about control of spare parts of machines in Plant 102 Gambatte Malaysia. A quick check on spare parts was conducted by the maintenance team. This episode demonstrates the significance of following the TPM standards and systems cautiously; enabling the validity and originality of how the knowledge transfer occurs in a real context and provides a novelty feature of this research.

5.17 Episode Number 16: PREVENTIVE MAINTENANCE

In this episode, the following details are involved:

Location	Maintenance Office, Plant 101 covers TPM implementation
Time	Monday, 10 April 2006
Personnel	Ghanesh, Bahrin and Radzi
Terminologies	PM = Preventive Maintenance
	PdM = Predictve Maintenance

The scene of this Episode 16 was presented in Part 4.17 (Chapter Four) on page 153.

5.17.1 The Discussion of Episode 16

From this episode, Gambatte Malaysia proved that the implementation of preventive maintenance in line with the requirements of TPM in Gambatte Corporation adhered closely to standards. We also learn that the implementation of PM by the operation in the production line must have the feeling that the machines is like their baby that needed to be handled with great care.

This is the essence of Preventive Maintenance in TPM approach. The following figure reveal this essence:

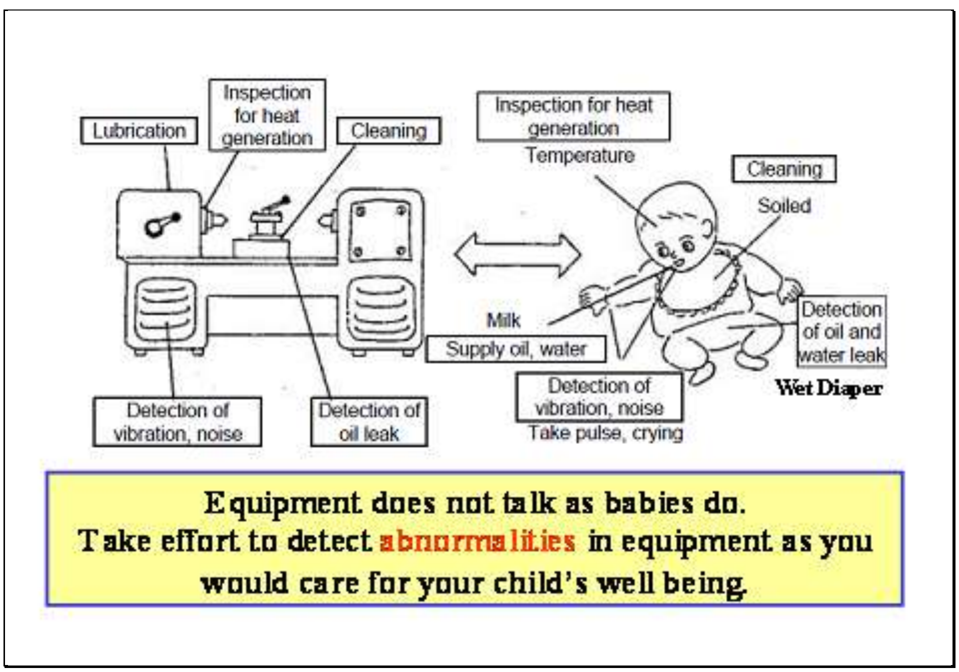

Figure 5.6: Analogy of PM with baby care

The establishment of PM schedule and checklists confirmed that TPM system is well versed in Gambatte. The knowledge on how to conduct predictive maintenance and conducting test run towards the machines upon finishing as well as taking care of them like babies further verified that Gambatte upholds a good standard of TPM.

Table 5.17: Activities in Episode 16 that represent Replication, Adaptation and Innovation

Episode 16 : Preventive Maintenance				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Establishment of Preventive Maintenance Schedule			
2	Establishment of Preventive Maintenance items and check sheets			
3	Deploy maintenance staff based on competency			
4	Conduct Preventive Maintenance (activities)			
5	Test-run machines after Preventive Maintenance			
6	Conduct Predictive Maintenance			
7	Summary Report of Preventive Maintenance			

Lastly, regarding knowledge transfer approaches, this episode shows that Gambatte Malaysia Preventive Maintenance as practiced in this episode applied a little more 'adaptation' in the situation.

5.17.2 The Summary of Episode 16

This episode is about Preventive Maintenance in Plant 101 Gambatte Malaysia. A quick detailed diagram of scheduling PM was showed. This episode demonstrates the significance of following the TPM standards and systems cautiously; enabling the validity and originality of how the knowledge transfer occurs in a real context be maintained.

5.18 Chapter Summary

To conclude this chapter, it is noticeable that by combining the elements of moderate observation by the researcher, coupled with in-depth interviews held with the respondents, made the screen-shots of the episodes more clearer so that a more dramatic, real, original and true evidence of how the processes, steps and ways of knowledge transfer are clearly crystallised in the real situations.

This is indeed a discussion of what actually happens on the shop-floor of the production lines involving three systems of the manufacturing practices, TPS, TPM and TS in Gambatte Malaysia. A further systematic qualitative thematic extracting chapter together with discussion is to be discussed in the following Chapter 6.

Chapter Six

Summary of Finding and Discussion

6.0 Introduction

This chapter explains in detail the findings of this research. The objective of this chapter is to present the comprehensible qualitative findings extracted from the thematic analysis techniques that generates the themes, categories and sub-categories of the data.

The thematic analysis method is based on inductive coding approach of Boyatzis (1998). Using this method, the themes emerge inductively from the data during the process of coding and analysis as explained in the methodology chapter. Throughout the analysis, the emergence and development of the dimensions for knowledge transfer is explored in detail.

In this analysis, the main data comes from the interviews. There are a huge number of quotes from the interviewees available, though only selected important quotes are presented here, to demonstrate the essential meaning of all the applicable categories. In certain parts, the scenarios from the episodes and observations of the production plant are also exemplified to connect them between the position and the events.

In some instances, the repetitions of the same quote could occur more than once if the quote represents more than one important issue. This is necessary as throughout the data analysis process, one quote can be given numerous different coding names to represent situations, issues and, or sub-category it signifies.

Above all, the essence of the emergence of the theme development in this chapter is based on the two main research questions:

1) **How does knowledge transfer within a subsidiary of an MNC occur?**
2) **What are the (necessary) circumstances that make the knowledge transfer possible?**

The following table summarizes the findings of the emerging themes based on the two main questions. The emerging themes are further elaborated in the remaining parts of the chapter.

Table 6.1: Summary of the Main Emerging Themes

How does knowledge transfer within a subsidiary of an MNC occur?
(*This question detailing the approaches of knowledge transfer – see part 6.1 below)*

Knowledge transfer approach via Replication
- Repetition in actions
- Mirroring and copying others
- Procedures and sets of tasks
- Documentations that are clear and fixed
- Standardized in a system

Knowledge transfer approach via Adaptation
- The need for understanding
- The requirement for explanation
- Need to perform additional tasks
- Need for adjustment

Knowledge transfer approach via Innovation
- Creating new interpretations
- Employing new ways in completing tasks
- Finding fresh solutions for existing problems

What are the (necessary) circumstances that make the knowledge transfer possible?
(this question detailing the circumstances of knowledge transfer – see part 6.3 below)

Nature and classifications of knowledge transferred
- Classifications and types of knowledge transferred
- Intensity of knowledge transferred

Place / Location where knowledge is transferred
- Certainty of the place
- Purpose of the place
- Bounded by time and the nature of the event

Diversity mechanisms and the nature of knowledge transfer
- Formality of the mechanisms
- Types of training activities

Mediums of knowledge transfer
- Language usage
- Types of communication

Factors affecting knowledge transfer
- Personal factors
- Roles of ownership and attributes of players
- Organisational factors
- Motivational factors

The following sections will further elaborate the themes as summarised above. The discussions are detailed out systematically, first of research objective one, followed by research objective two.

6.1 Summary of Findings on Knowledge Transfer Approaches (Research Objective One)

When talking about knowledge transfer, particularly within a subsidiary of an MNC, the need for understanding of how knowledge is transferred is very important. This is therefore addressed in the research question number one. To answer this, the findings from the episodes comprising interviews, observations and documentations generated three main approaches to how knowledge is transferred within a subsidiary of an MNC. The emerging approaches are explained in depth, in the following paragraphs.

6.1.1 Knowledge Transfer Approach via Replication

The first approach of how knowledge transfer occurs within a subsidiary of an MNC is through 'replication'. The following emerging themes are to show how knowledge is transferred through the approach of replication. For replication, there are five main criteria which emerged and they are detailed below:

Repetition in actions

Replication has the meaning of repeating the knowledge or techniques acquired through repetition of actions, meaning that doing the same thing or do it again and again at another time in another place. The repetition is mainly about how things are done in the parent company and the same way of doing things is applied by the subsidiaries. When the knowledge needs to be continuously repeated, application of replication is the most suitable way of transferring knowledge.

The following are the quotes from interviews:

> "…normally when we have a new method or technique to perform a new element of manufacturing, we need to repeat what we have been told and showed to us. And through repetition, new knowledge is implemented in our production line…" [*Mazni*]

> "…we just follow what has been instructed and showed to us by the line leader, and it is quite easy to do the same things over and over again…" [*Roslee*]

"…when we apply the new knowledge on TS, the more we repeat (the procedure) using the new standards, the more knowledge is replicated…" [*Neeza*]

In the quotes above from the three associates of Gambatte Malaysia, *Mazni* and *Roslee* are talking about implementing new knowledge in relation to the elements of manufacturing. Neeza's quotation other hands, shows how new standards of TS quality were applied.

The three of them are referring to different occasions on the manufacturing line; the first relates to implementing waste elimination programme and upholding quality in the production line, the second refers to having knowledge of performing his work related to manufacturing precision and efficient way of doing things by following his line leader, while the third mentions repeating to carry out standards of doing things on the shop floor.

Doing and performing tasks that are already established and giving the same output from the same actions are the gist of this theme. It is about repeating the actions. This indicates replication in knowledge transfer.

Mirroring and copying others

Mirroring and replication differs in regard to the time of action. Mirroring is when the actions of "imitation" happens simultaneously with that of the knowledge provider, while replication can occur at different times. Mirroring means following exactly the same in this context, one needs to be in close contact from mainly the line leader or the supervisor on the shop floor so that exact copying is achievable practically. Like the mirror that shows exactly the same image of how we look and appear, mirroring demonstrates the act

Excerpts from the interview are as follows:

"…Copying from the super-operator and line leaders allow me to understand manufacturing practices better…" [*Sodiqin*]

"…When any new knowledge come to our production line, and when we have new ideas to assimilate, the easiest way to do this is by copying the actions of a line leader. If we do this, productivity and maintenance practices improve …." [*Abin*]

"…to enable new operators to understand new ideas to be introduced is easy; we simply ask them to copy our actions …." [*Aileen*]

From the three quotes above, *Sodiqin, Abin* and *Aileen* are talking about exact mirroring or copying of new knowledge regarding manufacturing techniques. *Sodiqin* for instance was referring on performing new work at a production line that was newly established in Plant 101 and was left to perform the tasks on his first day at the production line, thus by exact copying from his line leader and super-operator, he managed to perform his task by the knowledge transferred to him by these people.

While *Abin* and *Aileen* are referring to doing the exact things as done by the line leader, and specifically for *Aileen* who is a line leader, according to her, one when stationed in a manufacturing line; if the tasks are easy to follow, he / she need to just copy and do what is done by the leader. In this regard, both productivity and experience can be achieved hand in hand.

Copying exactly what has been practised by others, mainly from one's leader, or superior or from seniors (senior operators) is the gist of this theme. It is about mirroring. This shows how replication is done.

Procedures and sets of tasks

Procedures are sets of work or tasks that follow instructions of a job that usually involves a series of specific actions and operations. Most of the procedures in MNCs are details and when the new knowledge or system becomes part of the procedures or process, replication and copying should be applied.

The following are excerpts from the interview:

> "…any knowledge of new techniques that come in with procedures and processes are easy to copy straight away. Whatever the Japanese do in their plant according to their practice, if there are coming in through processes and steps by steps, it is easy to copy…" [*Rostam*]

> "…in fact we can grab new knowledge of manufacturing techniques when we copy and replicate what has been outlined in the work order procedures (WOP)" [*Abin*]

> "…the more process and procedures of the new techniques coming from the parent, the much easier of them to be copied…" [*Haslan*]

Rostam, Abin and *Haslan* in the three quotes above, are referring to knowledge regarding manufacturing techniques that come in the form of processes and procedures. Rostam, a technical specialist is referring to applying techniques regarding assembling a die set inside a machine that comes with detailed procedures along with illustrations how they are done in Gambatte Japan.

Abin and *Haslan* are talking about practicing an element of schedule maintenance that needed to be followed by each and everyone in Gambatte.

The instructions come with ABC of easy techniques to follow, complete with the work order procedures.

Following a set of procedures in performing a task is the gist of this theme. It is about pursuing a set of procedures or tasks in action. This shows the replication approach in knowledge transfer.

Documentations that are clear and fixed

Any manufacturing practices and new knowledge to be replicated should also be documented and these solid, unchanged documents provide the ideal criterion for the knowledge to be replicated or copied exactly. The documents could be in the form of hard copy as well as soft copy. It is about having the practices documented in black and white.

Excerpts from the interview are as follows:

> "…the knowledge that has been documented need to be easily copied and transferred to the subsidiaries…" [*Nan*]

> "…the more documented the new knowledge, the much easier for us to copy…" [*Zainal*]

> "…If new manufacturing practices are documented, they are easy for my operators to copy and perform it …" [*Chua*]

The three of them are referring to documented materials of manufacturing techniques that need to be done by the personnel in Gambatte Malaysia. It is agreed among them that when the new techniques come with more documentations, the easier one can acquire what to do based on the knowledge transferred from the documentations.

Having clearly stated the instructions and procedures related to the new techniques documented in black and white is the gist of this theme. It emphasizes on the importance of documentations in leading one's way of doing things. This signifies another type of replication approach in knowledge transfer.

Standardized in a system

Another criterion for replication is that the knowledge should be standardized and systematic. The more standardized and updated the criterion for the knowledge is, the more it is transferred via replication. This approach is crucial so that the knowledge replicated matches the original.

Excerpts from the interview are as follows:

> "The operating practices of our parent follow standardised procedures, irrespective of who does the work. This facilitates copying in the subsidiary..." [*Irma*]

> "...not only that we have about similar shop-floor design like the one in our parent company, yet the similarity up till the arrangements of machines are in the form of standardized way, makes the process and tasks easy to be copied..." [*Roslee*]

> "...when we have meetings among departments regarding progress of TS plant-wide, it is easier to discuss if the practice of the new system is same and standard and that should be the same across all over Gambatte which make it very much easy to copy and implement..." [*Evelyn*]

From the three quotes above, *Irma, Roslee* and *Evelyn* are talking about knowledge of manufacturing techniques that result from standardisation that are similar to the parent as they are practised in Japan. This is very important for instance in the case of *Evelyn*, when there is a need to have meetings across departments that are using TS systems of quality, the discussion will be much smoother when the systems are standardised.

Following a standard and systematic way of doing things in performing tasks is the gist of this theme. It is about standardization in a system and this is about replication in knowledge transfer.

6.1.2 Knowledge Transfer Approach via Adaptation

The second approach on how the transfer of knowledge occurs within a subsidiary of an MNC is through 'adaptation'. The following emerging themes demonstrate how knowledge is transferred using the adaptation approach. For adaptation, there are four main criteria that emerged and they are detailed out as below:

The need for understanding

The first measure on how knowledge could be transferred via adaptation is when there is a need to seek understanding. Understanding here brings the connotation that things should not only be done correctly, but one should also recognise and comprehend the rationale for implementing it.

> "..when we want to implement new knowledge of manufacturing techniques which is transferred into here, not all of them could be directly apply as it is, we need to make our operators understand what they are and this requires some minor change..." [*Fadhil*]

"….For different levels of audience, we provide different type of materials so that they could acquire and absorb the knowledge smoother. The materials that we got from the Japanese parent were adapted to suit with the audience's level of understanding…."[*Zack*]

"…although the new systems of TS have listed the details of all items to follow, we also need to ensure that all the personels, plant-wide from top management to operators at the shop-floor could understand and comprehend what they actually are. This requires some adaptation…" [*Nasser*]

From the three quotes above, *Fadhil, Zack* and *Nasser* are talking about the need for the personnel to gain understanding on the manufacturing process before the knowledge could be regarded as successfully transferred. *Fadhil* for instance emphasizes that sometimes the new knowledge are quite difficult to comprehend and thus requires the executives or officers to make the operators understand why they need to implement them. *Zack* and *Nasser* also relate on the need to address understanding at various levels of personnel, comprising different levels of education, technical background and experiences.

Having an understanding of what one does in performing a task is the gist of this theme. It is about adapting through understanding which is classified as the adaptation approach.

The requirement for explanation

Adaptation in knowledge transfer is also be applied when the knowledge acquired needs further justification and rationalization.

Excerpts from the interview are as follows:

> "… some elements of TPS need further explanation and examples, for instance *kanban* call card system, we always explain using the example of McDonalds or any foodstall system of ordering, preparing, and cooking, …" [*Ghazali*]

> "…..well, When we transfer knowledge about TPM, it is better to employ everyday explanations. Also, some of the teaching materials supplied by the parent need to be changed to suit the needs of our operators…" [*Zack*]

> "…to educate people on quality standards, explanations need to be clear. Training materials need to be adapted to meet local conditions …" [*Nasser*]

> "…to make the new knowledge of quality standards transferable, we need to provide a clear explanation on the meanings of the new systems and the need to make a bit of changes to the original piece that we have, although we will still maintain the essence and contents…" [*Nasser*]

Ghazali, Zack and *Nasser* are talking about the same things but in different situations. *Ghazali* mentioned about how the new *kanban* card system needs some elements of adaptation to make it easy to explain so that the operators are able to comprehend and thus facilitate the transfer knowledge. *Zack* on the other hand was relating to the need to explain to the operators on the importance of self machine preventive maintenance, while *Nasser* was relating on the need to explain the systems to make it much easier to the operators than the original system that arrived from the parent's plant.

The need to seek an explanation on why and how in performing one's task is the gist of this theme. It is about adapting through seeking for explanation in adaptation within the process of knowledge transfer.

Need to perform additional tasks

When there is a need for additional jobs and tasks in order to perform and finish one's task, the adaptation approach also applied. This means that when the new knowledge is transferred, it is followed by some steps of extra jobs and tasks. The jobs and tasks are around the dedicated tasks which came with the knowledge of the manufacturing techniques. In other words, there is additional work to be done in order to capture the transferred knowledge, and this is when the adaptation is applied.

Excerpts from the interview are as follows:

> "...when the new knowledge on manufacturing systems come in with additional jobs in the shop-floor from what they are currently doing, there is a need to make a little change to what adapt with manufacturing systems..." [*Fadhil*]

> "...the more new tasks involved in the new TPM tools and machines cleaning tasks, the more we need to adapt the original TPM system that we received from the parent..." [*Mahdzim*]

> "....after discussing with the line operators and their supervisors, we realized that the implementation of TS here need some additional tasks to be done. We thus need to change and adapt it to suit with the existing local conditions..." [*Nasser*]

Fadhil, Mahdzim and *Nasser* are referring to situations where some further jobs or tasks need to be done in order for the knowledge of manufacturing techniques become understandable and achievable. *Fadhil,* for instance, need to make and plan for extra tasks on performing elements of cell production line to suit a small lot production in demand, as the production cell in Gambatte Malaysia is not exactly designed as the same as what is implemented in its parent plant, thus adaptation is needed. For *Mahdzim*, the cleaning part of machineries in Gambatte Malaysia also requires more tasks to be performed because of different moisture and humidity level in the environment within the Malaysian manufacturing plant. For *Nasser*, the implementations of the new TS standards need to be adapted to the local situations in order for the TS to be comply with the Malaysian standards of quality.

The need to perform additional tasks is the gist of this theme. Additional works need to be done in order to capture the transferred knowledge in this type of adaptation approach.

Need for Adjustment

For the new knowledge to be easily transferred via adaptation, there is a need for some adjustments to be made, meaning that there are few simple amendments that are required to be done by the personnel in the subsidiary in order to grasp the new knowledge that is being transferred from the parent company.

Excerpts from the interview are as follows:

> "…in the implementation of super-operators in Japan, the distance between machines that are handled by the single super-operator are according to the size and measurement of Japanese operators. Here we need to make some adjustments so that they are more suitable to our operators' size and to make the machines more ergonomically efficient to work with…" [*Fadhil*]
>
> "Well, for today's training, the target audiences or participants are the operators from the shop-floor, and looking at their academic background, role, status and responsibilities in the plant. To make them understand quickly and getting the gist of the TPM system in a smooth manner, we need

> to customize the training materials to accommodate personnel with lower academic background and make them much more attractive in terms of presentation. We use down-to-earth examples that could catch their attention and understanding much faster and make the training much more efficient. In this way, the new TPM system knowledge could be transferred…"[*Zack*]

Fadhil and *Zack* are discussing the adjustments that need to be made in relation to adaptation that can facilitate the transfer of knowledge. In the first quote, *Fadhil* was referring to the new line cell production implementation that took place in Japan among the super-operator that according to the size of Japanese which are generally smaller compared to Malaysians. Thus, *Fadhil* need to make some adjustment on the size and measurements that are received from the parent. For *Zack*, he emphasised on the training materials that needed to be adjusted to the local situation, to suit different levels of personnels from the source of knowledge.

Making adjustments to complete the way of doing things and one's tasks is the gist of this theme. It is about the need for adjustment in adaptation to facilitate the transfer of knowledge.

6.1.3 Knowledge Transfer Approach via Innovation

The third approach of how knowledge transfer occurs within a subsidiary of an MNC is through what is referred as 'innovation'. This is a major new approach of knowledge transfer from which the themes are developed from the data.

The following emerging themes reveal how knowledge is transferred through the innovation approach. For innovation, there are three key criteria which emerged and they are explained in detail as follows:

Creating New Interpretations

Innovation in knowledge transfer occurs when there is a need to make a new interpretation of the knowledge being transferred. Here, the knowledge that is transferred to the subsidiary company that came along with the expected output is in need of having new interpretations by the implementers within the subsidiary of the MNC. This is one of the ways that innovation occurs during the process of knowledge transfer.

Excerpts from the interview are as follows:

> "Normally certain output are expected from a particular way of doing things, however in a few occasions here, we do them differently as we understood them maybe differently. The main thing that matters is achieving the same output and product" [*Fadhil*]

> "For instance, in producing a single unit production line, in parent MNC they literally take it as giving an output of single unit production from the normal production line, but here we take it up another step, interpreting it by making a new kind of production line in term of production cell…" [*Nan*]

Fadhil and *Nan* are referring to the implementations of TPS manufacturing system, in which an important goal and objective is to produce up to a single unit lot of production, which is a batch size of one unit. This means that even if the customer order one piece of compressor for example, model *Pesona* for *Proton*, Gambatte Malaysia need to be able to produce it in a single unit order in the production line. In Japan, they do it in the line itself since they have a large area of facilities, but in Gambatte Malaysia, due to space and area restrictions, the unit need to be produced in a unique single production cell. As a result, in Gambatte Malaysia, the usages of new elements to simulate production line or cell are often used, as was shown in the episodes where *bento* and *sate* in line simulation are utilized, so that the interpretations of new knowledge could be achieved.

This is done by giving new interpretations to the knowledge that is being transferred and implementing them at work. This is the gist of the emergent innovation approach.

Employing New Ways in completing tasks

Innovation in knowledge transfer is evident when the knowledge transferred involves applying new methods of completing tasks. Here, the knowledge is transferred to the subsidiary using a certain method, but when it arrives at the subsidiary, new ways are applied to implement them. This is also another manner on how innovation emerges within the process of knowledge transfer.

Excerpts from the interview are as follows:

> "…certain knowledge that are transferred to us comes with a set of tasks. After considering them, and making evaluation on our conditions, it is not unusual to have them; ie the way of doing those tasks fully revamped, so we do it in a new way here…" [*Fadhil*]

> "…for example, in making a new kind of production line, we do it differently here than that in Japan. Here, instead of the normal production linear line, we make it into a U-shape production cell" [*Bahrin*]

Fadhil and *Bahrin* are talking about doing the tasks or steps in the process that are totally in a new way. This approach is adopted when the production team in Gambatte Malaysia evaluated the new processes suggested by the parent, and yet the results are not satisfactory. For instance when building a new production line that could not fit in the linear line, a U shape production cell is implemented.

Doing things in a totally different way is the gist of this theme. It is about doing new ways related to a task innovatively. This approach to knowledge transfer is classified as innovation.

Finding Fresh Solutions for Existing Problems

Innovation in knowledge transfer arises when the knowledge that is being transferred involves finding new solutions to existing problems within the subsidiary. Here, innovation is inevitable since it is necessary when producing new solutions. Thus, by implementing the new solutions, the new knowledge which comes with a new cure for trouble-shooting existing problems would be transferred via innovation.

Excerpts from the interview are as follows;

> "...some problems are locally triggered. By understanding the concept of TPS, we need to find out how to cure the problems, and thus fresh solutions emerged. This is totally a new way of providing solution to problems that already existed here in the subsidiary..." [*Fadhil*]

> "…knowledge of manufacturing maintenance also need to be transferred here, and that sometimes involved creating new solutions on how to do it, like creating the TPM Corner to accommodate our needs, which is new and is not implemented at the parent company…" [*Rustam*]

> "…although TS is a global standards regarding automotives, when implementing TS here, we need to look into new ways of implementing certain things that are still in line with what are in the system. Thus its like

> change the way of doing things with new ways, without discounting its purposes {the TS systems}…" [*Nasser*]

Fadhil, Rustam and *Nasser* are talking about finding fresh solutions to meet the needs of different situations. *Fadhil* mentioned about how the system of eliminating waste and waiting time need to be make workable in the local context, so that the operators can perform their daily tasks. In this situation, new solutions of staggered break across certifications running machines are implemented. *Rustam,* on the other hand was relating to the installation of TPM Corner which was finally agreed to be placed with only one table without chairs, while *Nasser* was relating on the need to find out new fresh solutions for TS compliance in the plant.

Indeed, providing new solutions to problems that are already around is the gist of this theme. It is about finding fresh solutions through innovation in efforts to enable transfer of knowledge.

6.2 Discussions on Approaches in Knowledge Transfer

This part of the discussion focuses on how knowledge is transferred within the subsidiary. The present study was motivated by a desire to extend the researcher's understanding of how knowledge is transferred within a subsidiary of an MNC. This part of the chapter expands the preceding part to review and discuss the findings from the first research question.

The findings are intended to draw attention to the need for understanding of how knowledge transfer occurs within the subsidiary. The data analysis indicates that knowledge are transferred through three main approaches, which are *replication, adaptation,* and *innovation.*

Extent literature on knowledge transfer literature reveals two main approaches to knowledge transfer, namely, replication and adaptation. For the purposes of recapitulation, it can be said that when knowledge is copied or reproduced, the term *replication* is used to indicate that it is a direct imitation of the original source. *Adaptation,* on the other hand*,* is used to refer to the situation when some adjustments are made to the knowledge (Szulanski, 1996, von Hippel, 1994).

In this study, replication occurs when there is a need for repetition, with the transferred knowledge strictly mirroring the original knowledge. Replication is also apparent when there is more documentation and standardisation required by the parent company. In the case of adaptation, however, knowledge is manipulated somewhat to ensure the need for understanding is met, and in this case explanations are required. Additionally, there is often a need for additional jobs and tasks, and in such instances adaptation occurs so that some adjustments can be done.

Whilst Williams (2003: 2007) has made the generalised comment that replication requires a more discrete approach, and adaptation requires more understanding, additional contributions have been made to the literature by this study providing details of the dimensions, criteria and categories of what and how these approaches actually work in real life situations.

And the novelty of the emerging themes from the knowledge transfer approaches is when a third approach is found from this study, which is referred to as "*innovation*". From the data, it is found that innovation takes place when new interpretations are created on the knowledge transferred using totally new ways of carrying out the tasks. Another key theme of innovation is when new knowledge is required to solve existing problems.

According to the literature, knowledge transfer is mostly intended from the parent MNC to the subsidiary (Gupta & Govindarajan, 2000). This study extends the literature on knowledge transfer, suggesting that many occurrences of knowledge transfer happened within the subsidiary itself and that the subsidiary make many decisions on the knowledge transfer approach to be utilized. The themes of criteria explicating when knowledge transfer approaches are selected through replication, adaptation or innovation are explained in the previous part together with the quotations that support them.

From the episodes provided in chapter 5, we can observe that when the same manufacturing techniques of lean manufacturing or TPS system is implemented in the subsidiary, direct copying (replication) or making adjustment (adaptation) is based on the choice of the subsidiary itself. This goes the same for TS systems and TPM implementations.

From the findings of the activities of episodes, we can gather another interesting feature. The more systematic and structured the manufacturing techniques that are transferred from the parent, for instance on the TS project, the more replications are applied, while the more conceptual, robust, open and flexible the manufacturing techniques coming from the parent, for instance on TPS project, the more innovations are applied.

The table and pie charts below explain the findings. From the 16 episodes, TS related episodes are elaborated in Episodes number 1, 4, 6, 13 and 14. Therefore, extracting the summary tables of activities from these five episodes, we would get the following overall TS activities table and chart:

Table 6.2: Overall TS Activities Table

Episode 1 : GEMBA and Abnormalities Treatment ***(TS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Production unit faced abnormalities, call for help using andon light			
2	Operator need to stop production (after 3 units abnormal)			
3	Prod Supervisor take action, and call related officers immediately {Prod Sup called Eng, Tech, PE and TPS Champion}			
4	Everyone gathered near the problematic machine, and decide to practise GEMBA			
5	Operator in charge was asked in details what and how it happens			
6	Every gemba members try to dig what went wrong, including asking for any funny sound / visual...			
7	The champion noted the gemba process neatly			
8	Source of problem found, and troubleshooting done			
9	Ad-hoc meeting conducted at the place of problem “itself” until the problem was solved.			
Episode 4 : Super Operator & Visualisation ***(TS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Manpower mapping – operators vs machines { skill charts black shape in round coding of expertise to show operator level }			
2	Special coding to run machines – some require certifications			
3	More machines run by an operator, much better process			
4	Up to 5 machines run by 1 operator = “super operator”			
5	Certain hours of training = certified for a certain machine and skills			
Episode 6 : Charts with Different Colours of Pen ***(TS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Visualisation of colour coding of inks on the charts			
2	Different colours represent different meaning			

	regarding the productions			
3	Supervisor will check the use of colour coding			
4	If wrongly coded, corrective actions are requested			
5	Visualisation of where to perform maintenance, for instance is assisted with real photo coding			
Episode 13 : Customer Complaint ***(TS related episode)***				
No	Activities and Findings	Rep	Adap	Innov
1	Establishment of customer complaint database			
2	Receiving and clarification of complaint			
3	Investigation customer complaint			
4	Establishment of counter-measure team			
5	Carry out counter-measure through cross function			
6	Sharing counter-measure to other area team			
7	Close-up the counter-measure			
Episode 14 : Process Control at Production Line ***(TS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Set up new production line			
2	Study the risk of defect			
3	Establish statistical process control			
4	Introduction of *poka yoke* in the production line			
5	Establishment of final inspection			
6	Control of First In First Out			

TS	Replication	Adaptation	Innovation
32 Activities	23	9	0

Table 6.3: Summary of TS Activities Represent Replication, Adaptation and Innovation

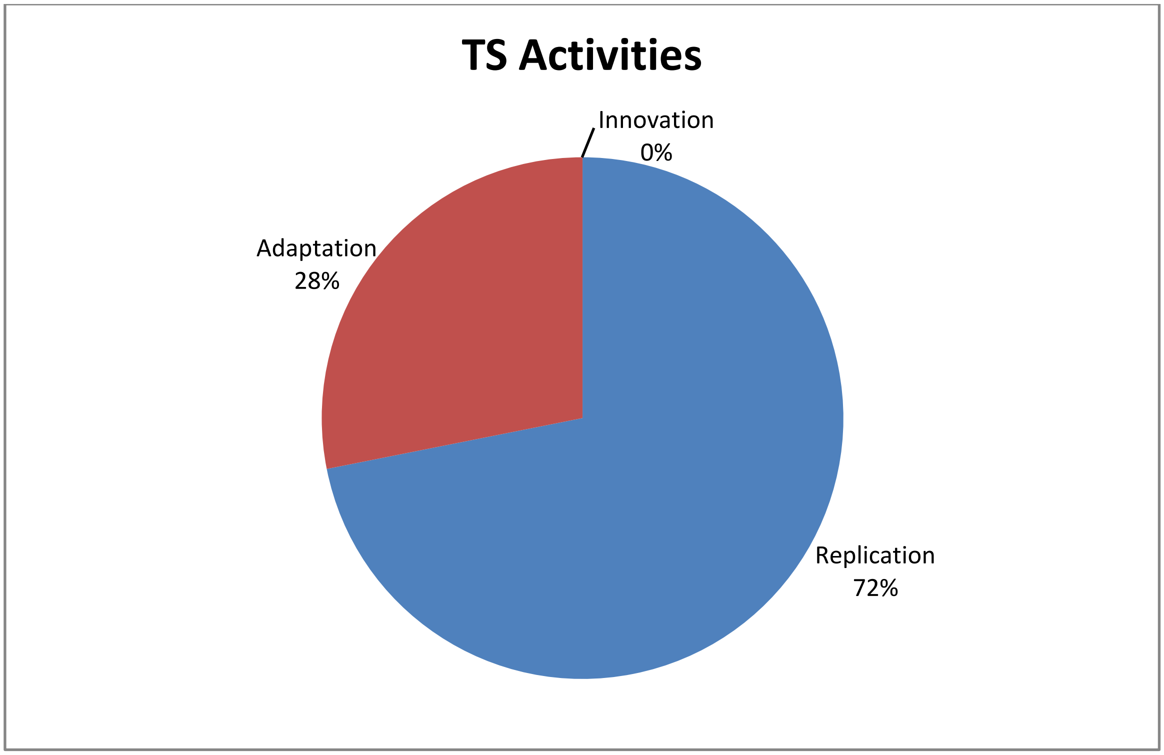

Figure 6.1: TS activities chart

TS is a project of manufacturing techniques nature focusing on complying the systems which are mostly related to systems involving TS16949 as well as QS9000 and ISO 9001:2000. Thus, the nature of the knowledge transferred is in terms of more systematically compliance and strictly endorsed and applied what have been described from the parent. These activities are exhibited in a series of episodes in chapter Five related to TS in episodes number 1, 4, 6, 13 and 14. Based on the five episodes from the thirty-two (32) TS activities overall, knowledge is transferred through 23 activities of replication (72 percent), while adaptation occurred in 9 activities (28 percent), with no activities being transferred by innovation.

Next, from the 16 episodes, TPM related episodes are elaborated in Episodes number 5, 7, 8, 15 and 16. Therefore, extracting the summary tables of activities from these five episodes, we would get the following overall TPM activities table and chart:

Table 6.4: Overall TPM Activities Table

Episode 5 : Training: Theory & Practical ***(TPM related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Training in two sessions, morning lecture style and afternoon practicals			
2	Early session started with ice breaking – trainer must be creative			
3	Start also with pre-training quiz and end up with post-training quiz, normally the 'same' sets of questions.			
4	Use of all 5 senses in 'sense training kit'			
5	Training with good analogy examples{boat and baby}			
6	Trainer need to know the level of trainees			
7	Steps in trainings			
Episode 7 : Daily Maintenance & 5 Ss ***(TPM related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	At specific time everyday 5S is implemented by operators			
2	Oiling and lubrications by operators are performed at specific intervals during the day			
3	Audio sense is used to mark a certain activity (5 S) at the shop floor			
4	On-job training by following what seniors are performing			
5	Explanation given during the 5S to the trainees			
6	Copying 5Ss via mirroring techniques			
7	Time of 5Ss applied there (Japan 2.00pm), and 4.30pm (time of the day in Malaysia)			
Episode 8 : TPM Corner & Why Why Analysis ***(TPM related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	At specific time of the day, important personnel involved gather for a meeting at TPM corner			
2	Meeting place allocated with table without chairs			
3	Finding out problem via troubleshooting in group discussion			
4	Looking into why the stoppages of the production machine occurs			
5	Charts and graphs are used for assistance in the TPM meeting			

6	Beside charts, first hand information and abnormalities reports from operators involved are also referred			
7	Performing Why Why Analysis (discussion in group)			
8	Finally answer emerged and machine repaired and back to running condition.			
Episode 15 : Control of Machine Spare Parts ***(TPM related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Establishment of Machines Spare Parts Management Systems			
2	Set up the Data Structure			
3	Set up the Ordering Level			
4	Establishment storage system condition			
5	Establishment identification labelling system condition			
6	Managing stock-in stock-out of the parts			
7	Conduct receiving and disposal of the parts			
Episode 16 : Preventive Maintenance ***(TPM related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Establishment Preventive Maintenance Schedule			
2	Establishment Preventive Maintenance items and check sheets			
3	Deploy maintenance staffs based on competency			
4	Conduct Preventive Maintenance (activities)			
5	Test-run machines after Preventive Maintenance			
6	Conduct Predictive Maintenance			
7	Summary Report of Preventive Maintenance			

TPM	Replication	Adaptation	Innovation
36 Activities	8	27	1

Table 6.5: Summary of TPM Activities Represent Replication, Adaptation and Innovation

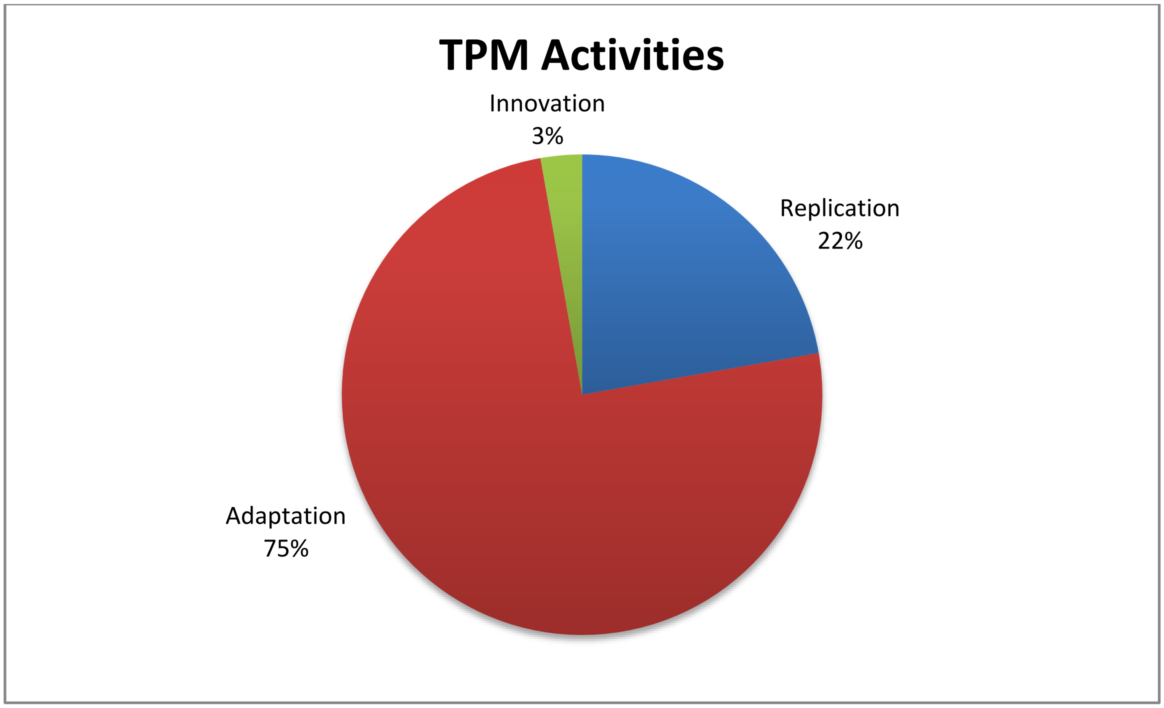

Figure 6.2: TPM activities chart

For the TPM project, which is about implementing manufacturing techniques related to comprehensive maintenance, the nature of the knowledge transferred is more of adaptation from the parent. These activities are elaborated in episodes numbers 5, 7, 8, 15 and 16. Therefore, it is clearly shown here that from the overall 36 TPM activities; knowledge transfer took place through adaptation, 27 activities (or 75 percent), while replication 8 (or 22 percent), and innovation with only 1 activity (3 percent).

While from the 16 episodes, TPS related episodes are elaborated in Episodes number 2, 3, 9, 10, 11 and 12. Therefore, extracting the summary tables of activities from these six episodes, we would get the following overall TPS activities table and chart:

Table 6.6: Overall TPS Activities Table

Episode 2 : TPS Activity Board and Line Tour ***(TPS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Senior manager check the operator's production understanding in his line tour			
2	The champion give an overview of the overall TPS development			
3	The leader explain the development of TPS project that has taken place particularly in their line.			
4	The manager check by asking the leader and Sup to explain what are shown on the TPS Improvement Checklist (on the TPS Activity Board)			
5	Two way communication took place here			
Episode 3 : Champion ***(TPS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	The Champion emphasising the importance of TPS philosophies			
2	The Champion express concerns to lesser the prod time with better significance of quality delivery as well as flexible production demands to be in "small lots"			
3	The Champion take (perform) his tasks and jobs all-hearted			
4	The Champion work intelligently; with best approach available			
5	The Champion lobby with meetings, follow ups and show/presentations in management meetings			
6	The Champion ensure the production plan transformed from 'one line' system into 'cell production' units			
7	The Champion remind of the pillars of TPS			
Episode 9 : Kanban Card System ***(TPS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Use of *kanban* throughout all the production processes			
2	*Kanban* emphasize Denso QR Code so that all info are in tact			

3	Only the warehouse can give (order) production *kanban* and that requested unit will ultimately arrive back at warehouse for shipment			
4	Shop order coming from the customers			
5	The (kanban) orders can be in small unit sizes (even n=1)			
Episode 10 : Production Line Simulation ***(TPS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	Simulating production systems with toys			
2	Simulating production systems with lego blocks			
3	Simulating with 'sate' system of ordering and producing			
4	Comparison of *kanban* with fast food outlets ordering system			
5	Changing line style production into cell style production			
6	Simulating production cell by using "*bento*"			
7	Simulating and applying the principles of '*kawakuri*' in the production line			
8	Asking on-hand feedbacks from operators (kaizen plan sheet)			
9	Use of yellow suggestion slips by operators			
Episode 11 : Gambatte Culture of Ownership & TPS Layout in Action ***(TPS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	The TPS Champion introduce layout of new line to operators			
2	The new layout built with less walking movement area			
3	*Chutes* are introduced shorter and less WIP involved			
4	Having / owning the machines as their (operators') babies/kids			
5	New layout aiming to develop more super-operators			
6	Making Denso culture as a way of working – Denso DNA			
Episode 12 : Asean Jeshuken ***(TPS related episode)***				
No	*Activities and Findings*	*Rep*	*Adap*	*Innov*
1	The activity of *Asean Jeshuken* involve 4 TPS teams from Asean region of Denso			

2	The joint team initiated with theory and concept training in a classroom environment			
3	Later the team would have simulation and role play			
4	The team conduct improvement project and activities at the site (production line)			
5	Champions of regional Denso (T) and (I) checking terminologies and testing the associates as per said processes			
6	The team present the project to the management of the host plant			
7	When the *jeshuken* ended, the team dispersed and went back to their own plant, and submit report to the (*Asean Jeshuken*) host.			
8	Visits among Denso in Asean (regional) to counter-check implementations and understandings (every 6 months)			

Table 6.7: Summary of TPS Activities Represent Replication, Adaptation and Innovation

TPS	Replication	Adaptation	Innovation
40 Activities	3	13	24

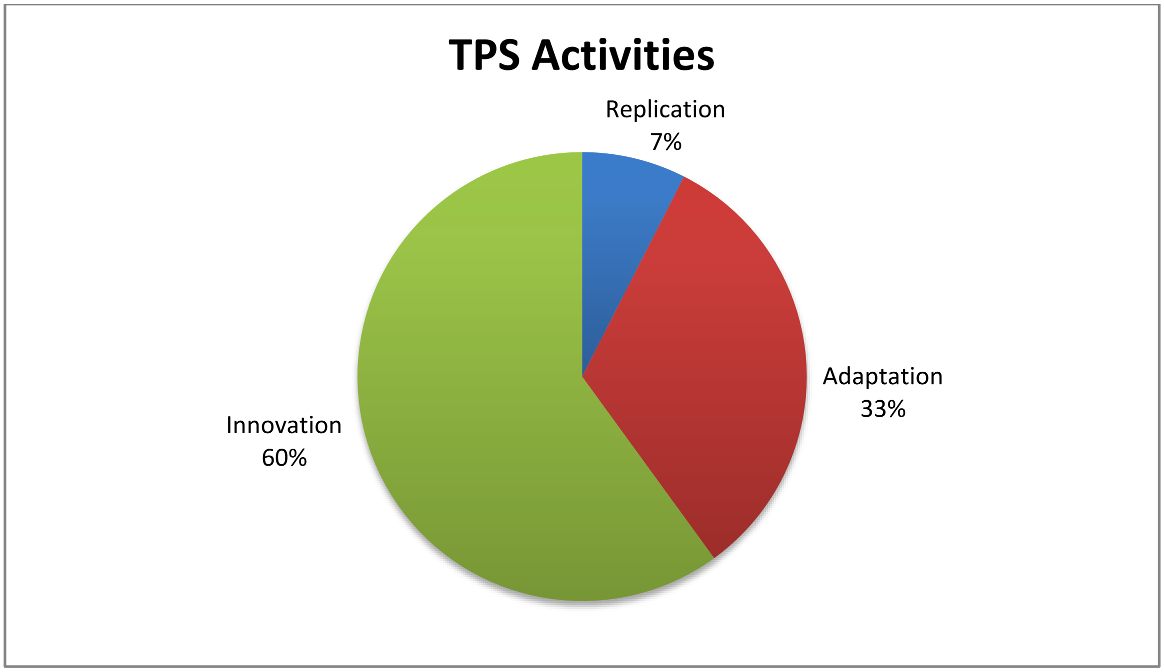

Figure 6.3: TPS activities chart

Finally for TPS project, which is about applying new manufacturing techniques of TPS system or lean manufacturing that is related to dynamic manufacturing processes, the approach of the knowledge transferred from the parent is classified as innovation. These findings are illustrated in episodes related to TPS in six episodes (numbers 2, 3, 9, 10, 11 and 12). More interestingly, some of the innovation originated here in Gambatte Malaysia are applied and used in other Gambatte's subsidiaries in the Asean region as well as received recognition by the parent in Japan. Therefore, it is clearly shown here that from the overall 40 TPS activities from the 6 episodes; knowledge transfer took place through innovation 24 times (60 percent), while adaptation was in 13 activities (33 percent) and replication 3 activities (7 percent).

6.3 Summary of Findings on Circumstances of Knowledge Transfer (Research Objective Two)

When researching on knowledge transfer, particularly within a subsidiary of an MNC, the need for understanding and finding out the circumstances of knowledge transfer is also vital. This is therefore raised in the study's research question number two. To answer this, the findings from the episodes comprising interviews, observations and documentations lead towards five main circumstances that emerged.

From the data gathered, five main circumstances of knowledge transfer within a subsidiary of an MNC are found, as summarised in Table 6.1 (in page 232). The emerging circumstances are explained in depth below:

6.3.1 Nature and classifications of knowledge transferred

One main category of theme is about the nature of knowledge transferred, which is related to (a) the classification of knowledge that is being transferred either explicitly or tacitly and the aspects or types of knowledge that is involved, and (b) the intensity of knowledge transfer. This also looks for the evidence of knowledge transferred, and how they are actually transferred.

Classifications and types of knowledge transferred

This category relates to the explicitness and tacitness of knowledge transferred, and the type of knowledge transferred. Therefore, in elaborating the categories under the nature of the knowledge transferred, particularly with regard to the classifications, let us look into the part where explicit and tacit are divided, and the knowledge types. The emergence of the refined sub-classifications are further elaborated below with the appropriate quotations from the data collected.

The first main nature of knowledge is the knowledge explicitness. **Explicit** knowledge is the knowledge that can be transmitted without the loss of integrity once the syntactical rules are required for deciphering it. The explicit part of knowledge transfer could be further branched out into routines, procedurals, codified in manuals and visualized in the form of signage and photos.

Routines are similar ways of doing things (jobs) that are performed consistently over a period of time. A job or task that requires a similar way of performing it and in a consistent manner of accomplishing it is a routine;

> "…certain things are done the same way at the same time, thus making routines easy to follow and to transfer among the operators…" [*Needza*]

> "…every day at 9.15 am there is a morning briefing, which among others involves discussing the production daily updates and also on familiarization of new TPM ways which is reminded for routinized in every shifts…" [*Eddie*]

> "In the transfer of knowledge in TS system, we also use the implementation of routines which are performed at the same time of daily tasks…." [*Chew*]

In all of the three quotations above, we can see that routines are an important type of explicit knowledge on the manufacturing shop floor. Routines tells the operators what to do for the same tasks, when is the time to meet on a fixed time basis, and what to do at certain time of the day repeatedly. Therefore, routines are the first type of explicit knowledge that are transferred to and within the manufacturing floor..

Another explicit part of knowledge transfer is **procedurals**. Procedurals are step by step new knowledge that needs to be followed and obliged. These are normally related to inevitable actions in stages that need to be done in one's work;

"...the new knowledge of implementing TPS comes with detailed procedures that need to be followed. The closure we follow the procedures, the more we get out of it..." [*Sadiqin*]

"...in Why Why Analysis, we follow the procedures in detail so that the technique is much followed and beautifully implemented..." [*Ishak*]

"...most of the systematic standards of the TS system are based on step by step procedures to follow and that make the knowledge more easily transferred..." [*Ghazali*]

From the three quotations above, we can recognise that whenever there are procedures that need to be followed, the type of knowledge transferred is of the explicit type.

The third explicit part of knowledge transfer is **codified in manuals.** When the new knowledge is codified in the operating manuals or detailed written statements, then it is explicit in nature. Another important feature of explicit knowledge is that the knowledge has high clarity and available in detail in manuals or practical reference log books;

"...for the new TPS system after its trial run launch, we received most of the operating manuals and instructions through our project champion, Fadhil...." [*Mazlan*]

"...the way of performing the machine check in TPM is clearly spelled out in each of the machine manuals which are kept in the machine and tool bay..." [*Ku*]

> "…normally, to minimise cost, our parent company does not send people. Usually they will send the instruction and the software, the documentation, and everything in detailed manuals…." [*Evelyn*]

Finally, the last explicit part of knowledge transfer is **visualized in signs and photos.** This nature of explicit knowledge is transferred when the new knowledge is visualized in the form of signage and photos in the working area;

> "…knowledge on the new TPS system is transferred here with the help of plenty of visual aids, signages and photos. Like the 8 points of TIE (total industrial engineering), we make it in bright coloured star to mark its importance…" [*Fadhil*]

> "..for the new TPM machine maintenance check, we make it now much clearer with the photos of sections on the machines to ease identification on the area that needed cleaning up…" [*Mahdzim*]

> "… in TS, we also apply a lot of visual aids to make the transfer of knowledge much easier to occur…." [*Zoul*]

The above four categories of explicit nature of knowledge transfer has emerged from the data. The knowledge being transferred which involve routines, procedurals, codified in manuals and visualized in signage and photos, illustrate the explicit nature of knowledge and their significance in facilitating knowledge transfer.

The second main nature of knowledge is knowledge tacitness. **Tacit** knowledge involves knowledge that resides inside one's mind, skill and expertise, which are not easily transferable through texts, papers and writings. This type of knowledge resides and develops in oneself through his/her experiencing certain processes and elements. From the cases as well as the observations, it is found out that the tacit part of knowledge are transferred through a way that involves the need to understand the content of the knowledge. The tacit part of knowledge transfer could be further divided into coherent experience, unambiguous understanding, expertise inheritance, and teamwork bonding.

The first sub-category of tacit classification of knowledge is its **coherent experience** point. It is about consistent logical familiarities that reside in one's skill and mind. This kind of knowledge which comes in handy in times of need develops through going through certain experiences;

> "…when dealing with problem solving issue, the view and feedback from line leader and super-operator need to be taken seriously due to their sound and rational skill and experience they have. Performing the tasks is not only about following what is stated in the operating manual, but we also need to have the skill and art of solving the problem…" [*Fadhil*]

> "…among the important input when we perform our daily TPM short meeting is that we get the articulate and sound view from our engineers and from our senior technicians based on their experience. They indulge in the oily machines daily, they basically lived with them. That part of knowledge is precious indeed to us because…." [*Zack*]

> "…when we faced problems with the TS system certification issue, we'll get back to Nasser. He has this consistent logical views based on many years as Gambatte ISO Champion and TS auditor help us with our system here. Indeed he is the gem of knowledge in this TS system…" [*Mazlan*]

From the three quotations above, we can see that coherent experiences and exposures on the problems and how to solve them as well as tackling problems that normally occurs are related to one's experience. It is tacit in nature.

The second sub-category of tacit classification of knowledge in nature is on **unambiguous understanding,** which is about unmistakable and clear cut perception on getting new knowledge, issues and problem solving. The notion is far reached by the persons whom the nature of knowledge is grasped and appreciated almost immediately and understandably;

> "…in performing this TPS system, when we talk among ourselves on certain issues, we could instantly recognize the same perception on things and issues that we are facing daily regarding TPS. This is important points that could be transferred when we have *gemba* or *jeshuken*…" [*Rustam*]

> "…sometimes when we are dealing with machine issues, certain problems need to be elaborated in details for the lay-man, but as we are working together, the things got unequivocal and we can be accepting the same meaning quickly of the problems being discussed and solved the problems and getting new insights faster.." [*Muqarabin*]

> "…some knowledge on performing TS system comes with similar understandings that are unmistakable and clear-cut to the same way of doing things with other colleagues, which is important in this fast pace production environment…" [*James*]

The three above quotations proved to us that having the same level of understandings unambiguously is a key in explaining things, getting new knowledge, as well as getting things and works done. These knowledge are tacit in nature and reside on each of Gambatte personnel's mind, and exist in their relationships, and transferred through their communications.

The next nature of tacit classification of knowledge is the new knowledge which involves **expertise inheritance** in which one's capabilities could become a legacy. This type of knowledge is preserved and cherished from one to another;

"..when talking about transferring the knowledge that involves one's expertise, it is almost about exploring one's heritage…the deeper we explore, the more we get the knowledge…" [*Fadhil*]

"…the experience of solving issues comes with proficiency inheritance of machine skills, trouble-shooting as well as production insights…" [*Zack*]

"…when the operator becoming super-operator, his or her expertise and capability become a legacy that could be well-used, kept, transferred and cherished along the way.." [*Nasser*]

These three quotations above confirmed expertise inheritance as the most important of tacit knowledge one can have. Their expertise becomes heritage and legacy that are useful for newcomers in the shop floor. These expertises were developed mainly from daily routines and tasks and their many years of experiences in problem solving on the production floor.

And the last type of tacit knowledge is related to **teamwork bonding** that could lead to group cohesiveness. The constant strong bonding among the teammates nurtures the creation and transfer of the tacit knowledge;

"…when we work together to solve some issues in the shop-floor, the cooperation relationship is very important to ensure that new knowledge will be transferred and accepted in daily practice. It is much easier to work together if everyone is '*satu kepala*', ie {trans compatible} in doing the things…" [*Mazni*]

"…among important aspect to ensure the new knowledge of TPM could be transferred is possessing the collaboration link, which would create cohesiveness among operators and team-members during TPM daily meetings, so that better results would be established…" [*Nan*]

"…the teamwork among the committee members of TS is vital. It involves cohesiveness; which is joint effort that support bonding among them that foster the knowledge transferred across the production lines…" [*James*]

Indeed, to make all the team members to be as 'one-head' is not an easy part, but that is the beauty of tacit knowledge exchange in teamwork.

In summary, four categories of tacit nature of knowledge transfer, that emerged are coherent experience, unambiguous understanding, expertise inheritance, and teamwork bonding demonstrates the important aspect of tacit knowledge.

The third main characteristic is on the **knowledge types**. This study involves exploring the sub-themes of know-how, know-what, and know-about of transfer of knowledge.

The first type about knowledge transfer is related to **know-what**, which refers to declarative knowledge that implies to directly related items when one is performing a task or function. Reflecting with the question of "what", this type of knowledge involves the substance of the knowledge itself:

"…some parts of the new knowledge transferred involved straight-forward items that need to be done as it is, this could be performing new steps, or doing new things in the production process…" [*Sadiqin*]

"…the part of performing new TPM machine care are hugely related to do certain specific things by following the procedures at located places onto the machine and certain specific time…" [*Ghanesh*]

"…we want the operators, at first stage to do and perform the new TS system by following all the requirements of the global TS standards, then…" [*Nasser*]

These three quotations above described the knowledge type of know-what. *Sadiqin* refers to the implementation of what to do in a TPS production line, *Ghanesh* emphasised on following correct things for maintenance, while *Nasser* demanded the correct know-what about the TS systems that need to be followed.

Secondly, **know-how** refers to procedural type of knowledge that entails towards understanding of completing tasks and things. Based on reflecting the question of "how", this type of knowledge is about how to get things done;

"…in addition to following all the systems closely, we also trained and ensure that the operators recognize and comprehend the new practice of TPS manufacturing systems, so that they are not just working blindly…" [*Nan*]

"..the more we educate them to appreciate the new TPM's way of performing machineries, the more they understand and thus, the more considerate they will become towards their important job in the shopfloor…" [*Zack*]

"…we want the operators, at first stage to do and perform the new TS system by following all the requirements of the global TS standards, then only we require them to quickly grab and understand why are they doing like that…" [*Nasser*]

The three quotations from *Nan, Zack* and *Nasser* above highlighted the importance of getting the understanding on the know-how of doing a task so that one does not just blindly perform the work.

Finally, **know-about** refers to a better grasp or deeper understanding of what is involved in the process as well as its accomplishment,

> "…not only making them know what are the new systems, and how to perform them, but to make them realize and grasp the significance of applying TPS in the line that could affect the customer need and satisfaction is of paramount important…" [*Sugi*]

> "…in TPM, by making them feel that the machines are not only the place for their work, but as their very important instrument to ensure productivity and profitability of the company, that resulted in their salary and income, will make them clearly aware of how important it is to follow the new system and make them committed to get hold of the knowledge and use the TPM system more conscientiously…" [*Zack*]

> "….in making them follow the TS system, ultimately is also to make them to have a handle on understanding and developing expertise on this new TS systems of world auto standards…" [*Evelyn*]

The three quotations above further clarify that in order for knowledge to be transferred, better and deeper understandings on know-about that make their life in Gambatte more meaningful is important. The three types of knowledge transfer as mentioned above which consist of know-how, know-what and know-about demonstrate their importance.

The three criteria under the classification and types of knowledge from the data analysis bring about that explicitness and tacitness with different types of knowledge all emerging in providing the circumstances of aspect and classification of knowledge transfer.

Intensity of knowledge transferred

This theme of the intensity of knowledge being transferred provide evidence of knowledge transfer in the three projects that related to its strength, including the quality and quantity of the knowledge transferred, level or degree of force and passion to transfer, and apply the knowledge towards gaining the depth of knowledge quality in the transfer.

One important aspect in dealing with the transfer of new knowledge particularly related to manufacturing practices, is about **quality** of knowledge. Quality refers to the level of one's understanding of the new knowledge and the new practices that are being applied.

Common understanding is about understanding the same thing from the source of knowledge. It is about having the understanding in general and that the way of how it is understood is widely accepted;

> "…when we transfer the new TPS system of manufacturing here, we make sure that what is generally understood here in the shop-floor of Gambatte Malaysia at least matched with what was generally understood in our parent company, in which I gained my training in TPS... [*Fadhil*]

> "…whatever examples and instances we use in our TPM approach, the bottom line is that we want all the operators to understand that maintenance of machineries are not only in the hand of maintenance team or the technicians alone, but it is also part of their responsibility…" [*Rustam*]

> “...when we implement the TS system in our plant, first of all we want all the personnels from the management team to the associates {operators} have a common understanding of it...” [*Nasser*]

The three quotations above draw attention to the need to have a common understanding on the important quality of knowledge needed to be achieved. It is about having the most number of personnels in Gambatte to have the similar or closest understanding as they could and get the consensus in understanding the most similar possible to the source of knowledge.

Secondly, **new insights** relate to obtaining a deeper understanding of the knowledge involved in the transfer. It refers to developing the understanding level up to a level where new appreciative awareness of making certain things occurs and applies accordingly.

> “...at one instance, when we want to streamline the new layout of our production line, an operator gave a suggestion to set the distances between machines in the line according to the height and size of our operators {local people}, meaning that, we not necessarily follow the exact measurement as in the parent’s company shop-floor {they follow Japanese people size}. This is indeed an example of a new insight that comes from understanding of the key areas of TPS...” [*Mazlan*]

> “...transferring and implementing the new TPM knowledge also involved creating new outcome in delivering its content. For instance, in the Why Why Analysis, we can get new ideas and insights from solutions and suggestions given by the members...” [*Ghanesh*]

> “...not only we ensure that the new TS systems are generally understood in the shop-floor, but we also welcome any new inputs towards the betterment of the systems implemetation...” [*Nasser*]

Mazlan, Ghanesh and *Nasser* in the three quotes above highlighted the importance of having new insights, and thoughts on the new knowledge they gathered and implement in the production lines and how these new thoughts develop into a good circumstance of knowledge transfer.

Another important aspect in dealing with transfer of new knowledge particularly related to manufacturing practices is related to its **quantity.** Quantity refers to the level or degree that the new practices and knowledge help improve the task and function, as knowledge transfer is also evident in the results or output of the task and function.

Reduction in cycle time, for example is one evident of knowledge being transferred from the quantity side. It shows that **reducing the cycle time,** is the result of having the right knowledge transferred, and can lead to improved overall performance time.

> "…the implementation of *kanban* indeed improved the whole process of manufacturing, it makes production more systematically executed and reduced the time it takes to perform a task…" [*Mazni*]

> "…by stopping any irregularities in the machines and follow the steps of TPM closely, we could help eliminate non value added tasks and waste as well as making the overall processing time shorter…" [*Zoul*]

> "…in TS we need to write the system precisely, so the rule of the thumb is we just write what we actually do in production. Writing standards that we are not usually done, or seldom done, will effect the time it takes to complete a task…" [*James*]

The three quotes above represent the importance of the quantity aspect of knowledge. The cycle time of producing a product from the shop floor as mentioned by *Mazni* and *Zoul* shows how important time is, and the latter quote from *James* proved that by putting cycle time as indicator or urgency, the transferring of the right knowledge becomes more important.

By getting more intense, in-depth details of the knowledge transferred means faster results when performing the new system. Waste is a result from production that would bring non-added value. Thus another aspect of quantity to be considered is related to the **elimination of waste**, as evidence in the following quotes;

> "…one paramount point that we aim in implementing TPS is to eliminate waste. By ensuring that everyone in the shop-floor understands the TPS wholeheartedly, the total waste could be eradicated…" [*Fadhil*]

> "…by stopping any irregularities in the machines and follow the steps of TPM closely, we could help eliminate non value-added tasks and waste as well as make the overall processing time shorter…" [*Zoul*]

> "…Implementing the TS is not only following the written standards, by implementing it with the precise standards, we can also reduce waste along the line…" [*Nasser*]

All the three quotes above highlighted that elimination of waste is another quantifiable measure for knowledge transfer. Much better knowledge is transferred when waste is removed.

A further essential aspect regarding transfer of new knowledge particularly related to manufacturing practices is its **accuracy** in implementing a certain process and task. Accuracy in this context refers to the degree the new practices and knowledge helps produce excellent results. A high degree of accuracy which leads to excellent output is one of the evidence of knowledge being transferred.

The first sub-category of accuracy is **efficient implementation**, where the evidence of accuracy in intensity of knowledge transfer is reflected in its efficiency.

> "…this would even give maximum impact, as at the same time what and how our line leader do, we just copy it and even the productivity of that product counts, thus efficiency and productivity goes together along the new knowledge received…" [*Suzie*]

> "…with the new maintenance check sheet, the implementation of checking, cleaning and oiling the machineries becoming more efficient…" [*Muqarabin*]

> "…the efficient implementation of TS will resemble during the TS Pre Audit trial, which will guarantee that every standards are followed…" [*Ghazali*]

The quotes from *Suzie, Muqarabin* and *Ghazali* above demonstrate the importance of accuracy in term of efficient implementation, in which with the need for accuracy and efficiently executed implementations new knowledge need to be transferred within the subsidiary.

The second sub-category of accuracy is **effective response**, where the evidence of accuracy in intensity of knowledge transfer could be reflected in its effectiveness;

> "…during *gemba* {Gemba in TPS}, we usually get immediate and effective response from all the personnels in the shop-floor…" [*Mazlan*]

> "...from the five senses training in TPS, we would get effective and better response from the operators if anything is wrong with the machines..." [*Ishak*]

> "...to guarantee that the full TS certification is acquired, we demand a quick and effective response from all the committee members to finalize the details of the standards... " [*Chia*]

The excerpts of three quotes above underline effective response as another main circumstance under the accuracy of intensity of knowledge transfer.

The three criteria under the intensity of knowledge transfer from the data analysis shows that quality, quantity and accuracy of knowledge are all combined in providing the circumstances of aspect and classification of knowledge transfer.

6.3.2 Place/Location where knowledge is transferred

There is another major important question to discover, specifically, the place or location where knowledge is transferred. The place or location can be any place that is physically available and accessible to host the transfer of knowledge. There are three main themes which emerge from places where knowledge is transferred, namely (a) the certainty of the place, (b) the purpose of the place, and (c) the place where it is bounded by time and eventful nature.

Certainty of the place

Throughout the three projects explored in this study, it is essential to know "where" or the certain location and place in which the transfer of knowledge occurs. For the certainty of the place, these places are further explained based on the three projects;

"…to be able to transfer the knowledge of the manufacturing practices, there are specific training places that take place in realizing this motive…" [*Sugi*]

"…most of the knowledge transferred to us are acquired in the destined training places accordingly selected for us to undergo…" [*Aisya*]

One important kind of certainty of place is the availability of such specific training places, as the **TPS Training Room**, in the case of the TPS system.

"…the TPS training room provides an ample place for training to get all level of personnels involved, from operators, to technicians, to section heads and managers. All of them need to be trained on the new system…" [*Fadhil*]

"…the most proper place I can say that give me the most information and understanding about the TPS system is the training I received in the TPS training room…" [*Sadikin*]

The second main training place in the TPM is the **TPM Why Why Analysis Section**;

"…the TPM section is a well maintained area, and from there our operators received the transferred new knowledge of manufacturing practices of TPM and they are trained to implement them…" [*Zack*]

"…this is the place where we get to know what and how to do in term of implementing the TPM Why Why Analysis, and Lost Reduction Activities. This TPM Section is very conducive indeed…" [*Mahdzim*]

For the third specific training place in TS the central place for transfer og knowledge is the **TS Certification Training Seminar** where all the main committee members are to help;

> "…once in every quarter, we call all the section heads or their reps (normally senior supervisors) to come to the training seminar to keep them updated on the TS requirements…" [*Nasser*]

> "…the seminar which is held quarterly to prepare our plant for the TS certifications and checking is very helpful, where every department come and sit together getting the details training on it…" [*Evelyn*]

The three places address above emphasize the significant of certainty of places in which from the quotes and examples given, each of the three projects has its own specific place in which knowledge transfer occurs, such as the TPS Training Room, TPM Why Why Analysis Section, and TS Certification Training Seminar.

Next, there are **specific meeting places** in the knowledge transfer process, based on the three projects accordingly;

> "…in realizing the move to make the process of transferring the knowledge of the manufacturing practices a reality, we create specific meeting places so that our personnels will feel much comfortable …" [*Sugi*]

> "…in making sure that the knowledge is transferred to us consistently, designated meeting places that are purposely built and prepared for it are needed…" [*Saras*]

For the specific meeting to take place, in TPS the main place is the **TPS Morning Briefing Area**;

> “Every morning, we gather around the TPS Morning Briefing Area for 15 to 30 minutes, mainly 15 minutes are spent on operators, part to brief the daily updates on TPS including the yield of productivity, and the remaining time are allocated among the section heads, supervisors with engineering and maintenance team to discuss any arising issues…” [*Nan*]

> “…the TPS Morning Briefing Area is basically a very simple place at the starting end of the production line, where there are only boards with charts and infos, and the boards are placed in a square shape so that we would be able to sit and meet for a while. We use the stools from the production line for the seatings…” [*Mazni*]

In the TPS Morning Briefing Area, knowledge of the day-to-day production which consists of yield, production updates, problems, challenges and solutions are briefed and discussed and normally a representative from the night shift is also around if there is any important issue that needs to be addressed.

For the second specific meeting place in TPM, the main place is the **TPM Corner**.

> “…meeting in the TPM corner often involved sharing of information on machinery problems. Usually the maintenance and operators who are facing problem with it need to take part. The corner has only a round small table at abdominal level so that we can get around meeting and discussing while standing up…” [*Muqarabin*]

> “…the TPM Corner provides a very good place to meet and discuss, and it is a place where most experiences and solutions regarding TPM is transferred…” [*Nan*]

In the TPM Corner, knowledge of machineries problems, trouble-shootings updates and solutions are discussed and exchanged and new findings on any machines updates based on time out, hiccups and need for attentions are updated.

And for the third specific meeting place in TS the central place is the **TS Control Centre,** where all the manuals of the TS standards are kept for references;

> "..whenever we felt confused with the new standards and need to check and get updates related to TS, we will go to the TS Control Centre, where all the important details of TS are available…" [*Abidin*]

> "…at the TS Control Centre, we normally meet once a month formally to update on the overall TS status of the plant…" [*Nasser*]

At the TS Control Centre, all the standard and systems are kept and updated systematically, and the monthly meeting as mentioned by *Nasser* is important in ensuring the standards are up to date and consistent with the international standards.

For the second main sub-category related to places, they are about **undefined and unspecific places** involved in the knowledge transfer process. Seven places are identified; namely *gemba*, ad-hoc briefings, water-cooler machine, canteen, smoking area, *surau*, and car parking area;

> "…sometimes, there are informal undetermined and unspecified places where knowledge could be transferred effectively." [*Sugi*]

> "…sometimes, more often the knowledge is transferred to us and we acquired them in places where we do not think for, meaning that the places that are not specified for…" [*Ai Lin*]

Purpose of the place

Throughout the three projects explored in this study, there are also places where related problems are dealt with during the knowledge transfer. Although some of the places are not specifically mentioned for meetings or any of such activities, the existence of these places provides a host for the transfer of knowledge.

One such place is the **water-cooler machine**. Water cooler fountain is identified as a good place to exchange views and obtain better understanding on work related problems. Besides refreshing themselves, they are able to manage the process of transfer of knowledge;

> "…a place where most operators and technicians informally meet is near the water-cooler drink place…" [*Zoul*]

> "…I could get new inputs when meeting {chatting} with operators and technicians of other department when I go to grab a quick drink at the fountain {water-cooler}…" [*Aisya*]

According to *Zoul* and *Aisya,* the water-cooler fountain machine provides a good place of exchanging and transferring knowledge and it is a place where operators from all other production lines gather for a short break to freshen out.

Canteen is another good place to discuss new knowledge transferred as there are special order section, which highly resembles that of *kanban* card system, a system for ordering meals, which they found very interesting;

"...knowledge could be discussed and transferred when we are in the canteen during our break. Some examples of story related to TPS, for instance about *kanban* can be elaborated during our break, for instance when we place 'special order; in our meals, how they place our orders on small paper sheets, pegged along a string in line with chronology...this is unique..." [*Eddie*]

"...apart from water-cooler fountain, canteen is a good informal place where we exchanged what we understood from the new knowledge..." [*Chua*]

Eddie and *Chua* suggested that canteen is another good place for knowledge to be transferred within the subsidiary. The situation and condition where everybody relaxes make the transfer smoother.

Another suitable place to transfer and exchange new knowledge found is the **smoking area;**

"...when our mind and body came to a limit, the operators normally take five at the nearest smoking area. This is allowed once in two hours time. This is another unstipulated place where tacit knowledge could be transferred..." [*Fadhil*]

"...getting some rest at the smoking area with some colleagues indeed open up an opportunity to get new info and skills on new knowledge..." [*Nan*]

The smoking area is another place, where normally operators and technicians spend some time releasing their tense body and mind. Though not much time are spent there by everyone, many of the technicians chat and exchange ideas in this place.

Whenever there is a call for prayer, they gather at this place, an excellent place to discuss new findings particularly those related to the air conditioner and compressor line, as the **chaplaincy / prayer room** is blasted with full air-conditioning system. Moreover, they are in a peaceful state of mind which leads to better transfer of knowledge;

> "…in the mid-day, some of the operators spend some time in the *surau* {prayer room}for their noon meditation, oftenly they also discuss new inputs on TPS…" [*Rosli*]

> "…in the *surau* {prayer room, we usually talk about the progress of our line {compressor line} as there are air-conditioning in the *surau*, thus giving us more opportunity discussing things in this extra place…" [*Muqarabin*]

Surau (prayer room) is an ideal place where when mind and soul are placed at their most relaxed mode. After the mid-noon prayer which take time during midday lunch break, some of them exchanges ideas, updates and solutions from their production line.

When the employees take a short break at the **car parking area** upon arriving and leaving home, the glance of new articles and materials that bear Gambatte logo which they have in their cars could also trigger discussions. This is also a very interesting finding as the operators who utilise buses to go to the plant will have to walk through the parking area where most of the supervisors and officers would park their cars;

> "…another undetermined place of knowledge transfer is the car-park. Normally when the officers arrive or getting home, they will have some chit-chat that somehow related to dealing with problem solving at the shop-floors…" [*Fadhil*]

> "…it is amazing looking how the place like the car-park can be a undisclosed place where we discuss and found some ideas on TPM, perhaps because we have such a big parking area that our staffs need to walk quite a reasonable distance to arrive at the plant…" [*Nasser*]

The above discussion shows that even as simple place as parking spaces, and when walking down the aisle in the mornings to the production line or perhaps leaving for home in the evenings, a chit chat and exchange of knowledge could take place.

Bounded by time and eventful nature

Throughout the three projects explored in this study, there are also places which are bounded by event that make them important.

Gemba is an ad-hoc problem-solving meeting area that is categorised under unspecified place. Details are as in the Episode (please refer);

> "…when we face any production problem, the TPS Champion will call a '*gemba'* which is an ad-hoc problem-solving meeting that took place at the 'place and scene of the incident', principally responding to trouble-shoot any immediate and urgent problems…" [*Fadhil*]

> "…during *gemba*, we usually gather very near to the problematic machine and that any updates, inputs and solutions needed worth to be trying could be easily done instantly…" [*Eddie*]

Gemba is a significant proof of how important Japanese MNC wanted its subsidiaries to produce with quality and timely. At any place within the production hour, whenever there is any production problem, *gemba* is called, and provide a great opportunity for knowledge to be transferred. Most of the TPS lean manufacturing techniques are reinforced from these *gemba* meetings.

Ad-hoc briefings are normally conducted at any suitable yet unspecified places in the shop floor that facilitate urgent briefings;

> "…it is not unusual for the TPM team sometimes to come with an ad-hoc briefing to update certain maintenance issues, it could be near the machine tool area, or near the maintenance bay at the production line…" [*Rosli*]

> "…during quarterly internal audit, it is normal for the TS team to come over to the line and to ask and check on the operators on the standards…" [*Ghazali*]

From *Rosli* and *Ghazali* quotes above, ad-hoc briefings will be conducted whenever there is any need to streamline any issues and problems in the production line and shop floor.

Indeed, the three criteria under places of knowledge transfer from the data analysis bring about that certainty of places, purpose of places and bounded by time and eventful nature of places are all emerged in providing the platforms for the transfer of knowledge.

6.3.3 Diversity mechanisms nature of knowledge transfer

Another important question is "what are the mechanisms used in the transfer of knowledge". Mechanisms of knowledge transfer involve instruments, apparatus and methods used to transfer the knowledge. There are two major sub categories for mechanisms, namely the formality of the mechanisms as well as types of training activities involved which will be further explained below.

Formality of the mechanisms

The first main sub category is **meeting**. Meeting is an important element of mechanism in transferring knowledge. In meetings, the organisational personnel meet and discuss new input, knowledge, problems and their solutions.

Formal meetings are sessions where the personnel gather and confer in a specific place at a specified time to discuss specific issues. Often the meetings are planned in advance and sometimes they are periodical and take place on a weekly, monthly or quarterly basis.

> "...with the section heads {or representatives} from all the departments, we have a formal TPS Plant Meeting once in a month to update on the progress of TPS in our plant, normally the second Wednesday of the month, while with the production floor in the plant, I chair our weekly meetings on every Tuesday afternoons..." [*Fadhil*]

> "...for the TPM, we have our monthly main committee meetings every third Wednesday of the month. This is to streamline with the management meetings that we have every Wednesdays, so after that meeting on the third week, we'll have our management meetings..." [*Mahdzim*]

> "...the TS Plant Committee Meeting is held every quarterly, during the last Wednesdays of each quarter. In these meetings normally, I would request updates from every departments on their TS status..." [*Nasser*]

The three quotes above illustrate that all the three projects in this study has its own formal meetings which are organized by the project teams themselves. In the meetings in which most of the key personnels attended, most of the knowledge transferred are closely related to the manufacturing systems involved.

On the other hand, **informal meetings** are sessions where the personnel casually meet and confer in unceremonious occasion at any place at unspecific time with free discussion on unplanned topics. Such meetings occur unplanned and would sometimes lead to discussions in a relaxed atmosphere.

> "…when we deal with the Japanese officers here, when they want to know, and inform something, they come, talk and discuss straightaway. I think this is good because people can understand quickly when you talk and discuss at that time, so it is very good when they come and talk to the production.." [*James*]

> "..informal meetings give opportunity for us to get the problems solved promptly…" [*Ghanesh*]

> "…when we face any problems with the TS standards, we quickly request from Nasser {TS Coordinator} an immediate informal meeting…" [*Ku*]

Another part of the mechanism is **visit and briefing**, which signifies another component of mechanism in transferring knowledge. Through visits and briefings, new insights, knowledge and solutions are discussed and transferred.

Visits and briefings imply that the knowledge is transferred through a series of visits and briefings that occur in the plant throughout the shop floor and other parts of the production line. The visit is categorised by planned visits and exchanges, while briefings normally relate to ad-hoc briefings. The points below give further details on the different types of visits and briefings.

Planned visits usually involve some kind of stop over and are called in by specific officers from the management or certain persons to look into the implementation of the new manufacturing practices. The two important planned visits are the monthly TPM MD Tour and the quarterly Asean Jeshuken.

Despite being a ‘mock-visit’, the **monthly TPM MD tour** is a major planned visit where no exact planning and dates are arranged beforehand;

> “…once in a month, at any time of the day, in any week {most probably second or third week}, the Managing Director (MD) would make a tour and check the implementation of TPM throughout the plant…” [*Mahdzim*]

> “…when the MD makes his monthly tour, each of us need to be ready with our understanding of the TPM, as he would pick up anyone from the shop-floor to ask questions and chit chat with him, and mostly checking on our understanding of the TPM…” [*Zack*]

This monthly TPM Managing Director (MD) plant tour would generate exchange of knowledge and ideas relating to the implementations of TPM particularly within the subsidiary of Gambatte Malaysia from the vast experiences provided by the MD.

Next, is ***“Asean Jeshuken”*** which is a planned twice a year review by officers from regional Gambatte plants. The word is derived from *jeshu*, which means periodic review and the short term *ken* is taken from *kenkyukai* that means self-learning. It takes place every six months and takes turns and is usually attended by the champions of the TPS projects in the relevant plants (details please refer to Episode 12).

As *Fadhil* explained:

> “….in ‘*Asean Jeshuken’* activity, all the three officers will look and check our implementation of the TPS particularly and also will ask some questions to the operators…” [*Fadhil*]

> "….it is a quarterly training review that takes place across the four facilities; i.e. our Malaysian, Thai, Indonesian and Australian sites, in which one of us will take turn to become the host. Normally in the series of *Asean Jeshuken*, most new issues of TPS are discussed, a more standardized streamlinings between the TPS implementations in the four sites are compared and a better way of new knowledge of doing things would be transferred, compared and shared…" [*Fadhil*]

Indeed, from the *Asean Jeshuken*, most important knowledge of the TPS systems as practiced in other regional Gambatte will be discussed and shared, thus significant knowledge of manufacturing techniques of TPS transferred.

Another mechanism used is **ad-hoc briefing** which is part and parcel of the 'visits and briefings' to ensure that the training for knowledge transfer is fulfilled. The two important ad-hoc briefings are the Champion Briefing and *Gemba*.

Champions are the key persons who are held responsible for certain projects, in this case they are the TPS, TPM and TS. The post is called Champion in TPS, Coordinator in TPM and Head Coordinator in TS. The briefings are done whenever necessary and are unannounced. Please refer to Episode 3.

> "…when we have some new updates, especially related to productivity issues connected to TPS, I will always call for an immediate briefing…" [*Fadhil*]

> "…during the certification, any discrepancies faced by the auditors will be jot down and a quick briefing will take place at the department where the problems faced…" [*Nasser*]

A ‘champion’ is the key personnel that fully entrusted with the implementation of the TPS manufacturing system. He is also the compass and the primary source for the system he represents.

And a “***gemba***”, an ad-hoc problem-solving meeting-training that takes place at the ‘scene of the incident’, usually deals with trouble-shooting any immediate and urgent problem. Please refer to Episode 1.

The use of *gemba* (ad-hoc ‘on the spot’ meeting) as a mechanism of knowledge transfer is an effective way of promptly dealing with a problem. This is confirmed by *Fadhil*’s remark:.

> “By doing this, the production stop-time is dealt with in a very minimum time and the operators could trouble-shoot the problem much faster, and thus less time is wasted In fact, by calling the personnels involved at that spot and at that very time of the problem, provide better outcomes...” [*Fadhil*]

By using *gemba* it also shows that in terms of trouble-shooting problems, knowledge is better transferred on the site of the incident itself, and that by gathering the right information from the right source, and responding to the right place and using the right process, the problems could be solved in a much more efficient and productive way.

Exchange of visit is part of ‘visit and briefings’ type which categorises the visit done as an essential part of the training to ensure that knowledge transfer is achieved. There are four essential types of visit, which are (a) expatriates coming from the parent company, (b) expatriates coming from the regional company, (c) locals going to the parent company, and (d) locals going to the regional company. All the visits are for the purpose of seeking, training and understanding the knowledge and implementing the new manufacturing practices.

The first type of visit is when the **expatriates come from the parent company** to the subsidiary;

"...from time to time, there are visitors coming from our parent company in Japan. Normally, they come with new updates on the system, latest materials for the training, and fresh inputs on solutions..." [*Fadhil*]

"...sometimes the expatriates from Japanese parent is stationed here for a month or two, which means quite a long visit for them,..." [*Needza*]

"...normally when the expatriates come here, they would like to focus more on getting explanations, not only hearing problems, and also emphasizing more on finding solutions rather than only gathering hiccups information..." [*Mahdzim*]

"...expatriates from our Japanese parent always take a brief stop to look into the development of the TS progress..." [*Nasser*]

From the quotations above, we can get the meaning that the visitors from the parent company are not in the mode of checking what the subsidiaries are doing, but rather getting inputs on new solutions or updates on the progress of the manufacturing systems. This is quite interesting where some of the innovations found and implemented in Gambatte Malaysia are noted and recognized by the visitors.

The second type of visit is when the **expatriates come from the regional** group of companies to the subsidiary;

"...apart from *Asean Jeshuken*, where most of them are TPS Champions, we also have other officers from Gambatte coming here from regional office time to time Even though the main purpose of their visit is business, but they like to know and exchange views on the TPS development..." [*Fadhil*]

> “…since the TPM implementation in Gambatte utilized quite a holistic approach, we always welcome and receive visitors from Asean Gambatte and exchange ideas through discussions with them…” [*Ghanesh*]

> “…TS is a dynamic project and from time to time we have regional visitors from Gambatte coming and call in to meet our committee members…” [*Nasser*]

An example of importance of regional visitors coming is the *Asean Jeshuken* programme, but that is only for the TPS, whereas for TS and TPM, these visitors could also provide useful insights for the transfer of new knowledge.

The third type of visit is when the **local officers** get the opportunity to **go to the parent** head quarters;

> “…every alternate year, the champion and key committee in TPS implementation team will have the opportunity to visit and exchange views on TPS development from the parent company…” [*Fadhil*]

> “…normally a key member of TPM committee from local Gambatte will join the visit delegation lead by the TPS champion to the parent head quarters…” [*Ghanesh*]

> “…only if necessary, the TS champion will visit Gambatte parent at the head quarters…” [*Nasser*]

And the fourth type of visit is when the **local officers** get the opportunity to **go to visit the regional** group of companies;

"…the regional visit we had as a TPM team to Gambatte Siam (Thai) was a very great experience. From there, we can see and understand how things are done in quite a different way, but all working towards the same aims and objectives in our ultimate production goals…" [*Fadhil*]

"…a couple of months ago we had visited Gambatte Indonesia, and the whole of our TPM team was very happy and gained tremendous experiences from them…" [*Mahdzim*]

"More oftenly, I got to visit Gambatte Siam (Thai) and Gambatte Indonesia to clarify and streamline some TS issues and so that better understanding on the TS standards could be achievable…" [*Nasser*]

These two types of visits to parent Gambatte and regional Gambatte provided useful experiences for local personnels to enhance their knowledge.

The above themes and sub-themes are related to the formality of the mechanisms involved in knowledge transfer.

Types of training activities

Training is another key element of mechanism in transferring knowledge. Through training, company personnel meet and discuss new input, knowledge and problems and their solutions.

Classroom training refers to the knowledge which is transferred through coaching and guidance and is conducted in a classroom setting environment. The training is normally run in a training room using formal and informal approaches. The formal approach of the training consists of lectures and a basic question and answer session whereas the informal training includes practical applications such as simulation, checking with senses, storytelling and role play (please refer to Episode 5);

> “…we always maintain a good number of hours in training, where the indoor trainings are very important so that the operators would have a sense of coming into a proper classroom environment and getting the new knowledge transferred in such a conducive setting…” [*Sugi*]

An extensive example of training was presented in Episode 5 in the previous chapter.

There are six further sub-categories in classroom training as stated below. The first classroom training type is **lecture**. Lecture is where a trainer provides the materials to transfer the knowledge and imparts it in the classroom context training;

> “…once in every 6 month we would have a three hours session of providing information and teaching to the operators regarding new TPS initiatives and updates…” [*Fadhil*]

> “…in the first part of TPM Introductory, we gather the operators inside the training room to deliver the theoretical and factual aspects of TPM…” [*Zack*]

> “For training of TS, normally we run a group training lecture of awareness and reminder for certifications together with the supervisors and section heads of the departments…” [*Nasser*]

From the three quotes above, lecture is considered as one of the most quick, fast approach of spreading new information and knowledge.

The second type of classroom training which is an important form of training mechanism is the **question and answer session**;

> "...after the lecture, normally we open the session and encourage any questions from the participants to eliminate any doubts they have..." [*Mazlan*]

> "...whether the lectures are understandable or not can only be judged by asking them questions towards the end of the session and also welcoming any questions from the participants of the training..." [*Nan*]

> "...the questions and answer sessions in training are very good to gauge the level of perceptive on the new knowledge of the participants..." [*Chia*]

Question and answer sessions provide operators and personnels with better understandings and prepare them for any problematic conditions they may faced in the production line.

Simulation is another important type of classroom training. It normally takes the form of role play in order to facilitate the transfer of knowledge.

> "...in getting us the feeling of understanding of the layout of the shop-floor, we normally have a simulation by making arrangements from the blocks if lego..." [*Mazlan*]

> "...the Why Why Analysis Section of training provides us with a good simulation training bay to get the understanding of..." [*Eddie*]

> "...oftenly towards near the TS certification audit of compliance, we conduct trainings based on simulation..." [*Nasser*]

Simulation is among the best training around within the subsidiary that would give a high impact on the trainees, not only on how to face the actual situations in the production line, but also to have the opportunity to face it in simulations during the training sessions.

The five senses prove to be another significant classroom training mechanism. Operators are trained to make their senses extra sensory (refer to Episode 8);

> "…it is a very unique training that we use the five senses we have to detect any abnormalities of the machines…" [*Zack*]

> "…in the TPM Introductory particularly, we use the five senses training kit to make them familiarize on how to detect the early signs of problems in their machines…" [*Muqarabin*]

Training with the five senses provide operators with understanding that comes with sensual perceptive as well as cognitive abilities.

Another central point of classroom training type is the **storytelling** session. With storytelling, more understanding of the transferred knowledge could be achieved;

> "…when we want to train them, we always include part of story telling in it…" [*Fadhil*]

> "…in TPM, we normally bring stories to accompany the training points for better understanding of the points that we are trying to deliver…" [*Zack*]

The works of operators are quite routine, and thus by providing training in term of story telling would give them a little bit of relief from their daily structured tasks.

Participating by playing different **roles** is another vital classroom training activity.

> "...apart from simulation, we also have role-play as a part of our training..." [*Sadiqin*]

> "...the training involving role play, where maintenance people would be operators and vice-versa, so that they could understand how important every positions are in the shop-floor..." [*Rosli*]

> "..near the certification compliance audit, we will have a training involving role-plays, where some of our committee members were put into the auditor shoes, and they have to conduct a mock-up audit..." [*Nasser*]

Role play is important when the system and knowledge transferred require each of the members to possess abilities different roles and positions in real situations.

On-the-job training is another major part of mechanism in transferring knowledge. With on-the-job training, the implementation and application of the new system of knowledge is functionalized.

On-the-job training brings the connotation that training is undergone while working, particularly during one's assignment at an allocated place. In this context, the training is at the shop floor of the production line. On-job-training consists of job rotation, job enlargement, job enrichment and the super-operator certification.

The three types of exchanging jobs are clearly elaborated as explained by the operators in the episode of 'super-operator' earlier; where job rotation is one who rotates and works on other machines that perform quite similar tasks, job enrichment is where one does another extra job or task in the same line of production while job enlargement involves performing a job outside the current production line, that is, in the next line or other production line. These three types of training are the main ways of how they practice to later become super-operators.

In order to become a super-operator, one needs to acquire the skills and knowledge and to pass tests and certifications apart from having the ability to face the existing work pressure.

This is clearly explained in the following quote:

> " Here in Gambatte, particularly in TPS we are encouraged to be certified to run as many machines as possible. The more machines we can run, the better. But this also depends on our capability to absorb the skills, knowledge and also the stress and pressure that we could face. The way we could do as we are encouraged and arranged to involve not only in job rotation, but also job enlargement and job enrichment." [*Saras*]

The concept of **job rotation** is when one rotates and works on other machines that perform quite similar tasks as he or she is currently doing. The closer the second or third machine to the original machine the operator uses, the faster the job rotation could be done. Normally job rotation involves working in the same unit.

Details on how job rotation is done are further elaborated in the interview quotes from *Saras* and *Suzie below*:

> "The way we could do as we are encouraged and arranged to involve not only in job rotation, but also job enlargement and job enrichment. As you would

> understand, job rotation is about working on other machine that performs about the similar tasks and jobs like the one we are running,…." [*Saras*]

> "Yes, and that is very interesting about our TPS line here, not only that we are trained and allocated to different machines so that one day we will be certified to use them {job rotation}, but also….." [*Suzie*]

The concept of **job enrichment** is where one does another extra job or task in the same line of production where he or she is currently working. The closer the next machine to the original machine the operator uses in terms of operation, the faster job enrichment could be done. Besides, the more machines one can work with, the more enriched the person is in the job.

Details on how job enrichment is done are further elaborated in the interview quotes from *Saras* and *Suzie below*:

> "The way we could do here is to have not only job rotation, but also job enlargement and job enrichment. Job rotation is doing similar tasks on other machines whereas job enrichment is about making ourselves understand how to operate other machines involved in our production line…." [*Saras*]

> "Yes, and that is very interesting about our TPS line here. Not only that we are trained and allocated to different machines until we are certified to use them {based on job rotation}, but also from time to time we are needed to understand the working of different machines used for moulding processes in our line…" [*Suzie*]

The concept of **job enlargement** is where one performs a job outside the current production line, that is, on the next line or other production line. The more machines one can work with, the more versatile the person is in the job.

Details on how job enrichment is done are further elaborated in the interview quotes from *Saras* and *Suzie below*:

"The way we could do as we are encouraged and arranged to involve not only in job rotation, but also job enlargement and job enrichment. As you would understand, job rotation is about working on other machine that perform about the similar tasks and jobs like the one we are running, job enrichment is doing or understanding to operate other machines involved in our production line, while job enlargement is far out-reaching to understand and involves training to operate other machines from the next or neighbouring line" [*Saras*]

"Yes, and that is very interesting about our TPS line here, not only that we are trained and allocated to different machines so that one day we will be certified to use them {job rotation}, but also from time to time we need to understand the different machines used for moulding processes in our line for instance {job enrichment}, and sometimes when the production rate is not at the peak, we are made to exchange jobs with the next line in order to master different machines, and later on certified on them as well {job enlargement}." [*Suzie*]

And finally the notion of **super-operator** comes into context when referring to the ability of selected operators (the working level of employees in the shop floor), particularly in the TPS project with the special ability to understand, and running different processes (machinery) in order to make them flexible and resulted in them being given the opportunity to rotate their jobs, and their jobs being enriched and enlarged.

From the observations and interviews by the researcher, it is found that certain super-operator can run a total of 5 or 6 machines at one time. Please see also Episode 4.

Details on the training or certification of a super-operator are explained by *Fara* as below:

"Basically, we need to be with our trainer, who is the 'certified owner' or the operator that runs the particular machine, and we need to learn under her supervision for a total of 40 hours. If the original owner of the machine satisfied with our training and that he or she is convinced that we can run the machine, of course with certain tests, then only we will be certified. To be a trainer, firstly we need to be certified and work for a total of 400 hours on a particular machine, and after taking a special practical and theoretical test, the operator can now be a certified owner (and/ or trainer) of that particular machine. There are a total of 4 or more machines that we own under our name that we are certified to run. Later, we could also train others, making it possible for them to be called "super-operators"!" [*Fara*]

There is another main aspect of mechanism in transferring knowledge which involves other **special training** comprising occasional seminar sessions and intermittent mass training assembly.

Seminar is the first other special training utilized in Gambatte Malaysia. The seminar is normally conducted at the main multipurpose hall, in front of Plant 101;

"…for TPS, once in a year, we would have a global management team coming from our head-quarters, and we sort of arrange a short one-day seminar on TPS implementation here in Gambatte Malaysia and we will get their feedback first hand. This kind of special training means a lot to us especially, as we are the main committee and myself as the champion. We really could sharpen our saw from it…" [*Fadhil*]

"…for TPM, we do have an unscheduled seminar and discussion kind of training when there are visits of special technical teams from other Gambatte (mostly regional) and sometimes from the parent come to our lines…" [*Mahdzim*]

"...organizing a seminar of TS awareness across the plant to cover all the supervisors up to top management level which we handled twice a year is a massive training event…" [*Nasser*]

The second special training done is **mass training**. In the context of Gambatte Malaysia, the mass training could be held either at the main multipurpose hall, or sometimes even at the Company's huge parking area;

> "…at some point of the year, we would normally be staging a mass training week that takes place at our production lines {shop-floor} to freshen up all our staffs on TPS as a whole complete system. This is done normally during near to Christmas and end of year time, where demands and productions are minimum…" [*Fadhil*]

> "..and the idea of getting everyone revive the training is to make a mass training session at special events selected throughout a certain period of the year…" [*Zack*]

Indeed, the two criteria under diversity of mechanisms of knowledge transfer from the data analysis bring about that formality of the mechanisms and types of training activities which emerged in providing the mechanisms through which knowledge is transferred.

6.3.4 Mediums of Knowledge Transferred

One important aspect to be considered is the medium of how the knowledge is transferred. Mediums in this context refer to the channel and the representation of how knowledge of manufacturing practices is transferred. In the category of medium, the sub-categories are related to language usage as well as types of communication.

Language usage

Language is a medium used to communicate with each other. It consists of a set of sounds and syntax. Language is also the main medium used in transferring knowledge of manufacturing practices. Through language, the meanings and the illustration of how knowledge is transferred could be clearly identified and shared.

In the language sub-category, further items extracted are shared understanding, simple samples and analogy, collective terms and jargons.

This is very important in language as it is about **sharing of understanding** which also involves figure of speech;

> "…the understanding of things are very important. It involves what we say about something and how we react to it…thus, the selection of certain words represent shared meanings and understandings…" [*Rustam*]

> "…there are certain words that bring specific meaning in our lingo. When we say that the auditor is waiting at your gate with the quality control (QC) team, that gate means the Quality Inspection Bay at the end of the production line. Thus, 'waiting at your gate with the QC team' means waiting at your production line Quality Inspection Bay with the QC team…" [*Zoul*]

> "…when we say that certain words, thus the meaning and reaction should means 'something' that is shared, for instance, when we refer to the rule of abnormality in our production line, upon hearing someone saying that some abnormality is detected, that means we need to act quickly to stop the machine. Similar to when one say 'expedite red lot', this means that the production lot need to be processed urgently as it is under urgent category

> {expedite} and the level is very urgent {red} which makes other lots need to be stopped for a while to make way for the red lot…" [*Ghazali*]

The language used indicates that some terms used are meant for specific meaning, and this sharing of understanding element is very important to make the user understand each other and provide an important circumstance for knowledge transfer.

The second point under language is on **simple sample and analogy used**. This means that when transferring knowledge, the use of simple samples and analogy works;

> "…language used are usually simple and easy to understand. The language that is utilized is highly related to our daily works…" [*Aisya*]

> "…we use the sample and analogy of treating machine like taking care of a baby, this analogy of using the term baby, to replace the word machine, really makes the language and meaning that aimed to deliver results achievable…" [*Zack*]

Simple analogy and sample used are indeed a very good way of providing a medium for knowledge transfer to occur.

Collective terms are normally used to give meaning towards something, usually a longer term that could be shortened by an acronym or so. It is more important when the usage of the term becomes very important and that every staff member should be able to understand its meaning.

> "…we normally use a shortened version of long term and that we combine them into becoming an easier term to use, like the terms you usually heard

of around here, TPS {Toyota Production System}, TPM {Total Productive Maintenance}, PM {Preventive Maintenance}, SOP {Standard Operating Procedures} and WPS {Work Performance Sheet}, for example…" [*Neeta*]

"…shortened version of long terms are always used and very good to make the transfer of knowledge becoming much faster, and very much easier to use, just like TIE {Total Industrial Engineering} and 5S…" [*Mazni*]

These collective terms would provide easy usage and quick to say on the terms they represent and that the users are well-versed on the meanings.

Another aspect of language used is **jargon**. It is important when the usage of the term becoming very important and that every staff member should understand what it refers to.

"…I just need to have the general meaning of the words that the other members of TPS from engineering and maintenance are using, for example the jargons that they used. Although I could not get word by word…but the jargons they are using very closely related to our line…" [*Ain Lin*]

"..when I started working here, there are a lot of new terms and jargon that I need to know, most of them are Japanese terms…" [*Sadikin*]

"..whether in TPS, TPM or TS, the basic Japanese jargons need to be on our finger-tips; such as *muda* {waste}, *kanban* {production card}, *kaizen* {continuous improvement}, *andon* {hazard light} and *heijinka* {leveling(in production planning)}, all of these need to be understood by us…since everyone always use the terms…" [*Nan*]

Jargons that personnels use them extensively that only could be understood by the inner circles within the subsidiary are also an important element in transfer of knowledge.

It is also extremely important for the project personnel to call someone with the nicknames that could be remembered, which is **the way of addressing people**. For Japanese, titles are put along with the person's name, as below;

> "...for instance, when one call a name and following with a 'san' , that means a very good relation among them, but if one call a name, with added ending by 'kun', this means the caller is much stronger in status than the person who is being called..." [*Nasser*]

This type of calling others also highlight the importance of how one need to handle knowledge so that the transfer would be beneficial and successful.

Types of communication

Communication is how we connect with one another, and from this viewpoint, we would like to see how knowledge transfer is realised through the medium of communication. Communication can be divided into verbal and non-verbal, documents, visual and sounds as well as feelings and sentiments.

A chief category of communication is **verbal** communication. Verbal communication is a medium of knowledge transfer that is categorised by the use of voice in communication. Voice is very important and this can be further branched out into face-to-face, telephone and teleconferencing.

In transferring knowledge in a Japanese MNC subsidiary, **face to face** communication is essential. This basic verbal communication is approved and applied by all the three projects involved.

"…among the personnels, if there is a Japanese officer, normally he come, talk and discuss. This is also practiced by all our officers here. We always talk and discuss with each other face-to-face…" [*Mazlan*]

"…whenever we counter any issue with the machines, we would communicate with each other face-to-face. As our plants here are centralized, it is quite reliable to communicate among each other physically…" [*Mizi*]

"…I always encourage the committee members to communicate face-to-face. Even I myself call in and see the relevant personnels having problem with TS system and I like to hear directly from them to get a clearer picture…" [*Nasser*]

Verbal or face-to-face is the most important type of communication occur, not only in the subsidiary but globally accepted. And in term of knowledge transfer, verbal and face-to-face provide a significant way of communication.

In making the knowledge transferable, a common means of communication to one another is through the **telephone**. Talking through telephone is very important in parting knowledge especially when confirming or clarifying matters or issues pertaining to the new manufacturing processes. From the interview, it is also understood that telephone is an important medium for knowledge transfer not only because one can talk and discuss through it, but also because of the capability of the facility today which can record and save important conversations.

"…when we face any difficulties with the line, and when line leader and line supervisor couldn't solve it, the next level of reference is to quickly phone the

TPS Champion and we always ensure the conversations are recorded so that we can retrieve again if the same problems repeat…" [*Marzuki*]

"…I always check the number of the caller when my phone rings, and if the callers are from the production line, I usually put the 'recording' option on, so that further references could be made based on the same solution discussed…" [*Fadhil*]

"…sometimes the question or problem looks small and simple, yet could still be important; thus, we make the initiative to always call {use telephone} the Champion {for TPS} or the Coordinator {for TPM} to inform about the problem…" [*Mazni*]

"…any problems arise, we always check and make phone calls to the relevant officers related…" [*Ghanesh*]

"…preparing for the TS audit is very hectic, therefore when facing any problem, the phone is just a dial away and I {as Head Coordinator} always need to be ready to answer…" [*Nasser*]

Using the phone makes the communication faster and enables one to connect to the person at any place to settle any issues on the knowledge of manufacturing practices.

Teleconferencing is another means of communicating with one another not only verbally, but also visually. This is important in transferring knowledge of the manufacturing practices, and is agreed by all the three projects involved.

> "…once in a while, we make teleconferencing with our counterparts in the parent company and exchange views and get some fresh solutions on TPS with them…" [*Fadhil*]

> "…by teleconferencing, we can communicate verbally and thus get solutions much faster and with more transparent…" [*Mahdzim*]

> "…we can get the feeling of closeness and importance when we could communicate through the teleconferencing system verbally…" [*Ghazali*]

Teleconferencing between personnel across continents between parent and subsidiary brings the problems much closer and solutions much faster.

The second principal category of communication is the **non-verbal** communication. Non-verbal communication is a medium of knowledge transfer that is classified as communication without voice. The researcher has divided it into two parts - paging and email.

The first non-verbal medium of communication is pager machine. Pager usage has become more important, thus when one **pages**, in which after getting a page, the receiver will call the number back to further check on any problems. Another salient feature is that, pager could get easier access in covered production plant building and that the person needs to find the nearest internal / fixed line phone to call back, in response to the page.

> "…when I get a pager beep, I quickly find a phone {internal phone} to call back the caller and start discussing {communicate} straight away…" [*Zack*]

> "…a pager is an important gadget for us, it is like screaming voice in a small box. When I received a page, I need to quickly attend it, since the person who pages also understand that only very crucial problems need to be paged to…" [*Fadhil*]

"...the uniqueness of a pager is, wherever we go, the pager signal is there. Therefore, in a packed hectic internal compound area of the production plant, I could be easily paged and that any problems in the shop-floor and anything related to the TS project problem, I can always be in touched..." [*Nasser*]

Pager is an important element of non-verbal communication particularly in areas in which mobile phones are not allowed due to high static waves and signals.

The second non-verbal medium of communication is **email**. Communication through email has grown significantly and is essential especially for information that does not require the urgency to respond. Another prominent feature is that when an email message is received, it provides some sort of a written record of the message. Through email also, one can communicate with a large number of people and send attachments without using a single piece of paper.

"...Emailing is now becoming like a substitute for the physical person to communicate among each other, the beauty of it, we can keep the memo for a long time..." [*Needza*]

"...we normally email our counterparts in the parent company asking for details of the TPM materials, if there is any problem that we face here on the shop-floor..." [*Mahdzim*]

"...normally if the update of TS system required explanation in great detail, they will email us with attachments..." [*Evelyn*]

Email nowadays can come in with all the attachments that could facilitate the transfer of knowledge within the subsidiary.

Email communication is a unique medium of knowledge transfer since the parent company normally has access to the computer system and all information is sent and updated in the email system and this information can be transferred into the computer systems;

> "...the update of the system helps us to be in constant communication..." [*Evelyn*]

Undoubtedly, an important medium of knowledge transfer is '**document'**. As a medium of knowledge transfer, a document is highly technical and includes instructions, modules, charts and software manuals, which are absolutely vital in ensuring that new knowledge is transferred and implemented effectively in the subsidiary. Three further sub-categories of documents are clear SOP (standard operating procedures), detailed WPS (work performance sheet) and charts & pareto.

Standard operating procedures or better known as **SOP** among Gambatte Malaysia and MNCs is a kind of central documentation in making sure that the employees follow the right procedures when completing tasks in the plant. An example of this is shown in the TPM Why Why Analysis Episode 8 through the flow chart which clearly answers the 5 questions of why in relation to the TPM.

Work performance sheet (**WPS**) is another main document that is the back bone of medium of knowledge transfer. It consists of the details of the work and job being done practically in the shop floor with further details added by the operator;

> "..we have to always refer to the WPS in our work and jobs..." [TPS]

Work flow **charts and graphs** are another very important medium in achieving the knowledge transfer. Based on the charts and understanding of what is shown, the knowledge to be transferred is achievable. (See Episode 2).

> "We can also understand what processes are taken part and what are the operators doing in the line by referring to the layout of this diagram" [*Latifa*]

Apart from all of the above, another main medium of knowledge transfer is **visuals and sounds**, and this medium speaks for itself during the observations of the researcher.

> "So basically, when you hear the sound of music, it tells us to do 5S...", [*Aisya*]

TPS Board is another important medium of knowledge transfer that is self explanatory. Its contents are easily understood by anyone who looks at it. (Please refer Episode 2).

> "Anybody who walked along the production line will be amazed by the simplicity of the system (board), but yet very comprehensive and easily understood. From there, we not only knew that the current TPS line at that very moment was running to assemble condenser for which cooling system, for which customer, and furthermore we actually will digest on what are the enhancements that were developed along the time-line." [*Latifa*]

Besides those mentioned above, **visualization** is another medium in transferring knowledge which appears in most of the documents attached to the machines as visual aids. They are very helpful as they give clear explanation in the form of visuals including photos which are attached together with the documents as in Episode 6 and presented again here in Figure 6.4.

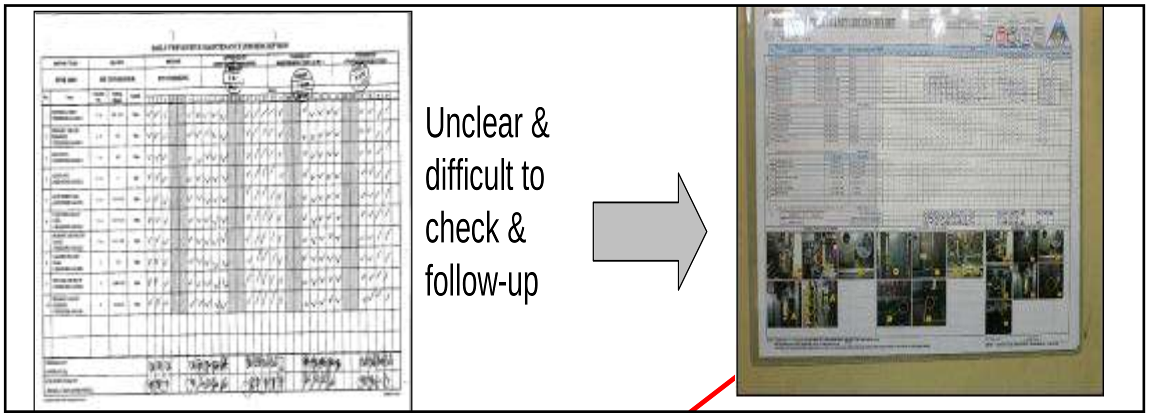

Figure 6.4: Sample of Visualization in machine checking.

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Andon lights by itself as well as in clusters would trigger to any abnormalities in the machines on the production shop floor accordingly. They would be prominently visible as they are located at high places such as the roof of the shop floor so that they could easily catch our attention. When any machines are idle or stop suddenly, andon light turns red, and one would know that the machine need attention, and less cycle time will be carried away, thus manufacturing would resume soon.

Signage is also very important as a medium for knowledge transfer. When one glances through certain signage, for instance tagged items, machinery or equipment, the person would notice and know what it stands for. Please refer to Figure 5.10a of *kanban*, which comes with T5 sign referring to TPS initiative. Similarly, machines that need to be maintained under TPM initiative would have a TPM sticker placed on them.

Another medium of knowledge transfer is the use of cards that are put together with their staff ID card known as **laminated cards.** These cards contain all the necessary information that all Gambatte employees have to know. Buttons on the other hand tell us that the bearer has been in service for 5, 10, 20 or 30 years. There is also a remarkably attractive button which says that the bearer is a Super Operator.

Colors are another medium of knowledge transfer, with different meanings associated with different **colours**, just like the “red cap” of the Quality Director in Episode 10.

Another important medium of knowledge transfer is **music**. Music could also be a medium of knowledge transfer as per detailed in the Episode 7. When certain music is played, one knows what the music signifies and what to do in the situation.

This medium of knowledge transfer is quite unique, in which when a certain **chime and buzzer** sound is played, the operators know that it is time for a break, to stop the machine, or to initiate final stoppages of production for the day.

And finally, the fifth sub-category of medium of knowledge transfer is the **feeling and sentiment.**

The first type of sentiment used is by nurturing the instinct of **care**. Care in this context means care towards the job, care towards the machines, care towards the products, as well as care towards oneself and others.

The second type of sentiment or feeling used is by developing the sense of **ownership** so that all Gambatte staff members have the feeling that Gambatte Malaysia is part of them. See Episode 11.

The third type of feeling or sentiment used is by instilling the spirit of **Gambatte DNA** in every Gambatte staff. This has been touched by the MD of Gambatte Malaysia and elaborated in Episode 11.

6.3.6 Factors Affecting Knowledge Transfer

There are several factors affecting the transfer of knowledge to the subsidiary of Gambatte in Malaysia. They are personal factors, roles of ownership and attributes of players, organisational factors and motivational factors.

Personal Factors

The first and most important factors affecting knowledge transfer are the personal factors. The personal factors can be further divided into three sub-categories, which are education, rank and experience.

This sub-category of **education** refers to the level of education held by the interviewees (respondents). The respondents basically come from two types of education background, those with the technical background, and those with entry-level qualification.

Those with **technical** education background means they have received education with emphasis on basic technical knowledge. As such, they could manage technical jobs with much ease and could climb the technical hierarchy ladder with their knowledge and experience.

From the findings, it is found that this group of technical backgrounds could absorb the transferred knowledge more easily particularly in the technical area, together with the use of technical jargons since their level of knowledge and understanding on technical matters are quite similar.

The second type of education background is **qualification level.** This means that the respondents' qualifications meet the minimum qualification requirements. Such respondents usually have to be trained in house from between 6 months to a year, and could climb the hierarchy ladder later when they have achieved certain levels set by the organisation. Those who join with degrees in management or other disciplines could also be given an opportunity to become management trainees at Gambatte Malaysia and at the same time pick up the basic technical knowledge along the way.

From the findings, it is found that this group of respondents with qualification level background could pick up the transferred knowledge particularly on non-technical matters quite easily compared to those with technical background. Furthermore, in terms of knowledge in management, this group shows quite good progress.

The second personal factors that affect knowledge transfer is related to the **rank** of the employees (actors) in the organisation which could be categorised into three levels; senior, middle and junior.

Seniority is gained through work experience and achievements over some period of time. Interestingly, among the respondents in Gambatte Malaysia, the more senior and higher the rank is, the more helpful the officers are.

The **middle** rank is achieved through hard work after serving for a period of time. Middle ranked staff can be good team players as they can assist and ensure the smooth transfer of knowledge.

Finally the **junior**-ranked staff members are those who have just joined the company for a short period of time. These staff, although young in terms of age and service, can be hardworking and diligent. Not surprisingly, some of them climb the promotional ladder to reach super-operator level within a short period of time.

The third personal factors that affect knowledge transfer is regarding the **experience** of the employees or the actors. The experiences are gained from their project involvement and certifications.

The experiences are gained from involvement in various kinds of **projects** in the plant. The more challenging and rigorous the project is, the more experience and knowledge is gained. An example is how a champion gained the experience after his involvement in the TPS project. (See Episode 3).

A c**ertificate** is awarded after one has been successfully certified to operate certain tasks or jobs, normally involving machines. Gambatte Malaysia practises standard regulations, in which only certified operators are allowed to run certain machines, including for maintenance purposes. For instance, if a technician is a junior staff, a certified operator needs to be on site while the maintenance takes place. The more certifications awarded, the more experience is gained, such as the example of the super-operator in Episode 4.

Roles of ownership and attributes of players

The second main factor affecting knowledge transfer in Gambatte Malaysia particularly from the subsidiary perspective is related to the roles of ownership of the knowledge. This refers to who or what position of an employee that possesses certain ownership responsibility of the knowledge.

The first type of role of ownership of knowledge is the **source or originator**. This role is when the owner of the knowledge holds it and manages it accordingly. This role is further divided into champion, referral point or trainer.

Champion or coordinator is the source of the initiated knowledge. The person is normally responsible for managing a project. See Episode 3 on Champion.

Referral Point refers to the officer whose expertise is sought after regarding project related matters. A good example is mentioned in Epiosed 10 on the charisma of the Quality Director that becomes a referral point in the project.

A Teacher or trainer is the person who has the knowledge and transfers it to a group of trainees so that they could understand and apply it. An example of the situation is in Episode 5 which is related to trainer and training of the TPM system.

The second type of role of knowledge ownership is the **receiver** whose role is to obtain, collect and receive the knowledge. There are three sub categories, namely at the shop floor, at the department and at the plant.

At the far end of the receiving part is the person and his team who are stationed **at the shopfloor**, working in the production line, and running the manufacturing processes. This role includes capturing what needs to be understood, done and completed in the production line.

At the more general location, the receiving knowledge point is **at the department.** This involves personnel with a more general role as the department is larger and busier than the production line.

Lastly; **at the plant**, which means that the role of knowledge ownership is much wider and the area is much bigger than just departments and production lines.

The third type of role of ownership of knowledge is the **implementer**. This role is related to the person from the team that implements or applies the knowledge in practice. A good example is shown in Episodes 7, 8, and 9 of the previous chapter.

The fourth type of role of ownership of knowledge is the **auditor**. This role is related to the person from the team that audits, checks and could also approve the knowledge initiatives. Monthly rounds and *Asean Jeshuken* as stated in episode 12 is a good example of this.

Attributes and qualities of the knowledge are crucial to the players themselves. Among them are cooperation, teamwork, integrity and one-headedness. **Cooperation** is a critical factor that affects the process of knowledge transfer as it is required in all types of jobs.

Teamwork is another important attribute expected from the players. Working in a team would ensure the right knowledge transferred, thereby achieving better results. See Episode 7 of 5Ss.

Integrity is about trust, loyalty and honesty. Working with integrity means that one works with full awareness and wholeheartedly. Integrity is an important factor in transferring of knowledge.

A good indicator for integrity is **transparency**. One needs to have clarity, precision as well as accuracy in dealing with his daily jobs and tasks in order to have integrity.

Another attribute among the players or owners of knowledge is the spirit of togetherness in thinking and agreeing. This is known as **one-headedness or trans-compatibility**. The sample exercise of *gemba* and WWA activity in the related episodes of the previous chapter proves this aspect.

A good indicator of one-headedness is its sign, for instance **wink**. When one winks to the other in the plant, this reflects the importance of togetherness and one-headedness.

Another important factor that affects the knowledge transfer process is the **nature of work**. One very important nature of work is working alongside at the **production line** or the **shop floor**. This type of work is rated highly by the operators, as per many occurrences elaborated in the episodes in chapter 5.

Technical support is also equally important in the process of knowledge transfer. Examples of their work given in the episode related to *gemba* and TPM WWA in the previous chapter prove its importance.

The third nature of work is related to **quality control**. Its strict and hectic nature of job is shown in the episode of ICAR in the previous chapter.

Finally, the forth factor that affects the knowledge transfer process is related to the **management** team. This is among the top rankings in Gambatte Malaysia, and their nature of work is different, thus giving them the opportunity to utilize different ways or approaches of transferring knowledge to their staff members.

Organizational Factors

Apart from personal factors and the factors of role of ownership, another factor that affects knowledge transfer is the **organisational factor.** Two main attributes related to the organisational factor are hierarchy and status.

Hierarchy is the place in the organisation levels in which one belongs. From research, hierarchy would be a factor in determining knowledge transfer, be it the type or way of transfer. (Refer to Episodes 2, 7 and 8).

Status is the position of oneself in the organisation. Different status would lead to different way of acquiring and transferring knowledge.

Another factor that affects the knowledge transfer process is related to the **environmental factor**. The environmental factor refers to the 'time' of the day, the humidity of the air, and the air quality.

The **time of the day** proves to be very important in determining the knowledge transfer process. Just ponder at episode 7 of the daily 5S in the previous chapter 5, which indicates how the time was selected for performing the 5S exercise.

The **humidity** of the environment particularly in the shop floor of the plants also plays a big part. Therefore, in order to maintain good humidity, the air conditioners are switched on and maintained at certain temperatures to ensure the condition is conducive, thus making the knowledge transfer process smoother.

Air quality is also another major element to be taken into consideration. For instance, the workers in Plant 103 need to wear and use "smock", a kind of anti-static materials so that the electrical elements of the products would not be spoiled.

Motivational Factors

The sixth factor that is affecting the knowledge transfer process is related to the motivational factor of personnels involve in the transfer process. The motivational factor can be divided into tangibles and intangibles.

Tangibles are the motivational factor that could be physically seen. In other words, the motivation is more on something that can be seen and utilised. Shopping vouchers, meal coupons, vacation trips and tickets are examples of tangibles items.

In Gambatte Malaysia, tangible motivation is mainly divided into three types. The first type is known as **monetary rewards** system where monetary incentives are given to individuals who contribute brilliant ideas or suggestions to the organisation. (Please refer to Episode 10, particularly on Figure 5.11a).

Another tangible motivation in Gambatte Malaysia is also related to the departmental side. This type of motivation is known as **monthly special meal**, and it is awarded whenever the department achieves the targets set in the previous month, and will be attended by the MD or high ranking top management.

The third type of tangible motivation is awarded for the best projects. For this incentive, the project winners including all members involved in the project will receive **a trip** sponsored by the company.

Intangibles, on another hand, are the motivational factor that cannot be perceived by the senses. In other words, the motivation is more on something that can be felt and is related to oneself. There are two kinds of intangibles - positive reinforcement and negative reinforcement.

Positive reinforcement here refers to any positive action made by the employee. In this case, the operators and officers of Gambatte Malaysia would love to be part of it.

One good example is by putting up the '**photo' of the operator of the month**, so that the motivation level of the photo-owner as well as others will be boosted.

The second kind of intangibles is **negative reinforcement**, which refers to any negative action that no employee in Gambatte Malaysia wish to be part of.

A good example is by giving **demerit points** to the production line. The points will be accumulated throughout the year. Therefore, the team with the most demerit points collected will receive some sort of punishment.

Another good example of negative reinforcement is by giving **ICAR** to the production line whenever a problem arises, and when this occurs, the production line has to be fully responsible for it.

6.4 Discussions on Circumstances of Knowledge Transfer

This discussion part mainly covers the second research question on the circumstances that make knowledge transfer possible. Five main emergent themes appeared from the data analysis related to the circumstances. They are nature and classifications of knowledge transferred, places where knowledge is transferred, diversity mechanisms nature of knowledge transfer, mediums of knowledge transfer and finally factors affecting knowledge transfer.

On the classifications and types, the category relates to the explicitness and tacitness of the knowledge being transferred. Knowledge can be classified here as information (explicit knowledge) and/or know-how (tacit knowledge) (Nonaka, 1991; Simmonnin, 1997, Koskinen, 2003). Information is knowledge that can be transmitted without loss of integrity once the syntactical rules required for deciphering it are applied. Thus, knowledge as information implies knowing what something means, and that it can be written down (Grant, 1996b; Nonaka, 1994). Therefore, in elaborating the categories under the nature of the knowledge that is being transferred, particularly on what classifications are to be divided, let us look into the part where explicit and tacit are divided.

This study would then be analysed to further understand the processes that facilitate the transferring of explicit or tacit knowledge in MNC which involves the procedural types of knowledge; i.e. know-how, in contrast to declarative knowledge, i.e. know-what (see also Becerra-Fernandez & Sabherwal, 2001; Gupta & Govindarajan, 2000; Kogut & Zander, 1993; Simonim, 1999b) or the better grasp of deeper understanding of things and doing things, i.e. know-about, which is an emergent theme of this study.

Furthermore, this research also makes an in-depth exploration of the nature of knowledge transfer. The findings reveal that explicit knowledge could lead to better replication while tacit knowledge could lead to better adaptation. The items detailing the classification between explicit and tacit knowledge clearly indicates that knowledge transfer has really taken place (see Chapter Six, 6.2). Therefore, not only does this study provide a comparison and examples of how knowledge is transferred explicitly or tacitly in nature, but the types of knowledge, i.e. know-what, know-how and know-about, are also examined.

Although in the organizational literature, Blackler (1995) and Szulanski (2000) have presented the common images of knowledge, they are nonetheless defined quite broadly; and by developing on their conceptual insights, as well as the earlier distinction made by Polanyi and other scholars (see also Kogut & Zander, 1993; Nonaka & Takeuchi, 1995; Szulanski, 1996), this study has deepened understanding of the processes that facilitate knowledge transfer in MNCs, where procedural types of knowledge, i.e. know-how as well as declarative knowledge (know-what) are concerned (see also Becerra-Fernandez & Sabherwal, 2001; Gupta & Govindarajan, 2000; Kogut & Zander, 1993; Simonim, 1999). Moreover, this study explores the detailed characteristics of knowledge transfer in a real situation, thus providing further explanation of the intensity of the process and the quality, quantity and accuracy aspects. This is clearly shown from the episodes and themes identified in previous chapter, particularly in section 6.2.3 where it was shown that quality of common understanding and new insights, time reduction and waste elimination, and accuracy, all occur within the process knowledge transfer. Quotations from the interviewees (Chapter Six) and episodes involving knowledge transfer (Chapter Five) clearly illustrate these aspects.

This study then considers the location of knowledge transfer. In the literature, Nonaka and Konno (1998) has outlined the concept of "Ba" as a place where knowledge is created and utilized, but this study provides extensive and detailed examples on the kind of places, physical as well as non-physical, where knowledge can be transferred. This is done through the empirical illustration that replication and adaptation indeed 'did happen' in these places (see Chapter Six, section 6.3). The places can be further extended to include not only specific locations, but also undefined and unspecified places that one might not imagine, such as the car park area and 'chaplaincy'.

Next, the study attempts to clarify the assumption that knowledge may be 'sticky' or difficult to transfer (Szulanski, 1996; von Hippel, 1994) by making the phenomenon and process much clearer. As from the findings, it has clearly indicated that by fulfilling specific conditions, providing appropriate places, and channelling through suitable mechanisms and mediums, even the transfer of 'sticky' knowledge is manageable, practical and viable. The exploration of such details regarding places, mechanisms and mediums of knowledge transfer via replication and adaptation, provides a great breakthrough in understanding this process, particularly in the context of MNC subsidiaries.

For instance, we can see clearly (in Chapters Five and Six) on how knowledge transfer can occur in places other than the usually anticipated ones (e.g. training situations, meetings, visits, language usage, and mode of communication). Definite elaborations of how visual effects and audio possessions can bring about knowledge transfer are provided and are remarkable (refer 6.4 and 6.5), thereby indicating that knowledge transfer is occurring throughout all processes along the production line in the MNC subsidiaries.

With the presentation of detailed information within the snapshots of sixteen episodes of knowledge transfer, this study makes important contribution to the theory of learning, as well as the practice related to the transfer of knowledge. Williams (2003) suggested that with regard to replication and adaptation, several of the main criteria required examination, including the role played by the ownership of the knowledge, mechanisms of transfer, relationships among the knowledge transfer line, tools and understanding levels. However, his study and most other research has adopted an approach that produces a *macro* picture, whereas this study has taken a detailed, inductive, and qualitative approach, which has shed more light on these issues than previously reported. This *micro* perspective offers a clearer understanding of how knowledge transfer is created.

For instance, we would not imagine that lights on the andon light would trigger an efficient way of telling operators what to do, i.e. stop machines or call for help, or that the sound of music for a period of ten minutes (Episode 7 in Chapter Five) would have an impact on the knowledge transferred and jobs done. By 'knowing' what to do when the lights on the andon light flash, and 'knowing' what and how to respond when the music for 5Ss is turned on, productivity has improved at large. This could not be achieved without the knowledge being transferred to the operators at the shop floor, and from these episodes, therefore, provides fresh insights in this respect, in which follow closely on the basis of production system (Bennett, 1986).

Furthermore, we can also see how sentiments and emotions can also play a part in making knowledge transferable. Whilst we do know from existing literature that clear instructions can make the process of knowledge transfer manageable, the importance of clear visualisation techniques, for example the use of colours, effective signage and information boards, has not been reported. Even what might have been believed as trivial aspects, like the colour of the uniform (in Episode 10, the colour of the cap) and daily routines, like using particular colours of pen (Episode 6) can promote knowledge transfer, particularly replication and adaptation.

This study has provided a clear illustration of the factors involved in the process of knowledge transfer, considering personal factors involving education, rank and experience, through to the role of ownership (see Chapter Six, section 6.7). However, it is not only such personal factors that have an effect on knowledge transfer, other work-related factors such as organisational, environmental and motivational factors are equally important. In this respect, the findings that environmental factors, such as the time of day and air humidity levels, have an impact on the knowledge transfer process are very interesting (see Chapter Six, section 6.7.5). Moreover it is shocking to learn how demerit and negative reinforcement are applied in the shop floor situations (see Chapter Six, section 6.7.6).

In terms of personal factors, it was found that education, service rank, and experience play important parts, and especially in relation to education, it was revealed that having a similar level of education can facilitate the knowledge transfer process, thereby confirming the findings in much previous research. It was interesting to learn that engineers graduating from Japanese universities have better understanding and acceptance from the officers, compared to local engineering graduates. Also officers possessing the same level of technical expertise can transfer knowledge between themselves more easily than those with different technical abilities.

This was consistently seen in projects, where seasoned and experienced officers are always able to easily understand and thus transfer knowledge more effectively than their less experienced colleagues. However in terms of service rank, it was found out that little difference exists in knowledge transfer capabilities, with the different hierarchies showing no variation, apart from the use of different flows which will be explained later. These particular findings further support the findings of absorptive capacity, which relates to how the knowledge recipient actually receives the knowledge, and causal ambiguity, concerning the difficulty of understanding knowledge. In this respect, some people can understand the intended knowledge among themselves only. Hence, apart from supporting the existing literature, this study also provides a comprehensive account of knowledge transfer in a simple and straightforward manner.

This study has highlighted the circumstances surrounding the choice of knowledge transfer approach, all of these being related to the factors elaborated in the themes as extracted. It can be seen that different approaches are selected for different occasions and circumstances that are related to a range of influences, including the nature of the knowledge concerned, personal factors, and the types of knowledge.

It was found that when knowledge is more documented and procedural, replication is favoured over adaptation that relies more on having to understand and therefore needs more explanation. This confirms that explicit knowledge is generally replicated, whereas tacit knowledge is usually subject to adaptation. However, it was also found that adaptation occurs when there is a need to express sentiments, create awareness, and foster a spirit of ownership (as in the example of Gambatte DNA) and like replication that involves copying, it can also use visual and audio aids (as in the example of Episode 5).

Moving from the nature of the knowledge to the personal factors of those involved in the transfer, it is interesting to find that the more educated the actors are, the more adaptation is applied in the knowledge transfer. The findings show that when the level of education is basic or average (as possessed by the majority of the shop floor operators), the replication approach is applied since it is easier to copy and implement than to consider and adapt before implementation.

Furthermore, it was interesting to see the effect of variations in environmental conditions on the approach to knowledge transfer. For instance, when the temperature is too hot, a cool air-conditioning environment with straightforward replication (e.g. Training episode) is applied, whereas after a long comfort zone, adaptation is applied.

As Szulanski and Winter (2001) suggest, firms need to focus on replication for the best leveraging of knowledge. Empirical work by Williams found that investments in both replication and adaptation have a positive impact on knowledge transfer (Williams, 2007) and this is clearly shown in the present study, where detailed examples from the parent to subsidiaries in the three projects indicate knowledge being transferred by both approaches.

However, this research not only found useful insights in replication and adaptation, but has also attempted to further explore and advance the literature by providing the detailed criteria, characteristics and dimensions of both replication and adaptation. It is very interesting to find out that although some knowledge or manufacturing techniques are done in a certain way, and are planned to be copied or replicated in the subsidiary, in some instances the subsidiary takes an interesting way of adapting it as long as the results or outcomes are similar.

It has also presented minute details on how these approaches actually develop, and has even suggested a third knowledge transfer approach as witnessed within the subsidiary, which the researcher has labelled as 'innovation'.

As Winter and Szulanski (2001) note, adaptation could include modification but this study introduces 'innovation' as a completely different approach and totally new rather than a sub-set of either replication or adaptation. In the researcher's conceptualisation, innovation involves refinement, alteration and full conversion of the knowledge transfer approach towards a better end result. In other words, it is how the knowledge transfer is done in a totally different and new way. This is clearly shown when the knowledge is transferred between people with similar and higher than average levels of education, and results in a highly cohesive team.

Innovation, therefore, would seem to be an approach that would bring great improvement in knowledge transfer as demonstrated in the many different enhancements and refinements that were made to the daily jobs of people reported on in episodes like TPM corner and Why-Why Analyse, Colour and visualised assistance in knowledge transfer and great implementation of story-telling in imparting the new knowledge.

As Davenport and Prusak (1998) argue, the transfer of knowledge involves both the transmission of information to a recipient and the absorption and transformation by that person or group, and it requires that the information 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 & Fish, 2000) and that is what really happens with replication, adaptation and innovation in this study.

As knowledge transfer is not considered to be just a mere communication, but rather a more complex process in which knowledge resides in organisational members, tools, tasks, and their sub-networks (Argote & Ingram, 2000) and much knowledge in organisations is tacit or hard to articulate (Nonaka & Takeuchi, 1995), this study has enabled them to understand how the total process occurs within the MNC subsidiary.

6.5 Chapter Summary

This chapter illustrates the themes that have emerged from the interviews, episodes and observations. The themes are then classified into several categories and sub-categories for better understanding of the knowledge transfer. This chapter demonstrates the significance of the themes regarding knowledge transfer which can be clearly observed and understood, enabling the validity and originality of how knowledge is transferred in a real context and provide a novelty feature of this research.

Chapter Seven

Conclusions

7.0 Introduction

This study has explored how the knowledge of manufacturing practices is transferred from parent to subsidiary; within an MNC subsidiary context. Chapter One places the research within the subsidiary context and explains the current study in detail. Chapter Two consists of literature reviews, by searching existing research on manufacturing practices, MNCs, Japanisation, knowledge transfer and intra-MNCs knowledge transfer process and its approaches of replication and adaptation. Chapter Three lays out the methodological approach of the study, with a detailed introduction of three cases that provide the contextual information of the MNC subsidiary selected for this study. Chapter Four presents the study's findings in the form of episodes of knowledge transfer, to illustrate the process more clearly. Chapter Five extracts the episode themes and analyses them using further supporting interviews, observations, and documentations. Chapter Six provides a summary of the findings and discussion that thoroughly discusses the findings in light of existing literature, signifying where the results adds to the knowledge. This chapter concludes this study and presents a discussion on the study's contributions to the existing body of knowledge. It also provides some future directions for research on knowledge transfer and discusses some of the study's implications on practices in organisational contexts.

7.1 Contributions and Implications of the Study

This study facilitates the exploration and understanding of the process and the approaches of knowledge transfer within the context of a manufacturing subsidiary of an MNC. This new perspective is built using a set of knowledge transfer activities in a number of project contexts, with detailed elaboration of an episodic nature. This study successfully provides three general contributions:

1. First, by using a thematic and exploratory qualitative study, this study explores how knowledge is transferred, within a subsidiary of an MNC, by detailing its approaches, nature, and place of transfer, mechanism, and medium, as well as the factors affecting it. A specific method of presenting the findings in episodes facilitates the data analysis and presentation process. This is considered as a novel approach of presenting and analysing data within the context of this field.
2. Second, this study distinguishes the approaches of replication and adaptation and their categories and items, for knowledge transfer in a project context of a subsidiary of an MNC, and identifies their circumstances.
3. Third, this study identifies a new approach of knowledge transfer (known as 'innovation'), which has not been explicitly identified previously.

Overall, this study further extends our understanding of knowledge transfer and its approaches.

7.1.1 Theoretical Contributions and Implications to the existing Body of Knowledge

Theoretical contributions and implications of this study are now discussed in detail. The first contribution of this study is overcoming the absence of knowledge that differentiates between the dimensions of replication and adaptation in knowledge transfer. In Chapter One, the researcher argues that there is a need for clarification and exploration on the definition, distinction, and dimension of knowledge transfer, particularly those involving replication and adaptation within a the contexts of an MNC subsidiary.

While the dimensions of knowledge transfer involving replication and adaptation are generally accepted (Szulanski et al., 2002; Williams, 2003; 2007), the evidence from this study suggests detailed themes within the dimensions. The study also generates an emergent dimension of innovation, and its corresponding themes.

This study seeks to contribute to the existing body of knowledge on knowledge transfer. Considering that knowledge transfer involves replication and adaptation, existing literature has suggested that replication involves more discreet knowledge, while adaptation requires more understanding. This study further enriches the existing literatures. Drawing extensively upon the detailed process of transferring Japanese manufacturing techniques that occurs in the micro contextual setting of the subsidiary of an MNC, this study provides a clear picture of how the process of replication and adaptation occurs. This study also identifies another approach to the transfer of knowledge (i.e., 'innovation'), which is a novel finding, because such a categorization has not been explicitly identified and deliberated.

In addition, the use of 'episodes' in detailing the process of knowledge transfer can be considered a breakthrough technique for further research in a qualitative approach in the management field. All of this addresses the first objective of this study, which is *'to explore how knowledge is transferred within an MNC subsidiary and how it is developed within the context of organisational projects'.*

A comprehensive table of themes, detailing categories and sub-categories of replication, adaptation, and innovation, is presented in Table 7.1 below:

Table 7.1: Comprehensive list of categories and items of knowledge transfer through replication, adaptation, and innovation

Replication		**Adaptation**		**Innovation**	
Characteristics	**Repetition Mirroring Procedures Documented Standardized**	Characteristics	**Need of Understanding Explanation Required Additional Jobs & Tasks Need for Adjustment**	Characteristics	**New Interpretation New way of working Fresh solutions**
Explicit	**Routines Procedurals Codified Manuals Visualized, Signs**	Tacit	**Coherent Experience UnambiguousUnderstanding Expertise Inheritance Teamwork - Cohesiveness**	Mostly tacit	Sometimes Combination of others
Intensity	Quality Quantity	Intensity	Quality Quantity	Intensity	Quality Quantity
Place	Defined Undefined	Place	Defined Undefined	Place	Defined Undefined
Mechanism	Meeting Training	Mechanism	Meeting Training	Mechanism	Meeting Training
Medium	Language Communication	Medium	Language Communication	Medium	Language Communication

The words in **“bold”** signify the new emerging themes

In response, this study has explored the meaning and process of knowledge transfer, by examining the actions of members of the projects; which is clearly shown in the three projects selected for study. These findings are elaborated in the sixteen episodes illustrated in Chapter Four. By employing a qualitative approach, the concepts of replication, adaptation, and innovation, within the process of knowledge transfer, are clearly examined and illustrated.

First, the data analysis of the study involved plotting and detailing the sub-points found in the characteristics and criteria of replication, adaptation, and innovation; together with the specific elements and classifications of its nature, mechanisms, places, and mediums of knowledge transfer. Although many categories of nature, mechanisms, places and mediums of knowledge transfer were discussed in previous knowledge transfer literatures, through corroborating the empirical data gathered from the deep interviews, observations, and documentations, this study further extends and elaborates categories and theories in great detail, within the knowledge transfer process. This further enriches the general literatures that are mainly theoretical and based on 'armchair' assumptions.

Furthermore, this study identifies the circumstances involved in making the knowledge transfer process possible. This addresses the second objective of this study, which is *'to further understand the significant circumstances that make knowledge transfer possible'*. Although many of the main categories and themes given in Chapter Six are based on existing literatures, determining their categories as replications, adaptations, or innovations, is a new theoretical contribution. Previous literatures mention that replication relates more towards discrete, while adaptation needs more understanding. This study elaborates more on those places, mediums, and mechanisms of replication and adaptation in knowledge transfer, together with additional insights.

Therefore, this study provides more understanding on how the approaches of knowledge transfer are actually developed through understanding into circumstances of replication, adaptation, and innovation. Moreover, this study discovered an emergent approach of 'innovation' within the knowledge transfer process. This is indeed a significant finding of this study.

The findings of this study may also help to explain that there are circumstances in replication and adaptation, within a project context of knowledge transfer, and even suggests 'innovation' as an approach to knowledge transfer on its own. Previous research focused on knowledge transfer via replication and adaptation in general; however, this study delved further by considering their circumstances in an organisational project context.

To recap, the gist of replication, adaptation and innovation is as follows; replication is about copying what and how the parent company (knowledge provider) do and perform, while the subsidiary (learner) perform the same tasks in the same way. Adaptation is when the subsidiary make some adjustments on the way and how the parent performs the tasks locally, while innovation is when the subsidiary embrace the goals, aims and objectives from the parent, and then work out the tasks in their own (subsidiary) way.

This study has also contributed towards the methodological aspect of research by applying a triangulation of detailed in-depth episodic elaboration of data, involving observations, and interviews. These findings, which are presented in episode form in Chapter Five, enables confirmation of findings against existing literature and brings out emerging theories and themes within the knowledge transfer process (as shown in Chapter Six).

On the whole, this study enriches the knowledge transfer literature and hence strengthens the overall Knowledge Management field. More importantly, from this study, it is further understood that the process of knowledge transfer can be explained as a process of Reciprocal Provider-Learner Exchange. This means that transfer of knowledge is a reciprocal exchange process between the parent company and the subsidiary, as well as the subsidiary and its sister subsidiaries, as well as within the subsidiary itself. The subsidiary not only assumed the role of learner, but also a main contributor to the learning within the group of companies. As the process of knowledge transfer can be described as a process of Reciprocal Provider - Learner Exchange, the study's findings can be linked to the Experiential Learning Theory (Kolb, 1984), where Experiential Learning Theory (ELT) provides a holistic model of learning process for adult development which is defined as "the process whereby knowledge is created through the transformation of experience, and knowledge results from the combination of grasping and transforming experience" (Kolb, 1984, p41).

7.1.2 Managerial Contributions and Implications to Practice

This study provides a number of managerial contributions, which are described in this section in an organisational context.

The first implication concerns the nature of how knowledge is transferred. The findings show that different criteria and characteristics are shaped differently between replication and adaptation, and innovation. In addition to the basic assumption that replication is related to discreet and adaptation is more towards understanding needed (Szulanski et al., 2002; Williams, 2003; 2007), this study shows that replication can occur through more mirroring and procedure-related effects, whilst adaptation requires detailing in the comprehension understandable experience, which can be related to seniority in rank and experience, and quality in education and problem-solving techniques.

The second implication concerns the role of different places, mechanisms, and mediums of knowledge transfer that shape the way knowledge is transferred. These findings provide further factual evidence that different types of places and mechanisms enable different levels of implementing ‘replicationness’ and ‘adaptationness’ for transferring knowledge. The lesson to be learnt by organisations from this specific finding is the importance of specific types of places and mechanisms, when combined with the right mediums of transfer during the project implementation, will provide greater responses, deeper sentiments, and inner feelings that can support a smooth transfer of knowledge.

The third implication of these findings for organisations concerns the development of knowledge transfer through the importance of job rotation, job enrichment, and job enlargement, as well as the certification of multiple jobs; known in this study as creating 'super-operators'. This will provide prospects for team members who are from separate shop-floors and production lines, to meet and work together so that knowledge is transferred.

The fourth implication of these findings is that organisational members must be advised to follow certain leads when applying new knowledge in their workplaces. In other words, different situations actually require different steps of application. This is highly related to the different factors found regarding personal, environmental, and organisational factors, which could be related to and lead towards establishing better knowledge transfer.

Table 7.2 below summarises the research objectives, data analysis used, and research contributions of this study.

Table 7.2: Summary of the study's research objectives, data analysis methods used, and research contributions

Research Objectives	**Data Analysis**	**Research Contributions**	**Contributions to Theories**
1. To explore how knowledge is transferred within an MNC subsidiary and how it is developed into the context of organisational projects	Applies thematic analysis approach by investigating the development of themes based on the episodes, interviews, observations and documentations.	Produces a clear understanding of how knowledge transfer actually happens in real settings. Discovers a new approach of "innovation".	Enriching the Knowledge Transfer and Knowledge Management Theory
2. To further understand significant circumstances that make knowledge transfer possible.	Applies thematic analysis approach by investigating related coding and categories. The findings then match research with the literature.	Produces a comprehensive list of categories and items under knowledge transfer related to replication and adaptation in organisational project context, and constructs a refined list of the circumstances in knowledge transfer	From this study, it is further understood that Knowledge Transfer is about (closely related to) Reciprocal Provider Learner Exchange in Experiential Learning Theory.

7.2 Directions for Future Research

This study has explored the understanding of knowledge transfer at project level. It has provided additional insights into the process of knowledge transfer and its associated organisational benefits. In this study, knowledge transfer was measured at project level, and the subsequent analysis has produced a detailed exploration and understanding of knowledge transfer in particular.

One important direction for future research is to conduct a longitudinal study involving multiple data collection procedures, to see how replication, adaptation, and innovation develop during long-term projects. Researchers could further incorporate the findings of circumstances found in this study, in order to shed more light on how knowledge transfer develops over time.

Secondly, future studies could be developed towards looking into a wider horizon of parent subsidiary relationships, in terms of related knowledge transfer; and later, they could also involve the vendors or knowledge transfer relationships amongst the subsidiaries, which could widen the horizon of the knowledge transfer chain.

The exploratory nature of the research objectives, and the dynamic nature of knowledge transfer, justifies the adoption of a qualitative case study with a thematic analysis for this study. This study countered the limitations of the interview method by adopting participant observation and documentations, in order to aid the triangulation of multiple interpretations. Furthermore, further queries, probes, and clarifications, were used to ensure that the responses were precise. Moreover, the use of episodes (in terms of presenting the findings) also helped to ensure the accuracy of the data analysis in this study.

As this study was conducted in a Japanese MNC subsidiary, another extension of this work could be to apply this research to a broad cross-section of the MNC and its subsidiaries across organisations. Researchers could examine the significant factors that influence knowledge transfer; which varies in different projects and industries; and later, prove or disprove whether the same circumstances exist across industries, MNCs, and parents. Such understanding would enable managers to make appropriate decisions when designing robust knowledge transfer circumstance selection models.

Additionally, how the new "innovation" approach could be illustrated in a more robust manner, together with replication and adaptation as the two known main approaches of knowledge transfer, could be further elaborated. This would be beneficial, not only to the academia, but also to those in business and industry.

In conclusion, this study has enriched the discussion on current knowledge transfer literature. By applying an inductive qualitative case study with a thematic analysis, this study explores knowledge transfer within a subsidiary of an MNC during project implementation. This study proves that replication and adaptation occur differently with their own unique circumstances. It also suggests that the dimensions of replication and adaptation may occur in a certain way, but require time to evolve. Interestingly, on top of that, a new and novel approach of 'innovation' was also developed.

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Appendix

Appendix A: Letter to "Gambatte" Malaysia

اونيۏرسيتي كبڠسأن مليسيا
UNIVERSITI KEBANGSAAN MALAYSIA

Cik Neksah binti Abdul Latiff
HRA General Manager
[redacted]

through:
Tuan Haji Mohd Nasaruddin Abdul Manaf
Quality Director
[redacted]
43000 Bandar Baru Bangi, Selangor
Malaysia

20 January 2006

Dear Cik Neksah

Conducting a Field Research

I am writing this letter to seek your kind permission to conduct a case study in your organization which will commence on 20th of Feb 2006.

My name is **Jamsari Alias**, a **lecturer** attached with University Kebangsaan Malaysia, and I am currently working on my PhD at Aston Business School, United Kingdom under the supervision of Dr Matthew J Hall from the Knowledge Management Group, Aston Business School, Aston University.

The research that I am undertaking seeks to examine on how knowledge is transferred from parent MNC Company to its subsidiaries. It will also focus to understand on what and how the processes of knowledge transfer are happening from one individual to another within certain projects. This study requires me to interview some of the team members who involve with the project [redacted]

The study is expected to contribute in the understanding of how knowledge is transferred from the parent company to its subsidiaries. It will explore the situation and generate better understanding about the whole process. Besides helping with the PhD research, this study would also offer some benefits to your organization.

Thank you very much and I look forward for our cooperation.

Yours faithfully,

Jamsari Alias

PhD Researcher
Aston Academy for Research in Management
11th Floor, Aston Business School
Aston University
Birmingham B4 7ET
United Kingdom

[redacted]

Appendix B: Letter of support to “Gambatte” Malaysia

ASTON
BUSINESS SCHOOL

Aston University
Aston Triangle
Birmingham B4 7ET
United Kingdom
Switchboard +44 (0) 121 204 30 Fax
+44 (0) 121 204 5271

OPERATIONS & INFORMATION MANAGEMENT GROUP

TO WHOM IT MAY CONCERN

20th January 2006

Dear Sir/ Madam,

Mr Jamsari Alias is a student of Aston Business School conducting research for his PhD into knowledge transfer within multi-national corporations under my supervision. As his research requires him to collect data within actual organisations, your assistance in granting Mr Alias access to the company and its employees would be most gratefully appreciated.

Please do not hesitate to contact me directly should you wish to discuss anything of concern.

Yours faithfully,

MHall

Dr Matthew Hall

Lecturer, Operations and Information Management Group
Email: m.i.hall@aston.ac.uk
Tel: 01212043120