KNOWLEDGE AGENT THEORY (KAT) FOR KNOWLEDGE ACTIVATION IN THE LEAGILE MANUFACTURING ENVIRONMENT OF THE SOFT GOODS INDUSTRY

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CERTIFICATE OF ORIGINALITY

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CHAN Yan Yu

Abstract

Many organisational learning researchers have been working on finding critical factors that allow organisations to learn better. Discussions on the ontology of learning activists within organisations, however, are limited. It is asserted that the knowledge agent (KA) is the simplest unitary entity. The Knowledge Agent Theory (KAT) has therefore been conceptualised, in which the KA operates in an autopoietic closed system. Cross-case participatory observation research has been employed to verify the constructs of the KAT. The soft goods industry is selected for study. The replication logic is used along with the participation of four firms in the textiles and clothing industry and a consultant in this study. To validate the primary data, multiple sources of evidence are collected from naturalistic environment to observe learning behaviours. More than one hundred and nine informants were involved.

The analysis identifies three types of learning groups: pseudo-, quasi- and proper KAs. The findings confirm that members who have the cognitive ability to learn, willingness and an action plan for change potentially have the components to become KAs. The commonality between members and tolerance of differences allow individuals to establish double neighbourhood relations at the individual and organisational levels to activate the functions of KAs to effectively handle collective problems in organisations. The ontology of KAs will be explained. This will contribute to empirical studies for future research in the domains of autopoietic properties that will allow practitioners to apply the theory in practice.

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List of Abbreviation

AWRM	Agile wheel reference model
CNERMS	Created natural environment with retrospective methods
ERP	Enterprise resource planning
GCC	Global Commodity Chains
GDP	Gross domestic product
ICAS	Intelligent complex adaptive system
KA	Knowledge agent
LPDS	Lean Product Development System
OBM	Original brand manufacturing
ODM	Original design manufacturing
OEM	Original equipment manufacturing
SAM	Standard allowed minutes
SECI	Socialisation, externalisation, combination and internalisation
TNKM	The new knowledge management model
TPS	Toyota production system

List of Glossary

5S Practice	Workplace management practice for organising and maintaining operation facilities and related items. The five S stem from the Japanese terms: seiri, seiton, seiso, seiketsu, and shitsuke.
Agility	Manufacturing method that focuses on achieving a short product cycle time with the rapid creation, development and manufacture of a new product.
Autopoietic systems	A unified network of component production processes which: (i) through their interactions and transformation continuously regenerate and realise the network of processes that produced them, and (ii) constitute itself as a concrete unity in space in which the components exist by specifying the topological domain of its realisation as such a network.
Boundary	A distinction or demarcation between an entity and the environment so that the entity can be identified and explained.
Commonalities	Something that has more than one element from different entities and shares the same attributes of something.

Cognitive abilities	Abilities that a person holds which are mentally-based skills which are used to conduct tasks from the simplest to the most complex.
Cognitive resources	They are collections of memories and information generated from previous experiences and inventories of knowledge.
Conditional knowledge	Knowledge that is specified in terms when and where it could, or should be, applied.
Convex region	A region in Euclidean space that if for every pair of points within the region, every point on the straight line segment that joins them is also within the region.
Declarative knowledge	Factual information that is sometimes described as know-what.
Deleted KA	KA set that does not establish any neighbourhood relations at the individual and organisational levels.
Deleted neighbourhood	A set that contains every point of a neighbourhood except for itself.
Double contingency	The likelihood that different entities meet each other at an appropriate time and then interact with one another to deal with an issue that is uncertain.
Double neighbourhood	Both primary and secondary neighbourhoods are established between the local and universal levels.

ERP systems	Abbreviation for Enterprise Resource Planning systems. Integrate management information across an entire organisation.
Explicit knowledge	Knowledge that is formal and systematic. Stored in a transmittable form, such as documents, books, audio-visual materials, or artifacts, and can easily be communicated and shared.
Extensive impact	Knowledge generated comprehensively benefits an organisation to eliminate latent systematic problems and errors, or minimise negative impacts caused by external changes.
External KA	Member of a knowledge agent entity who is not a member of the organization.
Implicit knowledge	Knowledge that is held within one's conceptual framework, and expressed in one's language, given the environmental conditions effective in eliciting them.
Knowledge	A pragmatic view of things contained in an organisation as a mix of facts, organised or justified skills, experience, value judgment and beliefs in which a person, group of members or organisation after acquiring can generate the capacity to act on the transformation of problem to solution, transmission to other parties, predicting the outcomes of processes, making better decisions, and making sense of signals from the environment.

Knowledge Agent	The simplest unitary entity who conducts the knowledge process, and creates, retrieves, shares, and implements knowledge to deal with collective issues in organisations.
Leagility	A total supply chain strategy that incorporates both agile and lean manufacturing paradigms.
Local impact	Potential positive value at the local level in which individuals, groups of people or departments have learned to deal with local issues.
Neighbourhood	A path that allows the internal and external to connect, when they have commonalities and differences are tolerated.
No impact	Organisation has not received positive benefits after a knowledge process is conducted.
OBM	Abbreviation for original brand manufacturing. Organisations that sell an entire product under their brand name, regardless of where the product is made and the individuals who made the product.
ODM	Abbreviation for original design manufacturing. Design and manufacture products that are eventually branded by another firm for sale.

OEM	Abbreviation for original equipment manufacturing. Offers the manpower and production facilities to produce components or final products, which are purchased by a company that has provided the design details and product specifications.
PDCA cycle	A cycle for continuous improvement through recursive steps: plan, do, check and act.
Primary neighbourhood	A relationship established between the KA set and individuals to carry out knowledge processes for an organisation.
Procedural knowledge	Processes or routines that can be described as know-how.
Proper KAs	An entity which recursively uses learned knowledge, including learning skills, solutions, and concluded relations between factors, as a reference to acquire, transfer and adopt new knowledge that deal with new collective issues and establish or refine the learning capacities for learning.
Pseudo-KAs	A learning group which has neither complete KA boundary properties nor fully established double neighbourhood relations.
Quasi-KAs	A learning group that has KA boundary properties, but double neighbourhood relations are not fully established.

SAM	Standard allowed minutes.
SECI	Four approaches to transfer knowledge within an organisation: socialisation, externalisation, combination and internalisation as developed by Nonaka and Takeuchi.
Secondary neighbourhood	An agreement between a KA set and an organisation in which group learning is needed to allow for betterment through organisational changes.
Self-observing	An operation of the nervous system in an autopoietic system to detect any deficiencies in the self-producing inputs which obstruct a self-living system to possess the characteristics of producing the self-components of an entity.
Self-producing systems	Operations that are continuously generating their own components to maintain an identity as a living system which carries out knowledge processes.
Self-referencing	Behaviour that allows an entity to remember its previous interactions in knowledge processes and creates records to justify the producing of components that sustain the KA identity.
Solution value	The amount of desirable knowledge generated after a knowledge process is conducted.

Stratified random sampling	The selection of a random sample from each stratum which divides the target population into subsets.
Structural coupling	A process of KA integrating new members who may hold the needed cognitive resources, either from inside the organisation or an external source to maintain its identity with the current components.
Tacit knowledge	Things that are understood but remain elusive and unarticulated.
TPS	Toyota Production System.
Triangulation	Multiple ways of collecting qualitative data to ensure that the variance reflected is that of the trait and not associated with data collection.

Chapter 1 Introduction

In the last few decades, the emergence of a discussion on the leagile manufacturing environment, in which the philosophies of agility and leanness are integrated into a new production management concept, has aroused a focus on the key factors to satisfy rapid changes in market situations. A knowledgeable workforce is admittedly a key factor to increase the productivity of business organisations under fierce competition in the global market. Many knowledge management researchers have been studying to understand and conceptualise the nature of the knowledge that is contained within organisations; the technical approaches aimed to create ways that measure, disseminate, store and leverage knowledge in order to enhance organisational business performance. The root of knowledge management development mainly, however, remains in the area of transforming cognitive resources within organisations, i.e. tacit to explicit knowledge (Nonaka & Takeuchi 1995), which is in the hands of knowledge agents (KAs). Some in the literature have named them as the learning activists (Argyris & Schön 1978, Cyert & March 1992, von Krogh et al. 1997); the knowledge workforce that conducts knowledge processes to deal with collective issues or problems. The nature of KAs has not yet been identified and discussions about the ontology of KAs are rather limited. Some critiques of knowledge management research have also been made on the grounds that they ignore the social architecture of knowledge processes within organisations (Hansen et al. 1999, Brown & Duguid 2001). Thus, consideration from a social perspective, such as a learning group identity, may be a crucial factor that is associated with organisational learning. Yet, why do some learning groups in organisations generate extensive positive impact solution values while others do not? Furthermore, what are the epistemologies of possession and practice of knowledge that can enable organisations to generate better solution values?

1.1 Background

Knowledge management, after the rapid development of information technology in the last three decades, has become a focal area of study for management researchers and practitioners. With the changes in communication technology, trade practices, transportation and customer requirements, the business environment has evolved from static to dynamic. The traditional organisational theories that cover the aspects of people, technology, environment, strategies, structure and culture may not provide sufficient description and explanation of the interacting characteristics and processes that are found in organisations. More and more studies reflect that knowledge has become an essential factor to cope with a tumultuous business environment. Under this situation, the leagile manufacturing strategy was proposed (Naylor et al. 1999). As Drucker (1993, p.7) stated, "the means of production is no longer capital, nor natural resources, nor labour; it is and will be knowledge". Therefore, there may be the need to redefine knowledge as it applies to leagile organisations. An examination of suggested knowledge management models which have been established to strengthen competency and performance of organisations since the introduction of the Cobb-Douglas model (Douglas 1976) may provide new insight to determine the direction for investigating the key factor that will manage organisational knowledge.

1.2 Leagility and Productivity

Leagility, which was proposed by Naylor et al. (1999) after they considered that a total supply chain strategy incorporates both agile and lean manufacturing paradigms, is a solution to a range of demands for both traditional and fancy products. An important enabler that achieves the requirements for a fast response to an unpredictable market situation with a short production lead-time is to acquire cutting edge knowledge that empowers organisational staff (McCullen & Towill 2001, Narasimhan et al. 2006). Echoing this sentiment is the production function established by Cobb-Douglas (Douglas 1976), which highlights that knowledge has been identified as one of the major contributors to the growth of productivity. In

terms of the basis of resources, Bernolak (1997) indicated that human resources are individuals with appropriate knowledge and skills who produce the goods or provide the services, and this explanation parallels the findings of van der Heijden (2002). From a human resource management aspect, van de Heijden studied the productivity of employees in terms of individual competency. She concluded that knowledge and the cognitive ability of individuals may contribute to organisational productivity. It is obvious that knowledge embedded in individuals is a key contributor to productivity growth, if the knowledge can be retrieved and collectively used with other members of a learning group in organisations. However, this concept is often absent in the meaning of knowledge in business organisations as defined by the literature on productivity.

1.3 Definition of Knowledge in Business Organisations

"What is knowledge?" is a timeless question that philosophers have been asking for years. As it has been difficult to understand in philosophical debates, researchers who study knowledge and productivity relationships rarely provide a definition for knowledge. This was the case until Dewey, the founder of the philosophical school of pragmatism, stated that knowledge is used to transform a problematic situation into a resolved one. The discussions on knowledge from a pragmatic perspective have been increasing. Among them, the concept of delineated knowledge by Davenport and Prusak (1998) is a fluid mix of framed experiences, values, contextual information, and expert insight which provides the framework for evaluating and incorporating new experiences and information. Their description embraces these into a form of structurised and informal experience that could be classified as explicit, implicit and tacit as mentioned in the literature by Nonaka and Takeuchi (1995) and Firestone and McElroy (2003). The description could also cover the functional use of knowledge in a declarative, procedural or conditional way in organisations as proposed by Alexander et al. (1991).

From the view point of pragmatists, knowledge generates the

capacity to act. Davenport and Prusak (1998) shared this same view and gave a more concrete explanation in which knowledge provides a framework for action; it evaluates and incorporates new situations. By integrating the views of other pragmatists on knowledge management, knowledge is therefore defined in this thesis as a 'mix of fact, organised or justified skills, experience, value judgment and beliefs that person, a group of members or organisation after acquiring it can generate a capacity to act on the transformation of problem to solution, transmission to other parties, predicting the outcomes of processes, making better decisions, making sense of the signals from the environment'. Hence, the ontology of knowledge actors may be the solution for management to understand the key to learning effectiveness in organisations.

1.4 Organic Nature of Knowledge and Enabler of Knowledge Processes

From a life cycle perspective (Birkinshaw & Sheehan 2002, Bukowitz & Williams 2000, McElroy 2003, Wiig 1993), knowledge is alive when it is applied in work. Knowledge, therefore, is organic in form, and incorporates the stages of generation, growth, sustainment, reproduction and decay. To keep knowledge alive, it should be activated by KAs which are living entities. Otherwise, knowledge in organisations becomes inorganic or forgotten (Chen et al. 2007, Firestone & McElroy 2003). From this perspective, the dimension for studying knowledge management, which was initially dominated by advanced information technology management for sharing and storage knowledge, has evolved into a socio-technical approach to make sense of things. The socio-technical elements may react to the requirements of the leagile manufacturing paradigm by quickly responding to an unpredictable market situation.

In the evolution of knowledge management, the Cynefin model by Snowden (2000) defined knowledge management as a social ecology which fosters the compatibility of diverse community types to create meaningful messages in order to cope with complex situations. The SECI model developed by Nonaka and Takeuchi (1995) provides a practical framework

in which knowledge can be created through a continuous cycle of four integrated processes: socialisation, externalisation, combination and internalisation. Both models have aroused the continuity of maintaining the life and growth of knowledge. McElroy (2003) even reverted his view from a supply to a demand perspective, in which the study of knowledge management focuses on knowledge processing; that is, knowledge-making is carried out in response to problem-induced demands in self-producing systems. Permeated with complex adaptive systems (Bennet & Bennet 2004), the purpose of knowledge management has started to take into consideration the possibility of enabling or reinforcing self-organisation in knowledge processing to achieve sustainable innovation that supports organisational adaptation. Autopoiesis, as developed by Maturana and Varela (1980), is as a way to identify living systems in that an entity in its simplest status can be self-contained to produce its components for existence and this has aroused the interest of other researchers in the organisational management field (Bakken & Hernes. 2003, Magalhães & Sanchez 2009, Seidl 2005, Seidl & Becker 2005).

Autopoietic characteristics conceptualise living system operations in a mechanistic way. Through operations, living systems have the properties to self-produce their components through self-referencing and self-observing abilities. The living systems also embrace interactions with their neighbourhood components within and outside their boundary to sustain existence. The autopoietic theory attracts system and organisational theorists alike to extend the concept for further studies in the identity of entities which have the properties to carry out referential and observation activities within the unity to manage knowledge processes for organisations. Both Mingers (2006) and Midgley (2000) have therefore built self-producing systems inspired and grounded by the theories of distinction as delineated by Luhmann (2002) on the basis of autopoiesis. Luhmann argued that boundaries are used to distinguish one entity from another. He further elaborated that connectivity can deal with the problem of double contingency between individuals and entities in which their interactions

occur with uncertainty, thus motivating the constitution of social systems. With his argument, the medium to connect individuals together might be the factor that constitutes new components outside a boundary. Then the neighbourhood components within and outside the boundary may be considered as important aspects for investigating the sustainability of KAs, who enable knowledge processes.

1.5 Objectives of the Study

The knowledge workforce has been indicated as a key factor for conducting knowledge processes that acquire, transfer, apply and store organisational knowledge for learning. The scope of the discussion, however, is often at an entity organisational level. Investigations on the nature of KAs, the workforce itself, are limited. This study tries to fill this research gap from a fundamental manner by investigating the ontology of the simplest unity, the KAs, which might be an important factor that will enable organisations to generate better solution values. Consequently, the objectives of this study are to:

- develop a new theory to conceptualise and explain the ontology of KAs,
- determine the relationship between KAs and their drive to activate knowledge in organisations, and
- establish a model that will vitalise KAs to activate organisation knowledge for bettering productivity.

1.6 Research Methodology

By considering that the knowledge of an organisation is organic and only knowledge enablers with living systems might activate this knowledge to solve collective problems, it is essential for knowledge management to next examine “what” organises and justifies skills and experience, “what forms of an entity” generate the capacity to act on the transformation of a problem into a solution, and “why” the entity transmits the knowledge to

other concerned parties in order to make better sense of the external environment. Hence, the fundamental questions are concerned with defining a KA, why it exists and how it sustains its identity in an organisation. To answer these questions, a new theory is necessary to explain the ontology of the simplest but important unitary of a learning group for conducting knowledge processes. The design of the research method, therefore, must sufficiently acquire data so that the constructs of the new theory can be verified. Taking such into account, this study is very specific to the context of the informants themselves in order to explain the behaviours of KAs in general. Ordinary self-explained questionnaire surveys may not meet the need of this study. Instead, a qualitative research method is used to observe behaviours in the real world and collect contextual interviews to supplement the observed data.

Furthermore, rigour of data collection also needs to be considered. To ensure that the data have validity, reliability and generalisability, convenience sampling is not considered. Instead, stratified random sampling in the soft goods industry in which the sample firms are confirmed to be in a leagile manufacturing business environment and have experience in organisational learning is recommended as the scope of the study objectives. Also, triangulation of the obtained data from different sources in tempo and spatial situation is also proposed in order that the reliability of collected data can be confirmed. The sources of data include opinions and information from interviews and open-end surveys. The communication relayed and interactions from the meetings which address and discuss the collective problems are also included. Three techniques for analyzing the field data, namely, pattern-matching, use of the logic model, and cross-case synthesis by an interpretivism approach are adopted.

1.7 Organisation of the Thesis

The structure of this thesis consists of two major components: (i) a theoretical component where the research questions are identified and the constructs of a theory to explain knowledge activists, namely KAs, are

developed, and (ii) an operational component, which concerns the research methodologies and data analyses to verify the theory constructs by a study in a leagile manufacturing environment. The knowledge agent theory (KAT) is developed by the integration of these two components, with descriptions of different types of learning group behaviours in organisations. The chapters of the dissertation are organised as follows.

Chapter 1 *Introduction*: the current chapter which gives an overall view of this study.

Chapter 2 *Literature Review*: a review on the background of the leagile manufacturing concept, the definitions of knowledge, its nature and the distinction between information and data. Then, the definition of knowledge in organisations is provided. After that, models of knowledge management are discussed. Finally, the research questions are discussed.

Chapter 3 *Research Methodology:* with the consideration of the research inquires and the rigour of data collection, a new qualitative research design method, namely, a created natural environment with retrospective methods (CNERMs), is developed and described. Then the sampling frame selection in a leagile manufacturing environment is explained. To effectively obtain quality information, strategies that are used to search for collaboration with leagile manufacturers will be established. After that the techniques and methods for data analysis are explained.

Chapter 4 *New Theory Development and Hypotheses*: the constructs and propositions of the KAT are explained along with the development of the hypotheses. In accordance with the completion of boundary properties and neighbourhood relations, different types of KAs who activate knowledge processes in organisations are defined and categorised.

Chapter 5 *Findings and Discussion*: An analysis will be carried out on the findings from four firms in the soft goods industry to justify the acceptance of the proposed autopoietic characteristics of KAs, their boundary properties, and double neighbourhood relations among the local and universal. The degree that these findings legitimise the hypotheses is elaborated.

Chapter 6 *Conclusion*: the contributions to the academia and management staff by this research work are discussed. Following that, the limitations of the research results are highlighted. Then, opportunities for further research in this study area are identified.

Chapter 2 Literature Review

The importance of knowledge in enabling organisations to deal with the requirements of leagile manufacturing has been discussed since the research of Naylor et al. (1999). However, the definitions of knowledge in organisations have not yet been clearly identified which may cause ambiguity for learning group members when they set goals to conduct knowledge processes for organisations. Consequently, a literature review on knowledge in organisations, knowledge management and knowledge enablers will be carried out in order to provide sufficient context for the study.

2.1 Introduction

In this chapter, the discussions on the contemporary leagile business environment and the importance of knowledge for production management are revisited. After that the definitions of knowledge in the literature and the characteristics of knowledge as depicted by different schools of thought are reviewed. Then, the definition of knowledge in this study will be developed by taking into consideration how organisations deal with collective issues. Following that, there will be a review on knowledge management models and the agents who conduct knowledge processes. Finally, the implications of the reviews for this research are discussed.

2.2 Productivity and Leagile

Productivity is an indicator that reflects the earning capability and the wealth generated by individuals, organisations and nations. In order to pursue a better standard of living for individuals and higher profitability for organisations, many researchers and industrial practitioners have been searching for factors to improve the productivity of organisations. An organisation is an entity that comprises different types of people who are joined together in a formal association to produce specified goods and services to individuals, groups and other organisations (Dawson 1996). It is therefore appropriate to start from an organisational aspect by examining the

determinants of productivity.

In the manufacturing transformation process, productivity is generally defined as the relationship of output (produced goods) to input (consumed resources) (Sumanth 1984). Simply defined, productivity is the ratio of the total value added to the total input of production factors. Bernolak (1997) provided a useful explanation of productivity that is related to manufacturing, which is: "how much and how well we produce from the resources used. If we produce more or better goods from the same resources, we increase productivity. Or, if we produce the same goods from lesser resources, we also increase productivity". Bernolak makes it clear that "resources" means all human and physical resources, i.e. individuals with appropriate knowledge and skills who produce the goods or provide the services, and the assets with which individuals can produce the goods or provide the services. Hence, an increase of productivity is a value change of output that is greater than the value change of input. The output value embraces the price that consumers are willing to pay as well as other external conditions, such as a sudden increase of demand that affects the market price. On the other hand, input relies on the effective use of resources that produce a product or service, and is part of the operational aspects of an organisation. Therefore, productivity is the relationship between output quantity, products that are correctly produced and fulfil their specifications, and input quantity, the resources consumed in the transformation process. The triple-P model, depicted by Tangen (2005), illustrates the interrelationship of productivity, profitability and performance stressed that common factors, human capital and knowledge, contribute to the improvement of the three Ps. He suggested that management should focus on managing the knowledge of individuals to make desirable/sensible changes to the external environment and effectively operate physical capital, such as facilities, machinery and new technology.

After the introduction of the value-added production function provided by Cobb-Douglas (Douglas 1976), knowledge has been identified as one of the major contributors to the growth of productivity. Many

researchers have turned their areas of study towards the relation between knowledge capital stock and productivity. The majority of these total factor productivity studies indicate that both internally generated knowledge and externally acquired knowledge acquisition have positive impact on productivity, and research and development (R&D) spending makes a significant contribution to productivity growth (Griliches 1998).

From a human resource management aspect, van der Heijden (2002) studied the employability and productivity of employees in terms of individual competency. Although her study mainly focused on individual occupation competency characteristics, the findings also reflected that the growth of individual knowledge contributes to an organisation. In other words, the competencies of an organisation include the knowledge, expertise and capabilities which have been collectively learnt by individuals so that their organisation can distinguish their performance from that of their competitors.

2.2.1 Leagility Supply Chain

2.2.1.1 Global Commodity Chains (GCC)

With advanced logistics systems, high-speed communication technology and the rise of trade liberation in the 21st century, there are increasingly more opportunities to operate businesses on a global scale. Gereffi (1994) claimed that industrialisation has undergone expansion on a worldwide scale during the past few decades. Economic globalisation has been accompanied by flexible specialisation or high product differentiation, and a short production lead time. In his commodity chains model, Gereffi (1994) described the commodity chain as being in a producer-driven or buyer-driven type of governance structure. According to his description, producer-driven commodity chains are those in which producers play central roles in coordinating product networks, including both upstream and downstream linkages. The product features embrace high standardisation of configuration. The mass production system is the primary way to produce goods, and therefore, producers often seek an ‘economies of scale’ solution.

In contrast, buyer-driven commodity chains are industries in which large retailers, brand-name merchandisers and trading companies play pivotal roles in establishing production networks. This type of trade-led industrialisation has become the norm in labour-intensive. The product specifications are supplied by the buyers and branded companies that design the goods. The buyers, therefore, most likely emphasise a flexible production system to respond to a changing market situation. Regardless whether a commodity is producer- or buyer-driven in nature, timeliness and mass customerisation are critical for success in global commodity chains. With that the emergence of lean and agile in the 80's, and later integrated into leagile concept were proposed to improve production management.

2.2.1.2 Lean concept

According to Gereffi (1994), it was thought at the time that the automobile industry is a producer-driven industry and one of the most popular industries for industrial researchers who were trying to determine the best way to manage manufacturing. The Toyota Production System (TPS) originally described the production system philosophy at Toyota. After a few decades of study, the TPS was dubbed as the pioneer of 'lean' manufacturing. The term "lean production", was first coined by Krafcik (1988). A comprehensive study of the successful factors for manufacturing automobiles in the world under the "International Motor Vehicle Programme" (IMVP) led by the Massachusetts Institute of Technology (MIT) examined the automobile industry for a decade which began in 1985 (Womack et al. 1990). The group concluded that the rise of lean production would not only have an impact on the automobile industry, but also on other industries.

In 1996, Womack and Jones (1996) further elaborated on the beliefs behind lean production. They summarised their observation of the success of the TPS into five principles that comprise the basis of lean thinking for manufacturing. They include: precisely specify the value of a specific product, identify the value stream for each product, create the environment for value to flow without interruption, allow the customer to pull value from

the producer, and pursue perfection. From their observation, the focal point of lean thinking is value stream identification and fulfilment with a pursuit of perfection, which is the drive for continuous improvement. To achieve lean production, the speed of knowledge creation is a factor that organisations have to develop as a competent condition. In addition, they stressed that "willingness to apply lean thinking" is important. They gave many examples on the behaviour of lean practitioners. They noted that practitioners are willing to share their experiences with improvement activities both internally and with visitors, in particular those who are their customers or suppliers. Furthermore, Womack and Jones (1996) suggested that to establish lean production, a change agent is needed to impose a profoundly egalitarian system for the new production philosophy. However, the philosophy behind this recommendation is not known. In relation to this aspect, Liker (2004), who spent twenty years studying the success of Toyota, provides a better explanation with Toyota's production philosophy.

Liker (2004) identified 14 principles of the Toyota System. He highlighted the fundamental principles of the lean concept as "respect(ing) people" and "organisational learning" (p.10). Liker (2004) incorporated the 14 principles into a "4P" model. The four Ps are: philosophy with long-term thinking, process that eliminates waste, people and partners that management should respect, challenge and make people and partners grow, and problem solving by continuous improvement and organisational learning. This is similar to the Confucian literature, The Great Learning, which indicates that an enlightened ruler will always try to do the best (Zhu 1996). The Toyota founders stressed that improvement is an endless task and there are always opportunities to seek improvement in any process. With the 4P model, Liker outlined a shorter total production lead time, reduced waste, minimised inventory levels, improved quality performance, etc. as the fruitful results of adopting a lean philosophy. These aspects encourage organisations to pursue this "new" concept in the operation of their businesses. Liker (2004) claimed that the Toyota founders were pragmatic idealists, who learned by doing and always believed in the mission of

contributing to society. Similar to Confucianism, their philosophy often emphasises employee empowerment which allows for creative and individual expression that improve standards. Toyota then incorporates the improvement into a new standard so that when an employee moves on, s/he can pass on the learning to the next staff member. This concept extends to developing people and partners so that they are the best teachers to transfer knowledge to others.

The knowledge is contained not only within the organisation itself, but also shared with business partners to help them improve. From his study on the TPS, Liker (2004) concluded with a strong message in that an organisation should become a learning organisation to coordinate the work, and motivate people to learn from each other in order to develop excellent individuals. Toyota believes that it is the individual who does the value-added work. The establishing of an organisation with the capacity to continuously learn and create new knowledge is, therefore, to vitalise the manufacturing force to compete in an unpredictable market situation. In the many research studies on Toyota, numerous tools and techniques were introduced, however, discussions on the philosophy behind these tools and techniques are few. The work by Liker (2004) not only provides a theoretical base for managing the manufacturing process, but also applies to areas like new product development and retailing (Morgan & Liker 2006).

2.2.1.3 Lean Product Development System (LPDS)

Having achieved promising results by utilising lean manufacturing concepts in the production process, Morgan and Liker (2006) developed a socio-technical model to extend their study to a product development system. They compiled the findings into thirteen principles that formulated the Lean Product Development System (LPDS). The LPDS embraces three subsystems: people, tools and technology, and process. The 4P model, indeed, is the foundation of the LPDS. Therefore, six out of the thirteen principles for the subsystem of people cover recruiting, selecting, training engineers, leadership style, organisational structure and learning patterns.

The LPDS, unlike other product development or operation systems, is less interested in the documented process. It would compile the design process into a concept on paper but rarely exceeds 25 pages. The lean view of communication in the LPDS is that:

- if everyone is responsible, no one is responsible,
- if everyone must understand everything, no one will substantially understand anything,
- if communication is going to everyone, no one will focus on the most critical item that is communicated for his/her role and responsibilities, and
- if you inundate your people with reams of data, no one will read it.

The reasons behind the success of the LPDS are twofold. First, it emphasises the nature of an individual's capability to deal with his/her work. Following that is the manner of capturing knowledge for excellent product development through holistic organisational learning. A summary of the LPDS is shown in Table 2.1.

Same as Morgan and Liker (2006) indicated that many industries are in a hyper-competitive market situation. The manufacturing capacity of producer-driven commodities, which was mentioned in Gereffi's (1994) commodity chains model, cannot satisfy the demand of customers. Product differentiation will become the dominant indicator of industry competence. It is therefore up to an organisation to prepare and equip itself to become a lean manufacturer by effectively managing its knowledge.

Table 2.1: Toyota Product Development System Model for lean manufacturing

Subsystem	**Principle**	**Relation to people knowledge capacity**
People	Delegate a chief engineer to integrate the whole development process	Recruit, select, and train engineers, leadership style with appropriate organisational structure and learning patterns.
	Integrate and balance experts and cross-functional individuals	
	Develop a technical competence path for product development engineers	
	Nurture suppliers in the same way as internal human resource development in Toyota	
	Build in learning and continuous improvement	
	Maintain the DNA of Toyota which comprise the core beliefs	
Tools & technology	Adapt technology to fit people and processes of Toyota	Integrate technology, designers and engineers, and standardise operation processes to generate new meaning of things to expand knowledge capacity for further improvement
	Align designers and engineers through simple, visual forms of communication	
	Use standardisation of processes and tools as foundations for further improvement	
Process	Establish customer-defined values to separate value-added activity from waste	Use established standardisations as foundation to generate new knowledge capacity
	Resolve potential problems in design, engineering and manufacturing in product development programme	
	Level product development process flow to keep takt time to a minimum	
	Standardise design components, production facilities and engineering skill set to reduce variation while create flexibility and predictable outcomes	

2.2.1.4 Lean retailing

As discussed in the previous sections, a turning point occurred that accelerated the velocity (Held et al. 1999) of global commodity chains (GCCs) which is producer-driven and buyer-driven. The revolution of information technology, together with the advancements in the development of transportation means and the global financial system (Borghoff 2005, Malone & Rockart 1993, Kobrin 1997, Held et al. 1999), enable a buyer-driven organisation to contract their orders on a global scale. The advanced communication system allows buyers, mainly large retailers (Gereffi 1994), to coordinate their orders in a wider production network on a global scale, and sophisticated transportation facilities and systems to shorten delivery time so that the total production time can be reduced. This provides the opportunity for suppliers to venture towards a lean retailing strategy. Indeed, buyer-driven suppliers often seek short delivery time, a variety of products in small amounts to avoid a large inventory so that they minimise their business risks. Suppliers often need to make a tradeoff between costs and product variety due to constraints such as proximity, technology, and trade restriction. With the promotion of trade liberation and a more advanced communication technology and transportation system available, product-driven suppliers are trying to realise lean retailing. To achieve lean retailing, industry buyers often seek suppliers who have ample knowledge about the market and customer needs so that suppliers can take part in the product development process. Gereffi (1999) mapped buyer-driven suppliers, which mainly refers to large retailers, branded marketers, and branded manufacturers, who make profits from their research, design, sales, marketing and financial services. They do not make profits by scale, volume or technological advances. Hence, an increase in the commitment to production tasks, such as product design and engineering, will ultimately mean more opportunities for increased orders from industry buyers. This gives the implication that the new standard for product suppliers who are buyer driven should be to acquire new knowledge that develops a sense of response to changes in the market.

2.2.1.5 Agility

During the period the lean thinking is promoted in supply chain management, the mission of the Iacocca Institute at Lehigh University in its 21st Century Manufacturing Enterprise Strategy was to map out a strategy for manufacturing enterprises in the 21st century. In 1991, the institute carried out this study to address the future of American industries under a new competitive environment for industrial products and services. In the report, the working team defined agility as: "a manufacturing system with capabilities to meet the rapidly changing needs of the marketplace" (Dove et al. 1991). The primary objective of the study was to determine an effective manufacturing model to improve competitiveness in uncertain and unpredictable business environments, particularly after the emergence of the TPS in the 80s. Agile manufacturing therefore focuses on achieving a short product cycle time with the rapid creation, development and manufacture of a new product. All business activities, such as research, manufacturing, engineering, marketing, finance, inventory control, etc., concurrently take place. A seamless information flow is the critical factor to ensure that different units or parties within the supply chain work together. Apart from information sharing, a knowledgeable workforce is another primary factor that is needed to develop an agile manufacturing system. It is known that the business environment can be subject to changes. Organisations need to build the capability to allow for knowledge growth. Continuous education for the work force that enables both individual and organisation to grow is therefore, a key area that management needs to address.

The Iacocca Institute report highlighted that the capabilities of an agile manufacturing system are limited only by the imagination, creativity, and skills of the work force, and not attributed to the equipment. The values of an organisation should be focused on egalitarianism, which in fact, is a similar concept to the management philosophy of Toyota. The agile manufacturing concept itself is also a breakthrough. It releases the traditional production system from mass production for economies of scale to flexible production for economies of scope. The implications of agile

manufacturing for society are that firstly, manufacturing not only produces a product for a consumer market, but also involves additional value for customers. Hence, agile manufacturing is not only about securing a blue-collar work force, but also staff members in different operation units. Many other supportive workers, who are in marketing, product development, logistics, etc., are also involved. Secondly, the report mentioned numerous times that knowledge and skills are the focal areas for achieving the objective of agile manufacturing; that is, a flexible and fast response to a rapidly changing and fragmented market situation. Thirdly, there must be a new social contract between employers and employees to build mutual trust that creates and shares knowledge. Lastly, there is the need to build a cooperative culture between business partners so that they grow together.

In 1999, one of the working team members of the Iacocca report, Dove (1999), extended the discussion of the relationship between knowledge management, response ability and the agile enterprise. He admitted that the original concepts of agility established that technology and globalism were the principle drivers of a changing environment. After years of further discussion and exploration on the concept of agility, he concluded that knowledge management and change proficiency, competencies which allow an organisation to effectively apply knowledge, are actually the key enablers for agility. Knowledge is assimilated in small steps. Agility, however, requires quick acquisition and mobilisation of knowledge to meet the requirements of quick response. Hence, a knowledge agent who is willing to put forth effort to acquire knowledge to help an organisation achieve a goal or objective, such as solving a problem or improving performance, is needed to realise the two enabling aspects of agility.

Many works have been done since Dove promoted agile manufacturing concept. Meredith and Francis (2000) carried out an industrial study to explore agility, particularly in small- and medium-sized enterprises. They developed an agile wheel reference model (AWRM) to highlight strategy, processes, linkages and people as the focal domains for agility. Again, people are essential for acquiring and mobilising knowledge

towards agility. Gunasekaran (1999) depicted an agile manufacturing framework with four enablers. These enablers are strategies, technologies, systems and people. Again, knowledgeable workers who are able to carry out multiple tasks and the responsibility for communication with geographically dispersed business units of an organization is the focal area. Other researchers in agile manufacturing have addressed the fact that people who acquire appropriate knowledge and creativity contribute to agile manufacturing (Goldman et al. 1995, Jackson & Johansson 2003, Kidd 1994, Plonka 1997). Yusuf et al. (1999) stressed that the success of an organisation depends on its ability to convert the collective knowledge and skills of its most critical resource: people. An organisation becomes a learning organisation to nurture a multi-skilled and knowledgeable workforce as the driver for agility. Yet, the literature is largely limited to untested prescriptions on actions required for agility. Some of these prescriptions include employee training, multi-skilling, multi-tasking, and job enrichment.

Sherehiy et al. (2007) created an overview of agile manufacturing concepts, framework and attributes from the aspects of manufacturing, organisation and the workforce. The original idea behind the adaptive and flexible characteristics of agile manufacturing can be traced back to the contingency theory, which was initiated by Burns and Stalker (1994). Organisations that operate in unstable, changing and unpredictable environments usually have an organic design, which is less formal and hierarchical. The organic design is more decentralised, has a less precise division of labour, fewer rules and procedures, and a more personal means of coordination. Unlike stable environments that possess a high-level of management, the knowledge to make decisions and organise work has to be distributed among employees in different levels. From this, the issue of leveraging impact on people has emerged.

Similarly, Ramesh and Devadasan (2007) also reviewed the literature and contributed a comprehensive model that identifies twenty for attaining agility. Unlike Sherehiy et al. (2007), Ramesh and Devadasan (2007) adopted an equation established by Sarkis (2001).

Agile manufacturing = flexible manufacturing system + lean manufacturing

in which agile manufacturing is the complement of flexible manufacturing systems and lean manufacturing. They studied the literature that deals with agile manufacturing criteria and designed an agile model with twenty criteria. The model is outlined in Table 2.2. Their approach, therefore, shadows the TPS on people, processes and customers.

To summarise the philosophy behind agility, an organisation needs to build a knowledgeable work force and break down the hierarchy within an organisation with trust among business partners allows people within and outside the organisation to share the power in making decisions.

Table 2.2: Features of agile manufacturing

Criteria		Features of an Agile Manufacturing Company
Organisation & management	Organisational structure	Flattened and team managed
	Nature of management	Participation based and susceptible to changes and improvement
	Devolution of authority	Self autonomous and empowered
	Cost management	Use of activity, strategy, quality and productivity based costing systems
	Time management	Very efficient
	Outsourcing	Supply chain management principles are adopted
Manufacturing process characteristics	Manufacturing set-ups	Flexible, easily collapsible, quick response to changes
	Status of quality	Customers are pleased
	Status of productivity	Rapid increase without lowering quality of performance
	Production methodology	Dominated by main assembly of components, external manufacturing and outsourcing
	Manufacturing planning	Short, just-in-time purchase and least dead investment
	Automation type	Flexible, smart and adaptable automation
	Information technology integration	Reengineered IT integration
	Changes in business and technical processes	Flexible set up enables effective economical changes in processes
People	Employee status	Employees are learning agents who are multi-skilled, multi-functional, and self-committed
	Employee involvement	Fully empowered employees, ideas and knowledge of employees are fully utilised
Products	Customer response adoption	Very fast
	Product life cycle	Short and effective
	Product service life	Short and flexible, the least or no mean down time
	Design improvement	Frequently and systematically

2.2.1.6 Leagility

Many researchers (Christopher & Towill 2001, Dove 1999, Goldman et al. 1995, Sarkis 2001) have indicated that agility is mutually compatible with lean manufacturing. Naylor et al. (1999) considered a total supply chain strategy which incorporates both agile and lean manufacturing paradigms, and yet does not contradict the production philosophy between these two approaches. They indicated that an agile manufacturing paradigm is best suited to satisfying fluctuating demands in terms of volume and variety, and lean manufacturing requires and promotes a level schedule to eliminate waste and synchronise cross-functional operations. In other words, lean manufacturing is suitable for a business environment where demand is relatively stable and driven by the manufacturer. They defined agility as the use of market knowledge and virtual corporations to exploit profitable opportunities in a volatile market place, while leanness means the developing of a value stream to eliminate all waste, including time, and ensure a level schedule. Equally important characteristics in both paradigms are the use of market knowledge and virtual corporations, with the idea of value stream and lead-time compression. The primary difference between them is the method of production postponement. For lean manufacturing, time compression shortens the total production time, including product development time, whereas agile manufacturing will supply goods to the market through excessive production capacity, and the trade off is to charge a higher price in the market. So from a total supply chain perspective, to satisfy demand at different locations along the supply chain, leagility would be instead a better solution and an organisation needs to prepare well for it.

The leagility manufacturing concept tries to provide a total solution package to the range of demand for both classic and fancy products. The common area of lean and agile manufacturing is a fast response to an unpredictable market situation, which includes a short production lead-time and a short new product introduction with no sacrifice of quality level (Agarwal et al. 2007). An important enabler to achieve these requirements is to acquire cutting edge knowledge to empower organisational staff to deal

with changes in the business environment (McCullen & Towill 2001, Narasimhan et al. 2006).

The emergence of the leagile manufacturing concept, which embraces a quick response to market changes when supplying both traditional and new products, has rendered management to consider a new dimension in managing the key enabler: organisational knowledge. It has been proven that intelligence capital or knowledge contributes to the performance of an organisation. The effectiveness of making use of existing knowledge or creating knowledge in an organisation is therefore important.

To summarise, it is obvious that knowledge is a key contributor to productivity growth and new leagile manufacturing environment. In the next section, the definitions of knowledge are explored. Then the nature of organisational knowledge is reviewed and discussed. Following that, some essential knowledge management models that explore the current work on knowledge management are examined.

2.3 Definitions of Knowledge

Knowledge as discussed in the introduction chapter is a factor which improves the performance of productivity, at both the quality and quantity levels. Although knowledge is named as an important input which contributes to productivity, there is no consensus on the definition of knowledge. Economists have adopted accounting data, such as knowledge stock in the form of patents, paid technological royalties, expenditure of R&D, training and education, in order to measure knowledge capital (Wagner & van Ark 1996). As the purpose of economics researchers is to seek the relation and contribution of knowledge to productivity, the definition of the nature of knowledge is not in their interest. Bernolak (1997) argued that many productivity measures are for macroeconomic purposes on a national or industrial level in which the measures are not only complex, but also make many assumptions, and therefore, individual organisations would not find them meaningful for improvement.

The economist's approach to knowledge measurement without a rigorous definition of knowledge is not uncommon. Drucker (1993), the pioneer of the knowledge society concept for modern economies, did not define knowledge in his literature. In his book, the "Post-Capitalist Society", he emphasised that the factor of production is not capital, land, or labour (Drucker 1993, p.5). It is knowledge. He coined the terms "knowledge work" and "knowledge worker" to depict the major activities and players in a post-capitalist society with the economics of knowledge. He claimed that knowledge workers are knowledge executives who know how to allocate knowledge for productive uses, just as the capitalists knew how to allocate capital for productive uses. He not only popularised the term "knowledge worker", but also actualised a new dimension in management trends, which is an economic resource: the application of knowledge. From a pragmatic aspect, Drucker (1993) stressed that there are three types of knowledge applications. First, there is the knowledge to continuously improve a product, service or production process. To generate new knowledge, the aim of organisations should be to improve their current situation. Kaizen (Imai 1997) and double-loop learning (Argyris 1977) are typical examples of this type of knowledge application. Second, there is existing knowledge that can be used to develop new and different products, services or production processes. Although the knowledge is not new, they are adapted by organisations into a new scope that expands the application of existing knowledge. Following the knowledge that improves existing processes and expands the application scopes of product development, there is the new type of knowledge that is used in innovation. In other words, there is no existing information or experience to use as reference to explain a new area in "knowing-how" or "knowing-that".

When Drucker (1993) commented on the non-productivity of the knowledge generated in developed countries like Britain or the United States, that are recognised as having a high level of scientific and technical knowledge, he referred to the 1980s, when Japanese products gained a higher market share than the other developed countries. Another given

example was the low productivity in Germany after World War II in new "high-technology" areas, such as computers, telecommunications, pharmaceuticals, advanced materials, etc. The assumption that underlined his argument is that old knowledge is less productive, and new knowledge, if it merely retains an information status, cannot be productive. Drucker (1993) did not give a full explanation of the difference between knowledge and information, their relationship or why new knowledge at an information status is non-productive. In his assertion, he claimed that the disconnection of knowledge to act on problems is the result of deficiency in knowledge application. From a pragmatic viewpoint, he highlighted the importance of the "act" and the requirement of a bridge or an agent to activate justified true knowledge into action. However, in his later published work, he neither elaborated the meaning of knowledge for an organisation or society nor provided a description of a KA.

Styhre (2003) reviewed different definitions of knowledge from various philosophers and knowledge management practitioners. He then illustrated the notion of "knowledge" from different languages. For example, the definition of knowledge in Greek encompasses at least three concepts: universal scientific knowledge, which indicates that knowledge is tempo-spatially independent and generally applicable and valid, regardless of the time and place in which the knowledge exists; know-how, skills and capabilities which describe knowledge as practical and context-bound; and practical reason which indicates singular or idiosyncratic experiences and skills that enable practices. In the field of organisation and management theory, researchers are often interested in practical and applicable models for the industry and organisations. The concepts behind the Greek lexicon of knowledge are too broad to cover everything and may lose the specific meaning. Another example that Styhre (2003) illustrated is the concept of knowledge in the French language. Knowledge may be likened to *connaissance,* which is expert knowledge used within specific areas, or *savoir* which refers to a more abstract, universal level of knowledge. By extending this thought, we may define knowledge as knowing-how and

knowing-that, as provided by Ryle (1984). “Knowing that” refers to propositional knowledge making statements and predictions about the outside world that involve the observance of rules. It helps people to make sense of the signals from the environment. However, know-how is knowledge related to action and skills. It relates to someone’s ability to do certain things (Ryle 1984). Styhre (2003) concluded his study without a final coherent definition of knowledge for two reasons. First, practitioners are not interested. Second, knowledge may not be able, in ontological or epistemological terms, to be formulated by definitions and propositions. It exists and is widely used in everyday life, yet it comes before any attempts to formulate it into a lexical form. However, it is difficult to follow management practitioners without a definition of knowledge and a thorough discussion of its nature. It then becomes too ambiguous to establish a framework for managing knowledge, or sometimes too much attention would be placed on management of data and information, and lack focus on knowledge itself.

Knowledge comprises a great variety of elements, such as skills, know-how, experiences, beliefs, capacities, and so forth, and is therefore catergorised in two ways: practice-based and abstract. In organisations, both abstract and practice-based knowledge are used. “What is knowledge?” is a timeless question that philosophers have been asking for years. As it has been difficult to understand in philosophical debates, researchers who study knowledge and productivity relationships rarely provide a definition of knowledge. So, much literature in this area attributes knowledge to being identical to information that may be stored, collated and distributed (Blosch 2001). In order to find a solution that would allow knowledge to be retained and hence result in better productivity, many organisations have attempted to gather a “knowledge base” in hopes of attaining some value in the process. The end result is that managers continue to be overloaded with information, but there is no common agreement on the definition of knowledge for pragmatic purposes.

Alexander et al. (1991) examined the number of researchers from

different fields who have defined knowledge. In the field of cognition and literacy, it is not surprising that knowledge refers to an individual's personal stock of information, skills, experiences, beliefs and memories. Knowledge, in this aspect, is a very personal characteristic that is used to establish an individual's competency. Conversely, in the field of epistemology which primarily asks: "What is knowledge?", "How is knowledge acquired?" and "What do people know?", there are claims that knowledge often refers to justified true beliefs and is reserved for universal or absolute truth. The rationalists, such as the Platonists or Cartesians, essentially say that knowledge can be deductively obtained through reasoning. This can universally explain the relations between different matters without any need to provide proof or evidence through experience. However, out of this, there are counterarguments, such as, "Who knows the truth?", and "When the outcomes do not conform to the deductive results, is the knowledge still truth?"

The empiricists, such as the Aristotelians or followers of Locke, however, say that knowledge can be inductively attained from sensory experiences (Nonaka & Takeuchi 1995). They claim that there is no prior knowledge and the only source of knowledge comes from sensory experiences. In the real world, the thoughts of these two schools of philosophers are complementary. von Krogh et al. (2000) argued that "knowledge is justified true beliefs". Unlike the Western philosophers, Nonaka and Takeuchi (1995) believed that knowledge is not absolute, static and non-human in nature. They considered knowledge to be a dynamic human process of justifying personal beliefs toward the truth. Their views of knowledge creation towards social constructivism is that an optimal learning environment is one where a dynamic interaction between instructors, learners and tasks provides the opportunity for learners to create their own truth due to interaction with others (von Krogh et al. 2000). They narrowed knowledge down to the construction of reality, where an individual justifies the truthfulness of his or her beliefs based on his or her observations of the world.

From a pragmatic view, knowledge is primarily aimed at solving a problem. Aristotle conceived knowledge as being achieved through experience and practical work. With reference to the founder of the philosophical school of pragmatism, Dewey's philosophy stated that knowledge is used to transform a problematic situation into a resolved one (Styhre 2003). In this aspect, all human knowledge consists of actions and the products of acts. In terms of actions, individuals continuously query the truth, examine the current situation, make justifications, review the changes and revise their understanding to create new knowledge. Consequently, all knowledge, such as knowing and the known, whether commonsensical or scientific, past, present, or future, is subject to further inquiry, examination, review, and revision. His action-oriented philosophy has influenced the course of knowledge research. For example, Sveiby (1997) defined knowledge as skills, experience, value judgments and social networks that generate the capacity to act. He further elaborated the characteristics of knowledge as being, to a large extent, in a tacit form, action-oriented, and supported by rules, which change all the time. The action research school is based on this philosophy and developed a theory for organisation learning. From an epistemological viewpoint, all beliefs should be justified as true before they can become knowledge. When beliefs are justified as true, they generate the capacity for action, particularly to make a decision (Manjula & Mustapha 2006). Apart from generating the capacity for action, knowledge is transmitted to others through a communication medium, such as language or written means (Bell 1976, Allee 1997).

Pragmatists view knowledge as related to the successful manipulation of real work. Truth relates to the successful accomplishment of practice. Knowledge, therefore, is true if it can predict real world outcomes. Blosch (2001) emphasised that knowledge is often socially negotiated and evolutionary, and firmly located in the process of learning. Hence, knowledge is not just eternal and accessible through philosophical training and thinking in Plato's way, but is in an action that relates to the successful manipulation of the real world. Blosch (2001) stated that in any particular

time, there may be one or more theories which attempt to account for a particular part of the real world, each in its own way by striving for ascendancy. The point is whether the new emerging theories are more accurate in accounting for the actions of the real world. Similarly, Ching and Yang (2000) described knowledge as generated when a person reads, understands, interprets and applies information to a specific work function. Knowledge becomes visible when experienced persons put it into practice learned, over time.

Alvesson and Karreman (2001), however, argued that the concept of knowledge is inconsistent, vague, broad, two-faced and unreliable. They indicated five problems with popular understandings of knowledge. Firstly, knowledge is treated as a functional resource, which represents a "truth" about a subject matter and/or a set of principles or techniques for dealing with things or social phenomena. The ontology of knowledge, on the one hand, is subjective, tacit and of a socially constructed nature based on the ideas of social constructivism. That is, knowledge is constructed through people who participate in activities and problems that they are facing, with added emphasis on the interaction between learners and facilitators who are working to arrive at a higher level of truth. On the other hand, the ontology of knowledge is true, verified, functional and non-problematic, like the Cartesian distinction between knowing subjects and knowable objects.

Secondly, Alvesson and Karreman (2001) stated that researchers or practitioners seem to have difficulties in defining knowledge or being distinct about it. Thus, the term itself is vague. Thirdly, even when they have tried to define knowledge, the concepts have tended to be rather empty in that they may cover everything or nothing. They also argued that knowledge is treated as objective and reliable as it is a justified true belief (Nonaka & Takeuchi 1995), but in practice or in theory, there are many matters with uncertain and controversial characteristics. Alvesson and Karreman (2001) even challenged the nature of knowledge itself, and questioned whether knowledge in an organisation is a good thing. From their point of view, functionalists do not mind the vagueness of the definition of knowledge.

Functionalists feel that if the claimed knowledge seems to solve problems in a practical way, then it should be used. The argument follows that, if knowledge is just as a way to solve problems, then it may not be self-evident. A solution may become a panacea for business practices, but may also create problems that constrain individuals into revealing the truth. According to Foucault (1980), knowledge creates a space for the exercise of power. From this point of view, knowledge creates rather than reveals truths.

Although Alvesson and Karreman (2001) pointed out the deficiencies in the definition of knowledge, there is no doubt that knowledge is still a key factor for productivity growth and organisations with intangible assets should better manage knowledge. In terms of a pragmatist view, beliefs are dispositions which qualify as true or false, depending on how helpful they prove in inquiry and action.

The views on knowledge are summarised in Table 2.3. To deal with organisational knowledge, the school of pragmatism provides a more practical explanation of knowledge. From a pragmatic approach, knowledge must begin with a consideration of its development and end with giving a resolution of a problematic situation. Unlike the rationalists, Dewey (1997) saw knowledge as the product of the interaction between an organism and the environment. The inadequacy of habitual responses to a new environment is the drive to pursue the fulfilment of needs and desires. The way to create knowledge is through the process of learning by inquiry and verifying it by taking action. If the reconstruction of an antecedent situation that contributes to a new environment is achieved, then the solution is no longer hypothetical; it becomes a part of the existential circumstances of human life.

Table 2.3: Definitions of knowledge

School of Thought	Definition of Knowledge	Emphasis
Rationalism Platonic views or Cartesian school	Knowledge can be deductively obtained by reasoning.	Knowledge is gained independently of sense experience.
Empiricism Aristotelian or Locke's view	Knowledge can be inductively attained from sensory experience.	Knowledge is a "posteriori".
Ryle (1984)	Knowledge embraces "knowing-that", which refers to predictions about the outside world that involve the observance of rules, and "knowing-how", whereby people have the ability to do certain things.	
Cognitivism Alexander et al. (1991) Goldman (1993)	Knowledge is an individual's personal stock of information, skills, experiences, beliefs, and memories with the process of reasoning, logic and probability judgment.	In terms of rules, knowledge becomes category representations.
Social constructivism von Krogh et al. (2000)	Knowledge is a construction of reality whereby individuals justify the truthfulness of their beliefs based on their observations of the world.	Knowledge is justified true beliefs and reserved for universal or absolute, truths.
Styhre (2003)	Knowledge is tempo-spatially independent and generally applicable and valid, regardless of the time and place in which the knowledge exists.	Knowledge is a generalisation that applies to all situations.
Pragmatism Dewey (1997)	All human knowledge consists of actions and the products of acts.	Knowledge is the process of inquiry and learning in action.
Sveiby (1997) Ching & Yang (2000) Blosch (2001)	Knowledge is a combination of skills, experience, value judgments and social networks that generate the capacity to act.	

2.3.1 Management Application Perspective

A review of the literature on the definitions of knowledge reveals that the empirical approach is the main approach of defining knowledge from a management application perspective. There are two issues with the definitions. The first issue is the nature of knowledge, particularly as it refers to the knowledge retained in an organisation. The other issue is the relationship between data, information, and knowledge. In the literature on knowledge, the terms for data and information are often used to mean the same or interchanged to describe the knowledge process management. Before discussing the nature of knowledge, it is necessary to differentiate between data, information and knowledge so that knowledge will not be confused with these terms.

As Boisot (1998) stated, knowledge builds on information that is extracted from data. Data are facts or statistics which can be analysed on the condition that an agent has a prior stock of knowledge or the capacity to convey the information; that is, a relationship between things and agent. In other words, it is the agent's perceptual or conceptual apparatus that filters the data into a meaningful relationship. When such relationships are structured into a form, either in physical artifacts or embedded into an entity, this is knowledge.

Davenport and Prusak (1998) defined data as a set of discrete, objective facts about events and materials for the creation of information. Add in the relevance and purpose of an agent to the meaning of the data and it becomes information that contains a message, usually in the form of a document or audible or visible communication. Although similar to the view of Boisot (1998), Davenport and Prusak (1998) emphasised that it is the receiver who decides whether a piece of message is meaningful to him or her. Sanchez (2001, p.5) provided a more comprehensive explanation of data. He elaborated data as representation of the events that people notice and bring to the attention of others in an organisation. Hence, the representation of an event is dependent on the aspects of an event that an observer notices

and thinks will have significance, either personally or for an organisation. In Sanchez's (2001) view, data are not objective, neutral or value-free.

Firestone and McElroy (2003) share a similar view. They believed that data are often collected within a specified context to represent an observation. As for information, Sanchez (2001) saw it as the result of the evaluation and interpretation of data that create meaning and understanding of the world in some aspect. However, information is just a message fragment given to recipients. There can be no linkage or generalisation of information without justified beliefs, and therefore, it is impossible to predict or to act on information alone. Many knowledge management researchers and practitioners have adopted the pragmatic concept of knowledge as a set of beliefs of causal relationships in the world, and in an organisation. This is not surprising, as the primary objective of management is to help organisations more effectively and efficiently do things. Hence, under the scope of knowledge management, a discussion on the form of knowledge would comprise something that is able to cause things to happen. This concept is important in order to maintain the distinction between data and information. The characteristics of knowledge imply actually having the capacity of ways to do things or cause things to happen.

In Davenport and Prusak's (1998) context, knowledge is a fluid mix of framed experiences, values, contextual information, and expert insight which provides a framework for evaluating and incorporating new experiences and information. As described, knowledge embraces all into a form of structurised and informal experience; it is intuitive and therefore hard to capture in an explicit format. From the pragmatist's view, knowledge generates the capacity to act. Davenport and Prusak (1998) share the same view and gave a more concrete explanation in which knowledge provides a framework for action; it evaluates and incorporates new situations. Since knowledge is generated from a knower's mind with his/her own values and beliefs, it holds judgment. From this aspect, a literature review about the nature of knowledge in organisations is needed prior to defining knowledge as referenced in this study. In the next section, the definition of knowledge

in organisations will be determined after the nature of knowledge is reviewed.

2.4 The Nature of Knowledge

In the previous section, the literature has revealed that there is no exact meaning for knowledge. Although the pragmatic approach provides a more practical explanation of organisational knowledge, the nature of knowledge unavoidably affects organisations in managing their acquired knowledge. In this section, the observable, functional and biological aspects of knowledge are reviewed to investigate its nature.

2.4.1 Explicit, Tacit or Implicit

The conceptualisation of knowledge into two poles, namely explicit and tacit, is one of the more popular descriptions. When Polanyi (1966) departed from his role as a scientist, he turned to philosophy. He reconsidered human knowledge by starting from the fact that, "we can know more than we can tell" (Polanyi 1966). Styhre (2003) stated that what cannot be codified, formulated and expressed, to the extent that another person could follow those instructions and then undertake the same activity, is knowledge that is tacit in nature. In the words of Nonaka and Takeuchi (1995), tacit knowledge is usually in the domain of subjective, cognitive, and experiential learning. Boisot (1998) indicated that there are three distinct types of tacit knowledge. First, things are not said because everyone understands them and takes them for granted. Cultural relevance mainly falls under this form. Another type would be things that are not said because nobody fully understands them and they remain elusive and inarticulate. This is the same as Polanyi's view (1966). Finally, there are things that are not said because while some people can understand them, they cannot articulate them without cost. The difficulty of articulating and communicating knowledge inside an organisation is that it tends to be locked up in the minds of its possessors. Individuals come and go and take their tacit knowledge with them.

Davenport and Prusak (1998) stated that knowledge originates and is

applied in the minds of knowers. Consequently, most organisational knowledge is embedded in organisational routines, processes, practices, and norms contained in an individual's mind. Explicit knowledge, on the other hand, is formal and systematic. It is stored in a transmittable form, such as documents, books, audio-visual materials, or artifacts, and can easily be communicated and shared. The attractiveness of transforming tacit knowledge into explicit knowledge is its transmittable form which can transfer knowledge in an efficient way. However, as Boisot (1998) indicated, there is a cost to codify tacit knowledge. The major difficulty is that the knowledge owners retain the context of the information before they transfer their knowledge into explicit knowledge, and that this context is either not transferred or the receivers, who do not have the capacity or background to capture it, remain unaware of it. Another situation is that the knowledge owners have no capacity to fully articulate their knowledge into an explicit form.

They further extended a discussion on the nature of knowledge by using different world types of knowledge. They distinguished knowledge into three types: 'World 1' knowledge is the encoded structure in physical systems which allows objects to adapt to an environment; 'World 2' knowledge comprises beliefs and predispositions about the world, the beautiful, and the rights that people believe have survived their tests, evaluations and experience; and 'World 3' knowledge emphasises sharable linguistic formulations, knowledge claims about the world, the beautiful, and the rights that have survived testing and evaluation by agents, who include individuals, groups, communities, teams, organisations, societies, etc., and have acquired, formulated, and tested and evaluated the knowledge claims.

Firestone and McElroy (2003), in fact, intended to argue that apart from tacit and explicit knowledge, there should be another type of knowledge: implicit knowledge. They defined implicit knowledge as that held in the form of one's conceptual framework, and expressed in one's language. Their argument is that if tacit knowledge is inexpressible, there

should be a third category of knowledge that is expressible, given the environmental conditions effective in eliciting them. Implicit knowledge contains non-focal knowledge or beliefs, such as those in an unconscious nature that can be brought into focus and made explicit, according to the different nature of the three types of knowledge. This approach provides a way to handle knowledge, which may have been originally identified as tacit knowledge. In fact, this is implicit in nature and can be transformed into explicit knowledge. In this process, the KA plays a vital role in learning and activating the learned knowledge. For example, World 2 implicit knowledge, which embraces hidden variables of personal psychological factors, may need to be abstracted by using measurement instruments, surveys or observation so that it may be transformed into an explicit form. Firestone and McElroy (2003) have created a new area of research for knowledge management scholars to explore the role of KAs.

2.4.2 Declarative, Procedural or Conditional

After exploring the definitions from different fields of research, Alexander et al. (1991) presented a conceptual framework for organising and relating terms that pertain to select knowledge constructs. They claimed that knowledge encompasses all that a person knows, or believes to be true, whether or not it is verified as true in some sort of objective or external way. From their view, any form of knowledge comprises declarative, procedural or conditional knowledge. Declarative knowledge is factual information that is sometimes described as know-what. Procedural knowledge has certain processes or routines that can be described as know-how. Conditional knowledge is the knowledge of when and where it could, or should be, applied. That is to say, when we know something, we know not only the factual information about it, but also how to use such knowledge in certain processes or routines. We can also understand when and where this knowledge would be applicable. Nevertheless, the acquisition of knowledge in one form does not automatically and immediately guarantee the embracing of knowledge in the other forms. Thus, it is certainly possible to know the ‘what’ of something without knowing how to apply it on a

particular occasion.

The knowledge framework may provide a better explanation as to why personal knowledge stays in individual minds and becomes embedded in a tacit form. From a pragmatic aspect, knowledge is acquired in action rather than deductively by reasoning. Thus, individuals, through experience, gain the know-how of doing things. Unless they have the ontological context, that is, they can find the reason or are able to generalise the phenomenon and facts that cause things to happen, they have no grounds to declare their knowledge and explain their know-how in the form of know-what. Apart from this, knowledge owners may also lack the awareness of the appropriateness of adopting and applying the knowledge. Hence, they will be in a status where they know more than they might tell anybody. However, it is not unusual that in most situations, knowledge owners unconsciously implement knowledge. That is, they do not know they know something and should make it explicit to others. Therefore, knowledge is often kept in a tacit form. Likewise, to elaborate on procedural knowledge, individuals should have the capacity to transform it into an explicit form. Literacy and common language (Davenport & Prusak 1998) are major factors in the success of any knowledge transfer. It is questionable whether knowledge owners possess such competence. Even if they do so, it is still not known if they have the intention to transfer the knowledge into an explicit form. If they do not, then the knowledge is kept in a tacit form. As discussed earlier, the articulating of tacit knowledge into an explicit form is not without cost.

2.4.3 Life Cycle: Create, Grow and Decay

From a life cycle perspective (Birkinshaw & Sheehan 2002, Bukowitz & Williams 2000, McElroy 2003, Wiig 1993), knowledge is alive when it is applied in work, regardless whether it is for daily business operations, or innovation to sense or cope with change. Knowledge, therefore, incorporates the stages of generation, growth, sustainment, reproduction and decay. In the generation stage, knowledge in an organisation can be obtained via acquisition or self-creation by learning.

Knowledge can be acquired from explicit forms such as books, artifacts or documents. The knowledge, however, can be activated only if there is a KA who is willing to learn the explicit knowledge and apply it in his or her work. Then the knowledge would have life. The other way to obtain knowledge is from external knowers, who are employed as staff or consultants or contractors, and apply their knowledge to finish a task or solve a problem. With the former, knowledge may have higher sustainability if the knowledge can be transferred within the organisation to other members or transformed from its implicit form and stored in an explicit status. Again, for the latter, a KA is needed to retain the external knowledge. It is, however, not an easy task as the KA may lack the context and capacity to absorb the external knowledge. Besides that, the external knower may not be willing to transfer the knowledge to the organisation in an explicit form.

As knowledge has a life cycle nature, many knowledge management practitioners emphasise the management of knowledge processes, specifically in the area of knowledge transfer from a tacit to explicit form, and in the repository technologies used to store and access explicit knowledge. However, Bukowitz and Williams (2000) also highlighted that the knowledge life cycle has a 'divest step' which can be used if the knowledge has no value for an organisation. It is important to an organisation to consider abandoning out-dated or unnecessary knowledge in order to sustain a competitive advantage and industry viability. In a similar approach, de Holan and Phillips (2004) developed a framework for organisation learning practitioners and suggested organisational forgetting might be an important strategy. Based on the results of their research on the knowledge dynamics of international joint ventures, they believed that one important dimension of knowledge in organisations that deserves much more attention is the dynamics of organisational forgetting. Their argument is built on deeply entrenched stocks of knowledge that can act as barriers to new learning, particularly out-dated (Chen et al. 2007), falsified (Firestone & McElroy 2003) or fossilised knowledge embedded in organisations that refuse any new knowledge.

Firestone and McElroy (2003) adopted the double loop learning theory from Argyris (1993) and Schön (1983) and extended the knowledge life cycle from generating knowledge based on current knowledge modification to a new aspect that looks into a problem. They explained that knowledge can produce in a situation specific conditions based on new perspectives and generalised knowledge that are related to new theories and models, ontologies, epistemologies, and methodologies. This approach, which is not exactly the same as knowledge-forgetting or divesting, highlights that existing knowledge is insufficient to respond to a new situation and that the knowledge life cycle may start again to acquire new knowledge. Firestone and McElroy (2003) also discussed the knowledge production process in combination with the predispositions and beliefs of KAs. Since it is the agents who act, knowledge is not owned by an organisation until it becomes stock and is retrievable and accessible by other people within an organisation.

2.4.4 Implications to the Nature of Organisational Knowledge

By extending the concept of the life cycle nature of knowledge, knowledge is considered to be perhaps contained in two forms, namely, organic and inorganic. In the organic form, knowledge may grow via refinement, by transfer to other members and/or be reproduced by learning. It may hibernate in an inactive state, either to be used later or enter another stage of life, by being forgotten or lost. In the inorganic form, knowledge is transformed into an explicit form and stored. It would subsequently be activated via a KA so that it becomes organic again or forgotten, decay, damaged or lost. Thus, to avoid becoming dead stock, knowledge needs to be kept in an organic status. This status needs to satisfy two conditions: the knowledge is being activated and there is a KA to activate it. In the literature, some knowledge management researchers call the KA a “knowledge broker” (Bukowitz & Williams 2000) or a professional (Dalkir 2005) who assumes the responsibility of gathering, repackaging, and promoting knowledge through an organisation.

2.4.5 Definition of Organisational Knowledge

Having reviewed different perspectives and aspects with regards to the definitions of knowledge and its nature, definition of Davenport and Prusak (1998) has been adopted with the following adjustment: a pragmatic view is taken into consideration in that knowledge contained in an organisation is defined as a 'mix of fact, organised or justified skills, experience, value judgment and beliefs that person, a group of members or organisation after acquiring it can generate a capacity to act on the transformation of problem to solution, transmission to other parties, predicting the outcomes of processes, making better decisions, making sense of the signals from the environment'. In the forthcoming sections and chapters, the above definition is used to refer to the knowledge required or adopted in organisations.

2.5 Knowledge Management Models

Knowledge management has been drawing attention after the rapid development of information systems in the last few decades. To capture the details of the latest studies on knowledge management, this section reviews its evolution and the models which have been developed after the information technology era.

2.5.1 Evolution of Knowledge Management

The knowledge management foundation provided by Wiig (1993) has aroused a widespread of discussion in the area. According to his knowledge management framework, there are three pillars which represent the major functions needed to manage knowledge. They are the exploration of the knowledge resources and their adequacy within an organisation, and the value assessment of knowledge and the knowledge process. His approach is more like a check sheet for examining the areas related to knowledge that need to be managed rather than a conceptual explanation of the relationship between the factors which influence the knowledge process. Nevertheless, it provides a framework for a starting point.

Koenig and Srikantaiah (2000) viewed knowledge management as a new paradigm that started from information sharing by using the emerging tool back then, the Intranet, which was extended to the concept of a learning organisation for the creation of knowledge. Information technology management dominated the trend of managing knowledge in the major domain of reengineering the business process by redesigning the operations and workflow from manual to electronic processes. The misunderstanding of reengineering the business process into electronic form as a concept of knowledge management resulted in mistrust between employers and employees. In Koenig's (2002) view, knowledge management progression should integrate information technology with soft technology such as communication and collaboration, tacit knowledge, incentives and rewards. According to Koenig's (2002) three stages of knowledge management, the first stage mainly refers to the electronic communication breakthrough. With the advance in information technology, organisations favour the deployment of new technology to capture all information and organisational knowledge. The perceived equivalence to business process reengineering however, raised a trust issue that involved cultural and human dimensions (Koenig, 2002). The second stage added the recognition of human factors and a shared value of the belief in sharing and creating knowledge.

Two important business publications, the work by Senge (1990) on the learning organisation and the cultivation of knowledge into different forms coined by Nonaka and Takeuchi (1995), catalysed the emergence of the second stage. In the third stage, there is the awareness of the importance of content. Koenig (2002), however, restricted his thoughts to information technology application in existing knowledge classifications and contexts. The concern, under this consideration, is about the efficiency of knowledge retrieval. Hence, the content management, taxonomy, and portal application concerns are about supporting knowledge coordination and transfer applications. The three-stage knowledge management evolution does not provide the answer as to why an organisation would progressively move from one stage to another. It seems that the development of knowledge

management is based on the compensation for the shortcomings of each stage rather than on a holistic consideration.

2.5.2 Snowden's Cynefin Model

Snowden (2000) described knowledge management as a social ecology which permits the compatibility of diverse community types. He asserted that culture, in a socio-cultural system, can be directly observed, documented and measured through different tools and artifacts which can be transferred to the next generation. From the ideational system, culture becomes tacit in nature. He emphasised that the function of knowledge in any organisation is to make sense of things, both to oneself and the communities with which one is connected. Unlike the information management approach which sees knowledge as a higher-level order of information, Snowden (2000) conceived knowledge to be a requirement for actualising the senses and creating meaningful messages that inform other community members on ways to cope with complex situations. To materialise knowledge into the senses, Snowden suggested that a common language, which embraces the context, is the key.

Snowden's approach, in fact, shadows the socialisation, externalisation, combination and internalisation (SECI) model from Nonaka and Takeuchi (1995), although its focal point is self-awareness rather than a prescriptive organisation model. The Cynefin model comprises two dimensions: culture and sense making. Snowden (2005) depicted three ontologies: ordered, complex and chaotic, to illustrate the situation of organisations. An ordered system may reduce the sense of awareness of the external world, while a chaotic system is in turbulence without form and substance. He argued that the complex system of organisation as evolutionary in nature. It is necessary for an organisation to have a complex nature so that it is competent, and this reduces uncertainty in chaotic situation.

Snowden (1999, 2000, 2002) mentioned in almost all of his publications that knowledge could only be volunteered to hold, share and

grow. He argued that formal systems contain conscription (1999) and therefore, effective learning and exchange of knowledge are low. He indicated that knowledge is polarised into an explicit and a tacit nature against another dimension, the expert level. He categorised tacit and explicit as dimensions of culture, while the expert and non-expert levels belong to a sense-making dimension. These two dimensions formulate different types of communities that exist within the boundaries of the ecology being managed, namely: (1) formal organisations with non-expert/explicit characteristics, (2) communities of competence with their characteristics falling in the expert/explicit quadrant, (3) inter-dependent communities with an expert/tacit nature and (4) a forced interdependence with a tacit/non-expert nature. If the organisation structure model coined by Mintzberg (1979) is revisited, Snowden's community types are almost embraced by the five structural configurations in the model: strategic apex, techno-structure, support staff, middle line and operating core. Different types of organisations are derived from these structures. His contribution to knowledge management, however, mainly falls into shifting the focus from managing knowledge as a "thing" to managing knowledge as a "flow" (Snowden 2002). That is, ways to manage knowledge flow in different types of communities while at the same time, reduce uncertainty. The Cynefin model is therefore more concerned about sense-making of the organisation context and narrative with a method to convert experience into stories under the consideration that the need to know is aroused. In Snowden's words, it is just-in-time knowledge management from the complex to the knowable (Snowden 2002).

2.5.3 Nonaka and Takeuchi's SECI Model

Nonaka and Takeuchi (1995) studied the success of Japanese companies in achieving creativity and innovation. They wholly identified knowledge creation with knowledge conversion. They theorised a knowledge spiral by which knowledge can be created through a continuous cycle of four integrated processes: socialisation, externalisation, combination and internalisation. Many publications in the literature refer to

this spiral as the SECI model. Knowledge creation, indeed, is a social process between individuals where knowledge transformation is interactive and spiral. The knowledge is conversable from tacit to tacit or tacit to explicit, and vice versa. Socialisation is a rather limited form of knowledge creation where the speed of knowledge transfer is relatively low. The knowledge is transferred through experiences shared with others, observations, imitation, and practice. Apprenticeship is a common way to learn tacit knowledge. Externalisation is a process that articulates tacit knowledge, which resides in an individual's mind and is difficult to formalise and communicate to others into an explicit form that is both formal and systematic. Combination is the process of integrating explicit knowledge and manipulating it as systemic knowledge, by sorting or other techniques, to form a new whole of knowledge. Lastly, internalisation is learning explicit knowledge by doing and sharing mental models and technical know-how is in order to broaden, extend and reframe the receivers' own tacit knowledge.

Nonaka and Takeuchi (1995) argued that Western culture often considers the knower and the known as separate entities and therefore, places greater attention on communicating and storing explicit knowledge. In contrast, the Japanese culture is influenced by Zen Buddhism, which believes in the oneness of humanity and nature, body and mind, self and other. In such a cultural environment, knowledge is principally group knowledge that is easily converted, mobilised, transferred and shared with other members within an organisation.

The SECI model is relatively robust and easy to adopt because of its simplicity. The model is attractive in that it provides a framework to manage tacit knowledge, either maintaining tacit knowledge in its original form, which is its tacit nature, or converting it to an explicit form. Knowledge conversion, however, only produces a knowledge claim formulation (Firestone and McElroy 2003). It does not address the condition and reasons for individuals or groups to become involved in a knowledge process, such as acquisition, sharing, transmission or creation.

2.5.4 McElroy's The New Knowledge Management (TNKM) Model

Compared with other knowledge models, McElroy (2003) developed The New Knowledge Management (TNKM) model starting from the supply and demand side. He viewed the first generation of knowledge management as created knowledge through distribution and sharing. Hence, knowledge management is about capturing, codifying and sharing valuable information and getting the right information to the right people at the right time. McElroy (2003) turned his view from the supply to the demand side so that knowledge management would also focus on knowledge processing; that is, knowledge-making in response to problem-induced demands. Permeated with complex adaptive systems (Bennet & Bennet 2004), the purpose of knowledge management is to enable or reinforce self-organisation in knowledge processing to achieve sustainable innovation that supports organisational adaptation. Under this premise, McElroy (2003) argued that a knowledge management model should combine both the supply and demand sides of knowledge processing and seek ways to enhance the processing. The TNKM model, therefore, mainly addresses the issue of knowledge claim evaluation, which is to manage knowledge production from a quality aspect, and has not, as yet, been discussed by other models.

2.5.5 Implications of Knowledge Management Models

The evolution of knowledge management provides a historical background that shows knowledge was not distinguished from data and information. Thus, at the beginning, knowledge management researchers put forth much effort to exploring information management, particularly after there was a breakthrough in information technology. Then knowledge transformation from implicit/tacit to explicit dominated the studies. Another branch of knowledge management is taxonomy. Nevertheless, when looking back at previous work in the literature, the original knowledge management research aimed to investigate productivity improvement and business competency.

According to the definition of knowledge adopted for this study

shown in 2.4.5, the potential achievement of acquiring knowledge in an organisation, whether it is generated internally or obtained externally, is to develop the means to receive signals of changes in the environment and respond to them in order to make better decisions or provide better solutions. There is an issue as to whether it is the organisation or the individual that establishes this means. As mentioned earlier, knowledge is in an individual's mind and organisational routines, processes, practices and norms. To manage an organisation's knowledge, it is insufficient to only considering the system's side without taking into consideration another key factor: individuals.

After reviewing the knowledge management models, there are several aspects that share the same focus. First, the human factor is addressed. Although technology support and knowledge processes are factors to take into account, people are still the major concern. Nonaka and Takeuchi (1995) stressed that respect for people and the development of a shared value on the importance of knowledge is the core aspect of knowledge management. Snowden (2002) shared a similar view and emphasised that people only know what they know when they need to know it. McElroy (2003) also pointed out that in the first generation of knowledge management, consideration of knowledge demands was ignored. In his proposed knowledge management model, he contended that the identification of the demand for knowledge is a necessary criterion to establish a system with appropriate actors to manage knowledge in an organisation.

Another issue that has arisen from these models is to ask "who" is going to activate the knowledge process, particularly the processes for creating, transferring and implementing knowledge. All of the described models have mentioned agents, although they might use different words, such as knowledge activists, who activate knowledge processes, but from different levels of concern. Snowden (2005) focused on narrative techniques for knowledge disclosure and very little was done to explore the roles and characteristics of KAs. The focal area of Nonaka and Takeuchi's (1995)

model provided suggestions on how different types of knowledge could be transferred or transformed within an organisation. In the publications that followed, the discussion of knowledge management extended to include enablers (Ichijo et al. 1998, von Krogh et al. 2000). One discussed the mobilising of knowledge activists. However, the discussion is bounded by who should be a knowledge activist and what tasks s/he carry out (von Krogh et al. 2000), but does not explore to a great extent, the ontology of the knowledge activist. Bertels and Savage (1998, p.10) questioned the aspirations of people who take part in the knowledge process of an organisation. The KA refers to an individual, a group of people or organisation as the energy sources of the actions for the process. So, it is important to determine the ontology of KAs by which management may learn the way to motivate people for knowledge processes in an era that emphasises knowledge.

To summarise, knowledge management models have provided aspects of the knowledge process. There are, however, some fundamental questions that have not yet been answered, such as who is the knowledge agent entity with the role to activate knowledge processes? Why does the agent activate the processes? What constitutes the identity of a KA? Unless there are answers for these questions, the effectiveness of managing organisational knowledge is questionable. In the next section, a new aspect of managing knowledge, i.e. knowledge agent and its existence in organisations to carry out knowledge processes are discussed.

2.6 A New Aspect of Managing Knowledge: the KA

It was highlighted in Section 2.5.5 that individuals who participate in knowledge processes should be considered as a key factor for effective knowledge management. In this section, the nature of knowledge containers and rationale of using agent to carry out knowledge processes are addressed. Then the characteristics of KAs are discussed.

2.6.1 Knowledge Container

In Section 2.4.3, it was discussed that knowledge is not a living

entity. It must be stored in "containers" to exist. As value judgment and beliefs, which are the major ingredients for forming knowledge, reside within human knowers, a clear distinction between information and knowledge is that information can be digitised in an explicit form while knowledge can only exist within the context of an intelligent system and is mainly embedded in the knower's mind. In consideration of such, a knowledge container would have two forms: organic and inorganic. McElroy (2003, p.72) described knowledge containers as codifications of various kinds through which shared knowledge is held and expressed. This then presents two issues: firstly, a codification method, and secondly, how the knowledge is held. These two issues cannot be separately discussed.

With regard to the codification method, when knowledge is in a tacit form and held in an individual's mind, it is not expressible. Indeed, it is in a parasitic form and the existence of knowledge is dependent on the holder. If the holder forgets, the knowledge cannot be recovered. In a situation where the holder moves to another organisation or leaves the industry and never returns, the knowledge will either be recovered from the new organisation or disappear. Besides that, there is the probability that the knowledge will remain in an unchanged form if the container parks the knowledge and does not implement it at all. This knowledge, however, can be changed into a more advanced form after a transformation. Such new knowledge is created based on the existing one, or by adopting existing knowledge in new areas, for coping with a new challenge. Another type of knowledge codification is implicit knowledge, which is also contained in the mind of the knowledge holder. The only difference is in the method of codification. In the implicit form, according to McElroy (2003), there is a common language to interpret the implicit knowledge; one that both the sender and receiver can understand. The knowledge still has the opportunity to be transformed into something that is new, forgotten, lost or decayed. Something which is organic has the power to adapt to its environment through changes that originate internally. Knowledge, if stored in an individual's mind as parasitic, in a tacit or an implicit form, can be changed via an internal process for creation,

transformation and implementation. At the same time, it can be decayed, its memory lost, parked without any awareness from outsiders of its existence, or mobilised to other parties. It is thus in a dynamic status.

Knowledge held in an explicit form, such as in documents or audio-visual materials, is considered to be stored in an inorganic container. The knowledge is in a situation similar to hibernation, and its function is stagnant. This knowledge may decay if codification is dysfunctional or memory is lost because the symbols, language, or process of making an artifact is unknown; or it may be never discovered if the container is damaged or does not exist, e.g. the programme language has changed. In conclusion, if knowledge is stored in an organic container, it may become organic. However, if the knowledge is held in an inorganic container, it can only become organic when there is an awareness of the organic container and its contents are adopted.

Many knowledge management researchers have been focusing on the transformation of tacit knowledge into explicit knowledge, based on the assumption that the speed of transferring knowledge into an explicit form is faster than that of a tacit form. This assumption is only valid if the KA is aware that such knowledge exists. In other words, to activate knowledge, whether it is stored in an organic body or inorganic container, the KA must be a living system.

2.6.2 Agent Theory

It is asserted that KAs are an essential factor for activating knowledge processes. However, do KAs actually exist in an organisation? If so, what form do they take, and why are they willing to put forth effort? To investigate the nature of KAs, a revisiting of the principal-agent theory may provide some vital information.

The principal-agent theory studies the existence of firms. The basic idea of the principal-agent theory arose under the conditions of incomplete and asymmetric information when a principal hires an agent. A principal-

agent relationship arises when the principal contracts an agent to perform some tasks on his/her behalf (Petersen 1995). The agent possesses the skills and abilities that are needed to perform the tasks, while the principal employs the agent because s/he lacks such skills and abilities, is less effective in performing the tasks than the agent, or can spend time to be more productive on other tasks. The key contributors who have provided the foundation to build the theory are Ronald H. Coase (1937) and Oliver E. Williamson (1999). Coase (1937) explained that an agent exists because the costs of organising additional transactions within a firm may rise and exceed the benefits brought in from additional transactions.

Hence, the employing of an agent can minimise costs and bring in better benefits. Williamson (1999) extended Coase's view of transaction costs to explain why some economic activities are coordinated through the market and others within a company or organisation. Due to human characteristics such as bounded rationality and opportunism, other complex and uncertain environmental factors, and asset specificity, when a company uses the market to complete a task, it has to bear the transaction costs which include searching, contracting, monitoring and legal enforcement costs (Rapp 1999). In summary: when the transaction costs are lower than the operation costs within a company, the tasks will be carried out through the market.

The principal-agent theory provides a frame of reference for the relationship between two parties, the principal and agent. The theory assumes information availability and risk sharing. Since information, or more precisely, knowledge, is a production factor, the principal-agent theory studies the contract types which would better fulfil the needs of both the principal and agent to share the risk of uncertainty. There are two types of contracts between a principal and agent; behaviour-oriented and output-oriented. Behaviour-oriented contracts are based on behaviour and compensated for merit. The principal will bear the consequence and the results of the tasks. In other words, the principal pays for the time that the agent is working. If an output-oriented contract is used, the agent is paid for

the outputs that have been produced. Then the principal, to a certain degree, has to identify some of the measurable output variables. However, there are some considerations behind contracts, regardless whether a contract is behaviour-oriented or output-oriented. For example, under certain situations, an agent may employ hidden actions, particularly those with moral hazard issues, which are not easily observable. Contracts must employ other kinds of safeguards to prevent such hidden actions from happening. In the principal-agent theory, therefore, the focal point is to study the behaviour of principals to search for optimum benefits, which is to minimise hidden actions. To do so, the principal-agent theory often aims at studying ways to change the behaviour of agents. Suggestions include threatening, rewarding and persuading. Some research studies show that human beings often learn ways to avoid threats, obtain rewards, but behave as usual. Only persuasion, that is education, can change the behaviour of an agent so that it has a long-lasting effect (Rapp 1999).

In a similar manner, when managing knowledge, principals fail to make the best use of the factors of production, i.e. know-how and know-what knowledge. The more complex the knowledge adopted and applied, the more difficult it is for the principal to cope with the variations. The principal-agent theory provides a comprehensive explanation of the decisions that a principal can make when employing an agent. However, the theory only explains part of the relationship between a principal and agent. The reasons that agents provide for offering their resources have not yet been explored, particularly in a situation where the agents also bear the risks of not gaining recognition or being rewarded for the knowledge work that they have contributed.

The implications of the principal-agent theory, first of all, involve the existence of agents, regardless of the nature of the firm or its external environment. However, it does not answer the question as to why an entity would offer its effort to the knowledge process in a tumultuous business environment. Furthermore, the principal-agent theory indicates that agents exist because of the asymmetric knowledge between a principal and an

agent. The KA often attempts to close the gap in an asymmetric knowledge situation to handle unpredictable or changeable environments by knowledge processing. This includes the process of knowledge creation and transformation for sharing. The principal-agent theory does not provide an explanation for the behaviour of an agent who is willing to create and share knowledge to members of an organisation and/or other partners outside the organisation in order to achieve the goals of an organisation. Instead, the principal-agent theory arises from the principal's perspective in that there is one view on the existence of the agent. Investigation is required from the perspective of an agent in order to understand why and what individuals become a learning group to conduct the knowledge process in an organisation.

2.6.3 The Intelligent Complex Adaptive System (ICAS)

The Intelligent Complex Adaptive System (ICAS) (Bennet & Bennet 2004) provides another means to explain the emergence of the use of KAs in organisations to deal with dynamic and unpredictable environments. Bennet and Bennet (2004) felt that nowadays, to demonstrate capability, an organisation needs to be flexible, robust, agile and adaptable. To attain such qualities, an organisation should acquire the characteristic of being knowledge centred and be in a symbiotic relationship with its environment. Thus, the organisation needs to have a learning structure and action culture for activating the knowledge process. To do so, the values of trust and high integrity must be widespread, and continuous learning and fair treatment of all employees must exist within the organisation. In addition, the organisation needs to encourage creativity, and allow a high degree of self-determination within an equalitarian basis. Under the new business environment, Bennet and Bennet (2004) proposed a new theory of the firm; they believed that firms should embed a complex adaptability, which embraces the forces of knowledge and knowing. The force of knowledge emphasises the creation, sharing, dissemination, leveraging, and application of knowledge. The force of knowing blends cognitive capabilities which understand the changes in the environment and make maximum use of

intuition and experiences to create deep knowledge with actions taken on such knowledge.

Under the consideration of the force of knowledge, the ICAS supposes that an organisation is composed of a large number of self-organising components. Each of those components seeks to maximise its own specific goals, but also operates according to the rules and context of relationships with other components and the external world. Bennet and Bennet (2004) claimed that the actors of a system are people. The assumption of the ICAS is that organisations are capable of fulfilling higher-level goals when people within the organisation are empowered to self-organise, and knowledge is available throughout the organisation. They introduced eight characteristics of the ICAS that can contribute to internal capability which will help to deal with the future environment. These are: organisational intelligence, shared purpose, selectivity, optimum complexity, permeable boundaries, knowledge centricity, flow, and multidimensionality (Bennet & Bennet 2004). The ICAS framework obviously adopts a teleological approach with recourse to ideas of function and purpose. However, Bennet and Bennet (2004) did not provide any explanation on the characteristics necessary for the interrelation of key actors in the system, which are actually dubbed as KAs in this thesis. There are no grounds to justify whether the system is viable for a dynamic environment.

2.6.4 Autopoietic Systems

Although Bennet and Bennet failed to provide an explanation on how the characteristics of ICAS relate to KAs, the description of those characteristics is reminiscent of a biological system concept in that the ways that an organisation survives in an uncertain environment are described. In this respect, the concept of a self-producing biological system or autopoietic system may provide a new perspective for explaining the nature of KAs as living systems who stay in business organisations.

The concept of autopoiesis was developed by Maturana and Varela (1980) as a way to identify living systems. The fundamental question that

they set out to answer is to ask what distinguishes entities or systems that we would call living from other systems. The problem arises not because it is difficult to identify something as living, but because it is not easy to determine the characteristics of such. Maturana and Varela (1992) further explained that to understand a living system, a biological individual should be studied instead of focusing on a species or genetic approach. In their observation, an essential feature of a living entity is its individual autonomy. Although it is part of an organism, population or species, it has a boundary and is self-defined by its components. In other words, the components create an entity, which automatically creates its own necessary characteristics and boundary. They called this structure-determined single entity, an autopoietic system. They further elaborated on the characteristics of an autopoietic system by stating that the living system operates in a mechanistic way, that it consists of particular components and has various properties and interactions with its neighbourhood components in and outside the boundary. A living system also interacts with its neighbourhood components and things outside its boundary; however, the interactions have different goals. These goals are related to whether the living system is being observed as a single entity, or as a whole, and related to some wider system. In the former, the living system is closed and self-produces the components to compose its own boundary. The external environment can only trigger the living system to change internally. However, the change is not primarily related to environment. Change is for the self-compensation of components within the life system, after it has been perturbed by its environment.

The autopoietic operation system is interactively open to the external environment when the system is required to survive in a state where the autopoietic entity needs to select appropriate structured components coupled with other entities for that environment. In this situation, the behaviours of one system become triggers for the behaviours of the other through the selection of individual components. Then, the interactions become inputs and outputs for a wider system. The relationship between a single living system and a wider system is not autopoiesis. This is called allopoiesis by

Maturana and Varela (1992), and the components generated by that living system are inputs into the wider system. The fundamental requirement of the entity is to constantly self-produce its components for survival. Indeed, it is the entity's function to realise that it should produce itself.

With the above explanation, Maturana and Varela (1980) defined an autopoietic entity as a unified network of processes of production (transformation and destruction) of components which: (i) through their interactions and transformation continuously regenerate and realise the network of processes (relations) that produced them, and (ii) constitute it (the autopoietic entity) as a concrete unity in the space in which they (the components) exist by specifying the topological domain of its realisation as such a network. The first part of the definition describes the general idea of a system of self-production mechanism. The second part specifies that the system must be actually realised in an entity that produces its own boundaries.

There are six-point key areas (von Krogh & Roos 1995) to identify an autopoietic system. They are: (1) the entity is identifiable from its environment with its boundaries through interactions among components, (2) there are constitutive elements of the system with describable components of the system, (3) the system is mechanistic and the component properties are capable of satisfying certain relations with the interactions and transformations of these components, (4) the components that constitute the boundaries of the system constitute these boundaries through preferential neighbourhood interactions and relations between themselves, as determined by their properties in the space of their interactions, (5) the components of the boundaries of the system are produced by the interactions of the components of the system, either by the transformation of previously produced components, or transformations and/or couplings of non-component elements that enter the unity through its boundaries, and (6) there are other components of the system which are not produced by the interactions of its components, but participate as necessary permanent components in the production of other components within the system.

von Krogh and Roos (1995) summarised the concepts of an autopoietic system with four basic properties: autonomous, mechanistic operation in a closed or interactive open system, self-referential and self-observing. For self-producing components, an entity autonomously constructs a boundary with its components. The basic living system is self-contained. The reproduction of a living thing is not for the self. It is for a family, a population or species. An autopoietic entity, in this consideration, is unrelated to reproduction. It does not mean that living things do not need an extension of life, but that the essence of reproduction is the production of others for a group. It involves heredity and evolution. An autopoietic system will interactively open its system to take in external components when those components are needed by the entity to interact with its inside components for the construction of other components. Such open and closed mechanisms, indeed, prolong the life of the entity.

An important property of an autopoietic system is self-referencing. As mentioned, an autopoietic system is realised through a particular arrangement of components, and the changes that it can undergo are determined by a particular arrangement to maintain its self-producing nature. All interactions in the system are determined on its own, through self-referencing activities. This self-referential ability allows the system to remember its previous interactions and makes justifications for producing components. It even structurally changes other components to constitute the entity's boundary in order to integrate outsiders to become a part of the autopoietic entity components, thus maintaining its identity in an existing situation. Without such self-referential behaviour, an entity will disintegrate. The determination of structural changes is by self-observation. Observation relies on the standpoint of an observer. Hence, an observer who is external to a system will perceive the relationship between an entity and its environment, while an autopoietic entity, which focuses its attention on the internal structure of a system, only sees the environment as the background. This concept imparts an important idea that the observation of a living system is purely the result of the interactions of neighbouring internal

components. Autopoietic observation does not come from a teleological approach, which sees a relationship in terms of function and purpose in that the explanation of any concept could become goal-driven and subsequently, exist in a self-subservient state.

2.6.5 Implications of Autopoiesis

This study asks the following research questions. What is a KA? Why does it exist in an organisation? How does it sustain its identity? This research queries if the knowledge management models developed by Snowden (2000), Nonaka and Takeuchi (1995), and McElroy (2003), are sufficient enough to provide answers to these questions. As many knowledge management researchers have adopted a teleological approach to respond to the purpose and function of knowledge management, their knowledge management models often embrace a mechanism to illustrate the methods that manage knowledge without a comprehensive explanation as to why the structure was constructed. The autopoiesis theory, which explains the nature of living systems, may address a conceptual discussion about the characteristics of KAs in an organisation. When a KA is defined as an organic container of knowledge, naturally it is being treated as a living entity or system.

von Krogh and Roos (1995) highlighted one of the important properties of an autopoietic system as an observer who observes his or her own system. There is no external viewer to perceive both an entity and its environment and see how the two relate to each other. What an observer views as an event is actually part of his or her own experience and lies within the environment so that the knower cannot separate the event from the world that s/he is getting to know. In the same manner, a KA, as an individual entity, observes what it needs to activate a knowledge process according to its own judgment. To distinguish the identity of the KA from others, its drive is to pursue and assimilate knowledge and turn itself into a competent individual for survival. This competency will be embedded into the organisation. A KA subordinates all changes to maintain entity. To

maintain an individual identity, however, an individual requires autonomy. A KA must keep its own components at a survival level through a self-producing operation, because knowledge in nature cannot be transferred to any entity that does not take part in the cognitive process. The property, however, is not necessarily linked with the components that an organisation requires for survival.

In the case where a KA finds that its knowledge stock cannot support its existence, it would self-produce the component that it thinks is important through interactions with other knowledge components. The external environment, however, will trigger it to change only if the environment perturbs its existence. Then the self-observing property helps the KA to increase its awareness of the activating knowledge process. In other words, if this property deteriorates, the KA disintegrates.

The concept of self-reference is another important explanation for the interaction of components within the boundary of a KA. The self-reference of a KA means that the knowledge of an individual is recursively accumulated by an entity from its previous knowledge. This self-referencing behaviour affects the structure and operation of that entity for survival. Therefore, self-referentiality is preparation for life. An autopoietic system may be self-referential with regards to a specific space-time combination, but can also be self-referential in terms of its own evolution. This property is similar to the pragmatic approach of knowledge generation. The implication of this property is that an entity learns through self-reference, which is a feature all living systems have with regards to previous knowledge. As von Krogh and Roos (1995, p.40) indicated, “that is what we know was influenced by what we knew, and what we will know depends on what we know”.

Another implication of self-referentiality relates to the change of an entity’s boundary. The mechanism of entity operation is not closed for self-production only. The operation system is open to the external environment through interaction with other external components for self-producing the

components of boundaries. Assume that self-knowledge is a major component for constructing the boundary of a KA. An individual recursively self-produces knowledge with previous knowledge and reconstructs his or her boundary. This appears to be perfect, but another question then arises: Is a knowledge component the only component for a KA? The answer is apparently "no". Hence, if the autopoiesis theory can explain the nature of a KA, then the KA theory is best left to identify the components of constructing a KA.

According to Beer (in Maturana & Varela 1980), the autopoietic method of survival answers to the existence of living things. Yet the autopoiesis theory does not give a perfect explanation of the KA as a living system. There remains a central question as to whether such a physically oriented concept can explain non-physical domains. Maturana and Varela (1980) identified six criteria that examine the realisation of a living entity. Like the assertion put forth by Mingers (1995), these six points simply and naively apply the autopoiesis theory to the social domain. Firstly, is there a physical boundary around a KA that distinguishes it from other parts of the wider system? Secondly, are the components that construct a KA observable? This question leads to the next: what are the properties of a KA that enables it to interact with the external environment? From another aspect, if the discussion does not focus on a physical system but instead on concepts or ideas, then could it help to define other conceptual theories with regards to the self-production of life? The answer is "yes" for the first and second questions. The third question has not yet been answered. If the KA is a separate entity with no relation to any other groups of entities within an organisation or does not show any concern about the norms within a group, then there is no point in discussing its existence from the viewpoint of any organisation. However, there must be some relationship between a KA and an organisation which is missing in the autopoietic approach. One missing aspect could be that the components of a KA have not yet been determined. These components might need to interact with the external environment for production. Therefore, it is an essential area that needs further investigation.

So far, the attractiveness of an autopoiesis theory for the study of the nature of a KA and its relationship with an organisation are that:

- both parties place the production and reproduction of systems in the particular idea that systems can be recursively self-producing,
- explanations should be non-functionalist and non-teleological, but concerned with actual historical interactions and processes that have occurred, and
- a clear distinction between that which is observable should be drawn.

2.7 Constructs of the Knowledge Agent Theory (KAT)

In the previous section, the properties of autopoietic systems were discussed and a KA was assumed to hold those properties. The KAT is a conceptual model newly developed in this study to bring out the most important capabilities necessary and contribute to an organisation's knowledge in an unpredictable, dynamic and complex market situation. It is an extension of the teleological approach in theories of firms into a constructive manner. The principal-agent theory which originated from an economic study of the relationship and behaviour between a principal and an agent is the most accepted theory in this aspect. The ICAS is another theory which provides a different dimension for examining the behaviour of organisations that are coping with a changeable environment. To understand the behaviours of organisations as a whole, their epistemology needs to be considered for theory development on KAs. The KAT aims to explain the behaviour of an entity which is willing to contribute to the knowledge process in an organisation for the life of the entity.

The constructs of KAT embrace two beliefs: (i) a KA is a living system with autopoietic properties who originally interacts with its components with the aim to self-produce its own components to sustain its existence; (ii) a KA is an enabler, who consciously and unconsciously contributes, depending on the tempo and spatial situation, in vitalising an organisation to cope with uncertainties. The assumptions of being a KA in

an organisation are that it:

- is capable of carrying out the requirements of a knowledge process,
- is willing to offer effort to a knowledge process,
- plans to carry out the knowledge process,
- is indifferent as to whether it is an individual or group of individuals, and
- views knowledge as beneficial which satisfies its needs and simultaneously meets the interest of an organisation.

2.8 Conclusion

In this chapter, the definition of knowledge in organisations has been determined after a literature review in relation to knowledge and its nature from different perspectives. After that, with reference to different knowledge management models and theories on the existence of agents who work for organisations, the constructs of the knowledge agent theory (KAT) as a self-living system has been basically established. The next chapter will discuss the selection of research method with the consideration of the research inquires and the rigour of data collection.

Chapter 3 Research Methodology

In this chapter, a new qualitative research design method, namely, a created natural environment with retrospective methods (CNERMs), is developed and described. Then the sampling method and frame, data collection procedures and data analysis methods employed to examine the research questions of this study will be comprehensively explained. This chapter also illustrates the strategies that have been used so that the data were collected within a manageable time frame.

3.1 Introduction

The aim of carrying out a qualitative study in this research is to develop and verify the constructs of the KAT. To do so, numerous activities are required to ensure that the approach is appropriate and the quality of the inputs meets the rigourous requirements. The activities involve methodology selection and design, determination of the sampling frame, methods and strategies of collection of data, establishment of the procedures, and implementation of data analyses. This chapter discusses the research method design to verify the theory constructs on KAs, and argues that the autopoietic characteristics of KAs are crucial attributes for organisational learning. A field study of group learning in a leagile manufacturing environment provides the context for the discussion. Qualitative researchers (Barley 1990) often need to accommodate and attempt to maintain control over the schedule and contents of data collection. In order to overcome the passivity of obtaining data under natural field conditions, particularly data collection through learning behaviour observations, a research site has been created. The extraordinary research design of a created naturalistic environment with retrospective methods (CNERMs) and a random stratified sampling plan collect qualitative data in a systematic, rigourous and explicit manner, which accounts for validity, falsifiability and objectivity, thus providing a better option. In addition, it would minimise time and finance resources.

3.2 Research Inquiries

In this study, KAs are defined as an entity which is composed of internal individuals from an organisation, and/or includes outsiders such as business partners or consultants who are willing to make an effort to acquire knowledge through creating, retrieving, sharing, or implementing different aspects in order to help an organisation achieve something which can be an innovation or solution that has the possibility of retaining an organic status in the organisation. In this research study, the focus is therefore on determining what a KA would be, whether the people in an organisation would and could play the KA role, and how they would change their behaviour in an organisational learning process. In other words, the research work will answer the following questions:

1. To what extent is the KA a living system in nature as conceptualised in KAT? What, if any, are the other attributes of a KA?
2. How does the KA affect the effectiveness of organisational learning?
3. What are the factors that enable a KA to take root in an organisation?

3.3 Selection of Research Method

After reviewing the literature in related disciplines, such as those that concern knowledge management, organisational learning, theory of firms and production management, the constructs of KAT were identified. However, it is first necessary to present a comprehensive explanation of the autopoietic nature and properties of KAs, particularly when there is more than one individual who is forming this entity within an organisation. In other words, the data obtained through this study is very specific to the contexts of the participants themselves in order to explain the behaviours of KAs in general.

One of the characteristics of KAs mentioned in KAT is that the KA entity self-observes its own behaviour, can only reflect on its individual experiences, and cannot separate such experiences from the world that it is getting to know. With the consideration of this characteristic, self-explained surveys may therefore be insufficient for explaining the behaviour of group

learning to reflect how an organisation learns.

In addition, the KAT was still in an early stage of development at the time of conducting this research. There is little previous work that examines the nature of KAs as defined in this study. Hence, a very minimal amount of previous research work is available for examining the nature of KAs as defined in this study. In other words, the theory is rather immature or nascent. Furthermore, it was assumed that organisations obtain positive impacts if proper KAs activate knowledge processes. The existence of KAs may not be in the form of a structured position which guarantees that the appointed individuals will carry out knowledge-process activities, particularly in knowledge creation and transformation. The drive to allow individuals to offer their efforts for knowledge processes is embedded in a contextual nature. To understand their thoughts, words may be more fruitful and even unanticipated in adding new integrations to the initial concepts.

Therefore, by starting with more open-ended research questions, the study may gain more useful data to understand the learning processes and refine the constructs of KAT. It is considered that the data collected from real life case studies via observations and conversations with informants would provide evidence to verify the constructs of the theory (Barley 1990, Edmondson & McManus 2007, Flick 2002, Miles & Huberman 1984, Silverman 2006, Voss et al. 2002). In addition, new insights may emerge if an open mind is kept at an interview or during observation to identify and investigate key variables over the course of the study. This approach will help to formulate a theory about the phenomenon that forms the basis for further inquiry.

To address these considerations, the studying of real people, problems and organisations seemed to be the most effective approach, which can best be achieved through qualitative research methods (Wacker 1998, Yin 2009). Qualitative methods that are considered include observation in the field, in-depth interviews and group discussions. These might provide appropriate answers within the framework, given the amount of resources

and their limitations in terms of timeliness, monetary resources, and facilitation support.

3.4 Research Evidence Requirements

The strengths of qualitative data are first, that the data reflect aspects of the real world. Open questions allow interviewees to express their opinions or describe their experiences in their own words (Northcutt & McCoy 2004). Similarly, observation in the field allows researchers to gain knowledge about how something works or occurs (Adler & Adler 1998). Second, the data provide comprehensive information with a high possibility of revealing various complexities. Furthermore, as the data are typically collected over a sustained period, this makes them powerful for researchers to study in a flexible way. For instance, data collection times and methods can be varied as the study proceeds (Miles & Huberman 1994, Yin 1982). Besides that, follow-up data collection work can vary from a general sense to very specific opinions or experiences in particular circumstances.

3.4.1 Naturalistic Methods

The crucial assumptions about KAs are their autopoietic nature and willingness to activate knowledge management processes. If the nature of KAs is understood and properly integrated into an organisation, organisational learning would be effectively carried out. In order to verify these assumptions and understand the learning behaviours with or without the boundary properties of KAs, the organisational learning impacts were identified in priority and related to the effectiveness of knowledge processes with or without the presence of proper KAs. Direct observation of the learning processes, therefore, is crucial for verifying the theory constructs. This can be achieved by attending different learning activities, such as meetings, observing the activities that occur in organisations, listening to responses during learning activities which include dialogue, reviewing existing knowledge or actions to be taken for solving problems (Barley 1990, Bresman 2010, Carlile 2002**,** Edmondson 2002, Hargadon & Bechky 2006), and reading available information in the form of meeting minutes,

presentations or reports. However, the involvement of researchers in these activities is often passive, and unavoidably, results in the participation of some activities that are unrelated to the study.

Besides that, the method is expected to examine the falsifiability and utility of the theory. Falsifiability determines whether a theory is constructed in such a way that empirical refutation is possible, while utility is the ability of a theory to both adequately explain and predict by using its theoretical base (Bacharach 1989). In addition, the study also provides a way to compare the theory to observed or experiential evidence through evaluation (Bacharach 1989, Wacker 1998) so that reliability can be checked and replication in different organisations and industries can be carried out.

In this study, attempts are made to avoid the placing of observers into a passive position for data collection. Hence, participatory research principles were used, which provided the collaborative management study with an observation schedule and contents that matched the research agenda and inquiries. The principle of participatory action research, as interpreted by Argyris and Schön (1989), involves practitioners as both the subjects and co-researchers. As well, this type of research aims to create an environment in which the participants give and obtain valid information, make free and informed choices, including the choice to participate, and finally, internally commit to the results of their inquiry. The outcomes of the research are beneficial to both the participants and the researchers under the condition that both parties share a fundamental interest in learning (Shani et al. 2008). After reviewing the research inquiries and availability of resources, an action learning project was designed and organisations were invited to collaborate so that they could have the opportunity to yield positive benefits that improve their operations performance. In this study, an advantage is that these organisations could be accessed to verify the constructs of KAT in a naturalistic environment under a controllable schedule.

3.4.2 Research Rigour

Similar to quantitative research methods, qualitative research also

needs to ensure that the process of data collection is rigourous in terms of validity, reliability, and generalisability (Seale 1999). Validity is perhaps the most important aspect to verify if the method is as intended to logically and truly measure the constructs, variables and their linkage to KAT (Denscombe 2010, Kerlinger & Lee 2000, Schwab 1980, Tsang & Kwan 1999). A triangulation method of data collection adopted in this study is included to ensure convergent validity.

To understand the behaviours of learning groups in knowledge processes, dialogue with employees and trainers is often a means to find out about their experiences through their own reflections. Both individual and group interviews serve this function (Symon & Cassell 1998, Denzin & Lincoln 1998, 2003, 2008, Denzin 1978, 1989, Northcutt & McCoy 2004, Silverman 2004). The former grants space and freedom to individuals in describing how they learn in groups, and allows them to elaborate on their personal experiences. The latter helps members to interact and exchange opinions or experiences in order to stimulate more ideas or recollections. However, this method may be insufficient, not only because memories may be lost, but also due to personal perception and judgment. Observation of behaviours in the field, on the other hand, provides the opportunity to understand about the natural learning activity processes which are used to enrich data from other sources (Crowther & Lancaster 2009). In particular, intensive observations of interactions at meetings or workshop activities which reveal group learning behaviours could be viable through discussion by members about the problems that they are facing or new knowledge that they are adopting to cope with changes.

Triangulation is a method of confirming findings. If independent measures of the findings do not completely agree, at least they do not contradict them (Flick 2002). Multiple ways of collecting qualitative data ensure that the variance reflected is that of the trait and not that associated with the data collection (Huberman & Miles 1998). There are two ways to triangulate: by data source and the method of collecting data (Adler & Adler 1998, Bryman 2004). The former approach obtains data from different

organisations, people, and places. With the latter, data are collected via interviews, focus group discussions, meetings and industrial surveys. In order to collect valid and meaningful data, and at the same time, avoid the likelihood of data misinterpretation, both data and methodological triangulation were employed to increase credibility. For data triangulation, it was anticipated that there would be a full spectrum of informants who are working in the organisation. In terms of the methodological triangulation, various data sources from different cases to examine whether the same phenomenon or results would come up at different times and places with different business natures, as suggested by Denzin (1989) were adopted and integrated.

3.5 Research Design in CNERMs

After considering the necessity of collecting data in a naturalistic environment and the rigour requirements of the primary data, participatory observation was selected as the means of carrying out data collection. Training workshops are one of the naturalistic environments for researchers to collect real life activities of knowledge processes. Workshops allow learning groups to carry out knowledge processes. It is an interactive method where participants are involved in activities to learn and apply new knowledge to solve problems or generate new ways of doing things. Generally, a facilitator helps participants capture the main theme of the introduced knowledge or skills for application. When researchers need to collect data in a particular environment to observe the natural responses of behaviours, semantic conversations in different activities within that knowledge process environment, such as discussions, new skills practice or learning processes, participatory observation is a common approach.

Workshops are a means for participatory observation which provide a spatial environment to release the constraints of participatory observation in a passive manner (Austin et al. 2002) which are wrought with uncontrollable factors, such as who will be in the field, whether the time is appropriate to observe the behaviour that researchers need, or if researchers

are allowed to carry out the observation in natural settings. Although observation in a natural setting of daily activities provides opportunities for researchers to visually capture a wider perception through audio means and other human senses, the observed participants cannot be limited or defined. Furthermore, disclosure of confidential insider information in the field and about the observed individuals is restricted (Flick 2002). In this study, a created natural environment with retrospective methods (CNERMs) is newly designed by using an operation management training workshop and integrating this workshop with retrospective methods to study the formation of learning groups and the impacts on knowledge processes. The details of the methods which take into consideration validity, reliability and generalisability, will be discussed in the following sections with the structure of CNERMs illustrated in Figure 3.1.

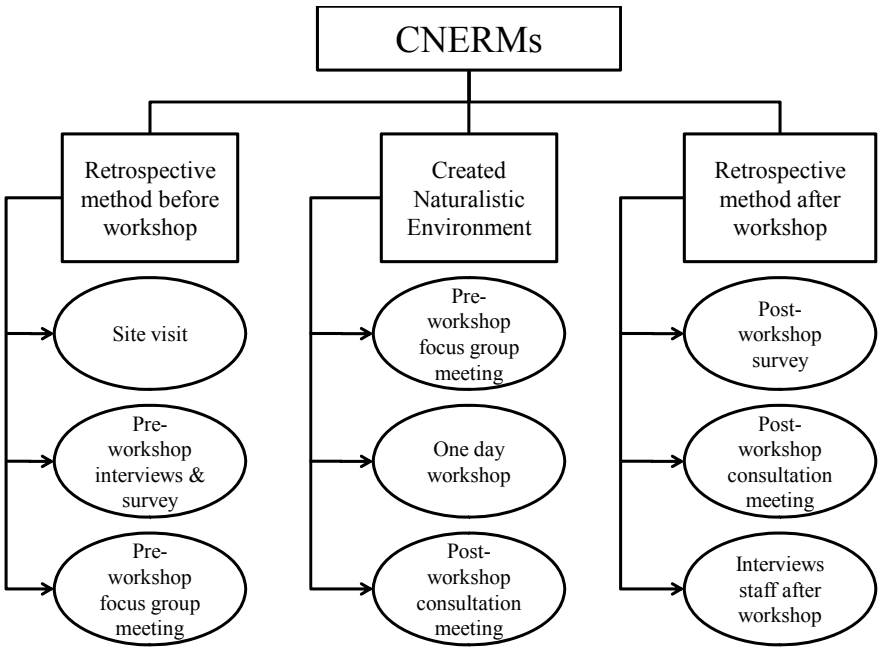

Fig. 3.1 Created Naturalistic Environment with Retrospective Methods

3.5.1 Design of Action Learning Project

In pursuing a natural environment for collecting data related to the learning behaviours of the knowledge process, an event facilitator was invited from the consultancy industry with the responsibility of carrying out

the training workshop, which took place in a planned venue. In the designed venue, the researcher became an observer simply by following the flow of events without participating in any parts of the knowledge process. At the same time, the schedule for data collection could be ensured, and organisational learning behaviours could be observed from the field under a controlled schedule. This approach also eliminates the drawback mentioned by Flick (2002) and Adler and Adler (1998) with regards to the difficulties of selecting an appropriate setting and timing to collect data as an outsider.

The design generated an opportunity to observe the participating organisations that are learning new knowledge to solve their operation management problems. At the same time, a real situation was obtained where learner behaviours in solving collective problems was observed. Carrying out observation is a complex task. The observer does not know everything at the beginning stages of a study. There could be a wide variety of topics, settings and situations that the observer needs to address (Lofland et al. 2006). To allow the implementation of research activities under a manageable schedule, a facilitator was sought. This facilitator also played a dual role as the external KA who participates in the knowledge process in the created field, which include focus group discussions, operation management training workshops and post-workshop consultation meetings. Another advantage for having a facilitator to run the meetings is to avoid any leading activities that would be designed by researchers in which some behaviours would be performed as expected that may bias the results. With an expert in organisational learning management to organise and take charge of the workshop in his/her own way, extra group learning behaviours with the external KA could be obtained.

An action learning project was designed by a 3x4 time-space activity matrix, to collect data at three different time points and four different venues with multiple levels of people within an organisation, and adopted different ways to collect data within a manageable timeframe. Table 3.1 shows the data collection method at different stages of the action learning project in different field settings.

Table 3.1: Action learning plan: 3x4 time-space matrix

	Activities	Data Collection Method	Venue	Participants
Stage I Pre-workshop	Site-visit	Observation	Production unit	1. Organisation production representative/manager 2. Facilitator 3. Researcher
	Individual interviews	Interview	Production unit	1. Focus group participants 2. Researcher
	Focus group meeting	Observation	Production unit	1. Top Management (6-8) 2. Facilitator 3. Researcher
Stage II Workshop	Learning and applying new knowledge	1. Observation 2. Survey 3. Reflection 4. Action plans	Training room	1. Key stakeholders (18-21) of the issue(s) to be solved at the workshop 2. Facilitator 3. Researcher
Stage III Post-workshop	Follow-up meeting	Observation	Meeting room	1. Top Management (not more than 4) 2. Facilitator 3. Researcher
	Individual interviews	Interview	Meeting room	1. Workshop participants 2. Co-workers of workshop participants 3. Researcher

Two types of activities in a naturalistic environment were arranged: a single day operation management training workshop, and the meetings and activities which were related to conducting the workshop. The purpose of the workshop was for the members of the participating firms to find solutions to a problem that they had encountered over a period of time with participation of an external KA. To formulate the framework for the study, the participatory research principles were adopted as guidelines. The participating organisations were invited to initiate some of the operation management problems that they had experienced in the previous twelve months and wanted to find a solution. The contents of the workshop, which embraced new knowledge on operation management and problem solving skills, were then prepared with a focus on these issues. In other words, the purpose of the workshop is to provide an opportunity for the participating organisations to acquire and apply new knowledge with external KAs, so

that learning behaviours in a real situation within a controllable schedule (McClelland & Burnham 1983) could be observed. The research field was composed of three parts: pre-workshop, workshop and post-workshop. The activities carried out in the research field in different parts are illustrated in Figure 3.2.

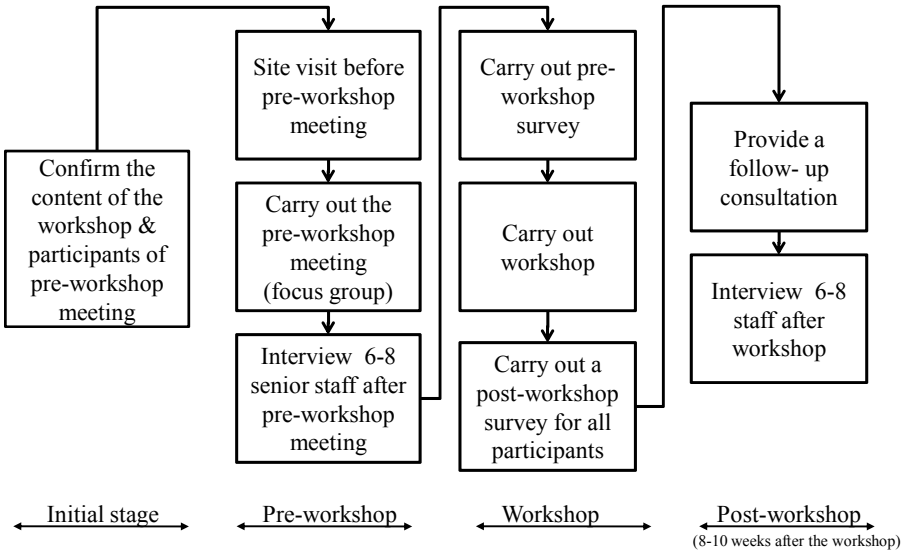

Fig. 3.2 Activities in research field

3.6 Data Collection

3.6.1 Pre-workshop Data Collection

3.6.1.1 Site visits

In this study, site visits were conducted to give the researcher the opportunity to understand the nature of the business and the operational systems of the organisations. At the same time, the researcher was able to observe how individuals evaluated their operation flows, strengths and concerns in order to triangulate the data collected from the informants from focus group meetings and individual interviews. The site visit was also used as the basis for preparing workshop content.

3.6.1.2 Individual interviews

The research plan included the implementation of interviews before the one day operation management training workshop. Arrangements were made for interviews with all participants before they took part in the focus-group meeting. The aim of the individual interviews is to obtain information on their background, the nature of their work, and relationship with colleagues. The purpose of the findings from these interviews is to compare and validate observed behaviours in the focus-group meeting. Furthermore, the findings could be used to structure the observation items for the forthcoming workshop.

The interview consisted of three parts. The first part was a conversation guided by open-ended questions to understand the background of the interviewees, and the self-assessed impacts from previous knowledge processes implemented on performance improvement. The second part was a survey that asked interviewees to identify their work relationships with the forthcoming workshop participants. The third part asked interviewees to prioritise the importance of six issues that they felt their organisations could target for further improvement. The purpose of the first part was to obtain basic information about the interviewees, including educational backgrounds, career development, past work experiences, roles in their respective organisations, experiences with knowledge processes in dealing with other

colleagues or departments, work relationships between colleagues outside their work places, and their suppliers and customers in order to assess the impacts obtained after knowledge processes have been carried out. The second part aimed to determine if there was any distinctive separation of the ownership of the issues that had been planned for the forthcoming workshop. With a data analysis, a localised or globalised relation between individuals and the learning group might be determined. The information, as a whole, was to verify the neighbourhood factor between individuals within the organisation. These interviews were audio recorded with the interviewee's permission. A copy of the interview protocol is attached as Appendix I.

3.6.1.3 Focus group discussion

The participants in the focus-group meeting included those who are at the management level and key stakeholders in the issues discussed at the workshop, and the owners who participated in the strategic planning or top management duties. The total number of participants was six to eight per meeting, depending on the organisational structure and the participating organisations that accepted the invitation.

The explicit purpose of the focus-group discussion was to determine the scope of the problems to be discussed at the forthcoming workshop. A real-life environment (Stake 2008) was essential to observe the discussion of the current problems in the organisation. The observation included the communication contexts, the ways in which the participants addressed the issues, and their learning styles (Argyris & Schön 1978, 1996). The ways in which participants responded to the opinions of one another and established views from the interactions that took place within the group were also included. Furthermore, in the focus group discussion, the participants had the opportunity to inquire about the reasons put forth by their colleagues, challenge different views and create consensus in areas which had to be improved in terms of operation management in general. The focus group meeting included meaningful activities on how participants addressed a problem, the likelihood that the problem would be solved, evaluation of the

level of solution, the working relations that would most likely form and the discussion flow prior to observation. A preparation list for the focus group meeting is attached as Appendix II. An audio recording of the session was carried out, with the permission of all participants.

3.6.2 Workshop Data Collection

3.6.2.1 Selection of workshop participants

The position of staff members who participated in the workshop was a key consideration. As the learning process for solving collective problems is essential to this study, the participants had to be stakeholders in the operation processes involved and came from different departments, at the supervision or management level. Furthermore, it was planned that the participants would form a few work teams to deal with different problems on group behaviours and for outcome comparison. In the workshop, at least two issues that were raised and indicated as related to the selected collective problem at the focus group discussion were selected for discussion. The total number of participants was anticipated to be between fourteen and twenty-one. To identify the departments and levels of individuals who took part in the workshop, the organisational charts of the participating firms were used. The participating firms finalised the participant list which had to include the key stakeholders of the issues under consideration, at the mid or top management level.

3.6.2.2 Observation at workshop

It was expected that a large amount of data would be collected during the workshop. To facilitate this, an observation scheme was used to systematically record the time sequences and durations of the different types of activities. The data included the teaching and learning settings at each workshop, lengths of different types of activities, structure of the contents, initial grouping before the workshop started, the time taken and activities undertaken to form internal learning groups, changes that occurred in learning styles, learning behaviours exhibited in different teams and the level of participation of staff from different levels. A copy of the observation

scheme is attached as Appendix III.

3.6.2.3 Reflection in workshop

Pasmore et al. (2008) defined reflection in collaborative management research as the process of jointly and collectively creating new insights and theories by referring to the related work of others and the investigation of intervention effects over time. This is a critical link between concrete experience, judgment after new knowledge is acquired and actions to be taken (Coghlan & Brannick 2010). In the workshop, a session for reflection was designed to allow the participants to reflect back on the conversations during the workshop, including dialogue among themselves; to recognise and build on the contributions of others, both within the working units and from different units within the organization; and to publish collections of studies and solutions about the issues discussed in the workshop. This type of learning reflection provides a rich resource to understand the feelings of the participants about the changes achieved through learning. It was also designed to provide any content which might have been missed during the collection of data through ordinary field work.

3.6.2.4 Survey before and after the workshop

One of the functions of the workshop was to provide a means in which the emergence of any KA entity could be seen. Immediate feedback with regards to the first person impressions of the participants might provide evidence of any self-referencing and self-observing activities that have occurred. The workshop was designed to start with an open-end question that was presented to each participant. They were to describe their expectations of the workshop to another participant. The other participant was then asked to repeat the expectation statement. This exercise was audio recorded with the permission of the participants. The aim of the exercise was to observe their conversation patterns, including the individual with whom they had initiated conversation. Collective expectations were used as a benchmark to determine the achievements of the participants by the end of the workshop. As well, at the end of the workshop, the participants were

asked to anonymously complete a written survey about their learning experiences during the workshop. The data from the collective expectations and survey were used in triangulation with the observation data to examine the validity of the KAT constructs.

Audio and visual records were used while the participants were formally presenting their workshop outcomes to the group, including their expectations of the workshop, a discussion summary of the issues, the proposed solutions, and collective reflections about the workshop. The protocols of the survey before and after the training workshop are attached as Appendices IV and V, respectively.

3.6.3 Post-workshop

The purpose of the collection of post-workshop data was to gather further information about the learning experience and the results of group learning in order to triangulate the findings in the workshop. Data were collected through an individual interview and a consultation meeting.

3.6.3.1 Interview

To observe the seeded behaviour of participants in a knowledge process, a longitudinal study is an effective way to verify the KAT. As the participants might become familiar with their new roles as members of a learning entity, and their co-workers might notice the changes through their behaviours expressed in daily activities and actions, an after-workshop interview was carried out to collect the views of various participants and their colleagues which took place eight to ten weeks after the workshop. However, not all of the interviewees were the same people as those who took part in the first round of interviews. Two cohorts were interviewed. One of the cohorts included participants at the workshop who had committed to change. The purpose of this interview was to collect their experiences and opinions about the learning process and results for dealing with the organisational problem at the workshop, and any issues related to their follow-up actions for the improvement plan. The other cohort was the co-workers nominated by the initial focus-group participants. The preset

criteria for the selection of this group were not given. The purpose of this interview is to investigate the workshop from the perspective of a non-participant, to examine the extent that they had obtained information about the workshop content and the action plan established during this process to evaluate the impacts of the learning results on a wider scope. The protocols of the interview of the two cohorts are attached as Appendices VI and VII, respectively.

3.6.3.2 Consultation meeting

It is asserted that individual value is different from organisational value. The organisational value is developed based on the perceived successful factors and those executed in an organisation. Similarly, with the formation of a boundary as the KA entity, there is a common value that guides the components of the entity converse to an edge that bounds the members. The generation of knowledge helps members to maintain the continuity of the KA entity to settle issues of concern in an organisation. The consultation meeting provided the opportunity to understand whether implicit or explicit statements produced by the top management indicated any commonality with those perceived by their subordinates and employees as the current success factors that help the learning group bond together and strive for positive impacts. The meeting was open to allow participants to raise any issues that they considered as discussion points with the facilitator, including their opinions of the workshop, experience with learning processes, changes made within their organisation to address an issue, and the difficulties of action plan execution. Such openness allowed participants to share their experiences and investigate how agreement between the management and employees could take place on what constitutes as success factors or failures. At the end of the workshop, all participating organisations generated action plans to improve their operational processes, which can be considered as a learning process to generate new knowledge to cope with new situations. The learning process was reiterated to develop new knowledge from the learned knowledge to cope with new situations that would help the organisation become a learning organisation. The

conversation between the top management and the facilitator was invaluable for identifying more contextual information about the necessary properties of being a KA.

Each participating organisation was offered a two-hour consultation session. The explicit objective of the session was to allow these organisations to clarify with the consultant about any doubts or confusion that came about from the workshop. Another objective was to examine any changes that the participants had made when they addressed an issue related to their organisation in general. As the discussion might involve strategic changes and some sensitive information about the participating organisations, only the top management team was invited to participate. The contents were made confidential, although an audio recording was created with the permission of the participants. The focus in this study is on the ways that the participants addressed and discussed the issues raised in the consultation session.

3.6.4 Other Considerations of Data Collection

3.6.4.1 Selection of venue

As a number of employees who are residing in Mainland China have travel restrictions on going abroad for business, the final decision of the venue location for the workshop was left to the participating firms. If the workshop was carried out in Hong Kong, the venue would be the Hong Kong Polytechnic University to minimise any daily work interruptions on the part of the participants during the discussion at the focus group. In the event that the venue would be in Mainland China, the layout would need to be approved to determine the appropriateness of the teaching and learning facilities. Basically, the layout of the venue needed to be suitable for group work and the furniture would have to be movable to form different groups for the activities and observation.

3.6.4.2 Language

In Hong Kong, over ninety percent of the people speak in a local

dialect, Cantonese. In the Pearl Delta, Cantonese also dominates communication in the manufacturing society, but Putonghua, the national language, is still primarily used for communication. Hence, a bilingual approach was adopted at the workshop to avoid any misunderstandings or misinterpretations.

3.6.5 Preparation for Data Collection

3.6.5.1 Prior to the workshop

All of the learning and teaching materials were prepared by the facilitator. Since the intellectual properties of the learning and teaching materials are owned by the facilitator, a limited amount of materials were printed out for the workshop participants with his permission. Before the workshop, the facilitator explained about the flow of the workshop so that an observation chart could be prepared. The workshop activities basically comprised five parts: warm up exercise, new knowledge introduction, knowledge reinforcement exercise, knowledge application, and closing section. The facilitator, on behalf of the researcher, would carry out the reflective exercise at the end of the session.

An observation scheme for a pre-workshop meeting was designed as part of the records. The participating firms were asked to provide an organisation chart. The sequence and duration of their conversations during the meeting were recorded in a written format. A log-book was used to write down their first impressions of the organisation, their operation processes, and ways that they would address the issues in their organisation after the site visit.

3.6.5.2 Observation at the workshop

The objective in this research study is to verify the autopoietic nature and characteristics of the KA entity. Hence, the boundary characteristics of the KA entity, any changes in self-observing and self-referencing behaviours, and the results of the learning process would form part of the study. There would be several shortcomings if informants were merely asked to recall

their learning experience. Those include: fallibility of memory, and rationalised answers provided by informants to describe their experience. There could be some unawareness of changes which would be essential for the research study to investigate, but the informants might not be able to explain them in the interviews. To maintain a natural environment for observing actual behaviours, the workshop or facilitated group event (Woodhead & Downs 2001) is an effective means to acquire knowledge on unawareness. As there would be many actions and responses generated at the workshop, an observational strategy is required so that systematic charting of the roles and role relations associated with each construct of the KAT could be carried out.

After discussion with the facilitator, a rundown of the workshop was given (see Appendix XIII), which indicated all activities to be carried out at the workshop. Meanwhile, a copy of the teaching materials and exercise worksheets were also provided so that the duration and major observations could be more efficiently recorded. With the workshop flow chart, a matrix chart was designed to record the characteristics of a KA boundary for forming the KA entity, the duration of different learning and knowledge generation activities, reactions and responses after new knowledge is introduced, feedback, and discussion results (see Appendix III). All of the teaching activities and learning outcomes were later classified into different clusters that related to the constructs of the theory.

3.6.5.3 Learning experience translated into documents

Although the researcher was isolated from the field in order to focus on recording the observable data, it was inevitable that events took place at a much faster rate than the ability to write down the information. To supplement the written records, participants were asked to make presentations for each core discussion after learning a new means to handle their problems. Audio recordings were then carried out. At the same time, they were asked to write down the key points. The audio recordings constituted an important source of data which captured the tone of the

presenters along with emotional expression of their feedback and solutions. The data provided a sufficiently detailed database that would comprise explicit analyses. For example, it was possible to calculate the proportion of activity duration during which participants communicated with their team members and later established a neighbourhood relation to form the KA entity from the field notes.

3.6.5.4 Different periods and phases for data collection

Although it was intended that the observation and survey questions would be finished before the research study was executed, it was considered that the analytic categories could be developed a posteriori. In order to maintain consistency in the study process to compare the findings, all of the cases were scheduled to be completed without overlapping in the same phase in which more than one case is studied. That is, after the workshop for the first firm was completed, the workshop for the second organisation was then started. In between, the field notes were reviewed to refine the approach in developing the theoretical notions and hypotheses that would more systematically direct the analysis. The interludes also provided the opportunity to identify indicators that reflect the properties of being a KA which provided better direction in later observations. For example, in the first case, the firm misinterpreted the request and initially sent an administrative staff member to sit in the workshop pre-meeting. This was discovered during the site visit, and clarification was made. Then the firm made rearrangements for another staff member from their production department to attend the meeting. In the forthcoming cases, the objectives of the pre-meeting were clarified to every participating firm before the site visit started. This gave the organisations more time to identify the right individuals to participate in the pre-workshop meeting.

3.7 Data Analysis Plan

3.7.1 Data Analysis Techniques

Three techniques for analysing the field data, namely, pattern-matching, use of the logic model, and cross-case synthesis by an

interpretivism approach (Miles & Huberman 1994, Yin 2009) were adopted. The pattern-matching analytic technique provides a method to compare the data obtained from the firms before and after the participation of the external KA on the basis of similarities among different firms or informants who exhibit the same behaviour in group learning, and on the basis of the differences among similar cases in which the members display different learning behaviours. The logic model is very similar to the pattern-matching analytic technique, but involves sequential stages and the purpose is to investigate the cause-effect relationship by repetition to view the patterns of a dependent variable (e.g. solution impacts) at an earlier stage which becomes the independent variable (e.g. KA) for the next stage. The technique consists of pragmatically matching observed outcomes to theoretically predicted outcomes. For example, the solution impacts after knowledge processes are carried out by different types of KAs could be traced. The actual outcomes over time that at a minimum give more attention to the chronological sequence can be traced by this technique. The observed field data with the surveys and interview findings can also be triangulated for data validation.

In addition, the cross-case synthesis technique was applied to aggregate findings across the firms of the sample. The theoretical predictions across the cases were compared and conclusions accordingly made. The technique was used to guide the analysis of the interview data from the firms before and after the participation of the external KA. Then, recurring facts are noted across cases that contribute to the explanation of the constructs of KAs, and having all of the boundary properties which affect the learning behaviours and solution impacts. Figure 3.3 summarises the techniques used for the data analysis of this study.

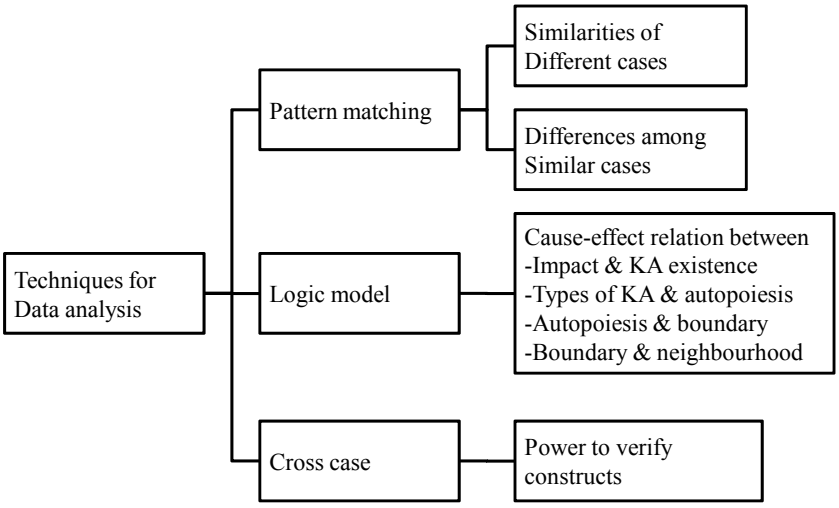

Fig. 3.3 Techniques for data analysis

3.7.2 Methods for Analysis

To analyse the data, an interpretivism approach (Miles & Huberman 1994) was adopted. Interpretivism sees human activity as text, which is a collection of symbols that provide layers of meaning. Interpretation comes from understanding the meanings behind the actions of individuals and their interactions with others. Then, the essential linkages are drawn. The sources of data in this study stem from observations, interviews, and discussions in meetings. There are two sets of data that are required to move through the process in order to facilitate interpretation: the learning activities which are associated with the likelihood of the learning group in an organisation to generate positive solution values, and the behaviours of the learning group which are associated with the likelihood of the sustainability of KAs in an organisation to deal with collective problems or issues. The analytical process for the observed activities and behaviours progressed as four phases: (1) data coding, (2) variable identification, (3) relating of reasoning variables, and (4) cross case comparisons.

To make the analysis easier to carry out, general categorisation was used for the observation data per Lofland et al. (2006). Working charts were

designed to classify the observed data into different categories with reference to the collection methods (Appendix VIII). A start list of codes based on the theory construct of the hypotheses and preceding research questions was created prior to the workshop and review of data (Appendix VIX). The purpose is to verify the constructs of the theory with the data which were collected in the fieldwork. The start list of the codes provides a framework to effectively observe and interpret the data. This is so that the original thoughts of the constructs of the theory can be compared with the empirical data from the field in order to re-examine the validity of the constructs. All of the transcripts were coded with actions related to the KAT model. The actions include: (1) noticing relevant phenomena, (2) collecting similar examples of such phenomena within and across cases, and (3) analysing these phenomena in order to infer relations of variables. The data were then decontextualised and recontextualised.

3.7.3 Integration/consolidation of Data from Different Sources for Analysis

Each individual interview conducted before or after the workshop was about forty five to seventy five minutes in length. The pre-workshop focus group meeting was conducted for about sixty minutes. The post-workshop meeting was carried out for about one hundred and twenty minutes. All of the interviews and meetings were recorded, by both audio and written means. After the interviews were conducted, the written records were reviewed and the immediate impressions were also separately written down. Three undergraduate student assistants from bilingual studies were recruited to transcribe the transcripts of each firm. All of the transcripts were cross checked by the assistants for accuracy.

The single day workshop was conducted for about eight hours. All activity outcomes were recorded in audio or written form. The observations recorded during the workshop included: (1) initial group formation before the workshop activities started, (2) descriptions of obstacles to change, (3) action plan establishment and uncertainties, and (4) search and confirmation of commonality. These are included in the matrix chart in Appendix III. Data

from a survey carried out immediately after the workshop are used to validate the findings collected before and at the end of the workshop (see Appendix V).

Experiences with knowledge processes in the last twelve months from the perspective of every informant were solicited by individual interviews before the workshop. By using a standard set of interview questions (Appendix IV), the learning attitudes of individuals towards collective issues such as willingness to contribute time to work on the issues, commonality shared with other stakeholders and priority for handling a series of problems were then determined. The questions were problem solving experience oriented and concentrated on facts and informant interpretation of experiences (e.g., "What did you do? How did you feel about the outcomes? To what extent do you think a similar problem would occur again?"). The transcript data were consolidated with the observed data at meetings and the training workshop. They were arranged according to the intentions, plans, and actions that the informants and participants had taken to solve collective problems and the outcomes achieved. Four parts of speech from the action inquiry model are adopted per Torbert (2004) to analyse the behaviours of the learning group members. The contents of the interviews and meeting transcripts were classified into four different areas that pertained to experience and items that affected behaviour; framing, advocating, illustrating and inquiring, to determine (1) the existence of KA boundary properties, and (2) the occurrence of primary and secondary neighbourhood relationships in the KA set.

3.7.4 Methods to Identify Key Dependent Variable: Solution Values

The informants at the managerial level from the four firms were first asked to self-weight the amount of desirable knowledge generated after a knowledge process was conducted during the last twelve months before the training workshop. This could comprise: (1) desirable knowledge or capability generated after a problem is solved, (2) absorptive capability (Cohen & Levinthal 1990) such as the ability to understand the intricacies of

new knowledge, capacity of knowledge application to the company's unique circumstance, or potential of absorbing other knowledge after learning processes are introduced, and (3) associated benefits or solution values of their experience in solving collective problems. To help the informants self-interpret the outcomes from previous knowledge processes, a standard set of questions was used at the individual interviews to determine: (1) how likely that the outcomes were useful, (2) how likely that the outcomes which the executives perceived as significant affect local departments, and (3) how likely that the outcomes which the executives perceived as significant extensively affect other departments. They were also asked to evaluate the solution values of the knowledge process at eight to ten weeks after the training workshop in a similar manner.

Multiple sources of evidence that validate the self-weighted yields in individual interviews were collected via focus group discussions, workshop observations, consultation meetings, as well as two surveys, one collected from the individual interviews and the other immediately at the end of the workshop. In each firm, the solution values of recent collective problems that the firm had addressed for two periods of time, that is, before and after the workshop was conducted, were identified. The various sources of learning experiences triangulated the data to validate the analytic results of the impacts obtained from knowledge processes into three types: those that have no, local and extensive impacts.

When it is assessed that an organisation has not received positive benefits after a knowledge process is conducted, the solution values are classified as having no impact. If the outcomes of the knowledge process bring about a potential positive value at the local level (Edmondson 2002), individuals, groups of people or departments have learned to deal with local issues. In the short run, the improvement of local performance may excite the organisation or persons involved. However, the impact cannot be extended to a wider scope within the organisation to solve problems inherent companywide. In the long run, the problems previously addressed reoccur across different departments, the promising results gained at the local level

cannot be guaranteed or extended to other departments. Subsequently, the local impact is diminished by the deficiency of overall business activities (Walton 1975). An extensive impact is obtained when the knowledge process generates knowledge which comprehensively benefits the organisation in a broader manner. Latent systematic problems, errors that randomly occur in different locations within an organisation without specific causes, will be eliminated or the negative impact caused by external changes will be minimised (e.g. Argyris & Schön 1996, Edmondson & Moingeon 1998, Huber 1991, Levitt & March 1988, March 1991, Senge 1990, Weick & Roberts 1993).

3.8 Strategies to Effectively Obtain Quality Information

3.8.1 Trust Building with Informants

Field research is a complex process. There were many constraints, including sample selection, case choices, time limitations for collecting data, the natural environment which would best suit the research requirements, and the willingness of the targeted organisations to take part in this research project. At the same time, to achieve a theoretical contribution based on valid and reliable data, high standards had to be established to collect quality data. Besides these considerations, there was the need to ensure that the response rate would meet the target.

To address these issues, a research strategy was created, which would establish and build a relationship with potential firms and their members. This would secure the commitment of the firms to the collaboration (Holland & Blackburn 1998, Jackson 2000). It is acknowledged that the building of trust with the participating firms would result in attaining high-quality research data. This meant that the participants would be more likely to openly share their information for the study of this research. The conditions that must exist for trust to arise are, first, to keep risk at a minimal level so that the participants feel comfortable and willing to share their data (Rousseau et al. 1998); and second, to build an interdependent relationship (Lewicki et al. 2006) at the very beginning in

order to motivate commitment from the target firms to the project.

To begin with, concerns of confidentiality and consideration of ethics were identified because if these are breached, the result would be distrust. Distrust for these individuals or entities would mean embarrassment, loss of status, employment and self-esteem, exposure of identity, internal information leakage, and weaknesses exposed to business rivals. Hence, the handling of personal and organisational information was extremely important. At the initial stage of contact, relationship of the author with the targeted organisations was probably infused with a low level trust or a high level of distrust, or a shallow dependence (Sheppard & Sherman 1998). Two types of risks for these entities, as identified in this research, are the risk of unreliability and the risk of indiscretion. These risks stem from a high level of distrust. To lower the level of distrust, the aim of the research project, method for data collection, level and nature of information for disclosure in the project, personnel who would be involved, and the commitment of the firms for participating in the project were briefly explained in an invitation letter. A half-hour presentation was prepared for those who were interested in participating, to explain the nature of the project, in order to eliminate their concerns. The presentation also provided a communication opportunity to the interested organisations for clarifying the research objective and removing their doubts.

To assist the firms in making a decision about the collaboration, a brief introduction of the learning model was prepared. In particular, the firms were informed that the knowledge introduced in the workshop was mature, and the purpose of the research study was not to treat the participants as guinea pigs to explore new knowledge about production or operation management or a new method of learning. To increase the confidence of the potential participants on the appropriateness of the workshop contents, the curriculum vitae of the facilitator was provided.

Apart from the considerations about data confidentiality, the flow, contents, and method used to collect and analyse the data for research

purposes were also introduced. Appendix X outlines the presentation materials provided to the invited firms. With the exception of the output generated during the focus group discussion and at the workshop, the data collected from individual interviews and questionnaire surveys were the property of the research team and adopted in aggregate form. The data generated at the focus group pre-workshop meeting and at the workshop were to be limited to the observations related to the learning processes, such as ways of addressing problems and the time duration of different learning and teaching activities. All outputs from the workshop that were related to the efficiency or effectiveness of operation management, new knowledge to solve problems, and the context or contents of actions to be carried out, did not belong to the research team and could not be used in the research project or anywhere else. Mutual expectations, aims, and interests were also negotiated before either party committed to the project.

There would be no contract between the research team and the interested organisations. A memorandum was instead provided. The interested firms could have the right to withdraw from the research project at any time. The only obligation was that of the research team, in that no individual data that concerns either the individual participants or the participating firms could be divulged or publicised. For the memorandum details, please see Appendix XI.

On any occasion in which audio recordings were made, permission was sought from the participants. During the research data collection process, in any situations where the participants felt uncomfortable about the content to be recorded, they could ask to stop the recording, and were assured that no form of the observations or audio recordings would be used in the research. They were also informed that no visual forms of data collection, such as those with photos or videos, would be carried out during the workshop. Photos of documents such as the presentation flip chart would be taken with the permission of the participating organisations.

3.8.2 Consideration of Intellectual Properties

The setting of the venue, contents, flow, and all activities of the workshop were designed by the facilitator. As previously mentioned, the purpose of designing a single day management training workshop was to establish a natural environment for learning where participants could deal with real life problems in the workplace. The observer would then be able to observe and understand their learning behaviours and attitudes towards the knowledge making process. At the same time, the observer could also observe the aspects that would cause an external KA to become a component of a learning entity for the transfer of knowledge, and help the internal KA generate new knowledge to solve his or her own problems. However, at the workshop, three types of intellectual properties existed. All of the design and contents of the workshop were owned by the facilitator, so it was up to the facilitator to decide how to run the workshop. The observer, on the other hand, had a role that is purely observation of the collective learning and knowledge generation process. The knowledge generated at the workshop was owned by the participating firm. Only the data from the observations of the learning process and the survey were owned by the researcher. In order to clearly distinguish the intellectual properties (Eisenhardt 1989), a memorandum which listed the activities and ownership of each party was given to everyone involved, i.e. the participating organisations, research team, and facilitator (Appendix XI). The observation was, therefore, restricted to:

- the teaching and learning setting at each workshop,
- the length of different types of activities,
- the structure of the learning and teaching contents,
- the initial grouping before the workshop started,
- the establishment and the activities that had been carried to form the internal KA,
- the changes in learning style, if any,
- the learning behaviour of different teams,

- the role of the external KA, i.e. the facilitator, in the learning process, and
- the level of participation for different levels of staff.

3.9 Sampling Framework

3.9.1 Study Scope

In many participatory qualitative research studies, it is not common to discuss the selection criteria of the participating organisations in relation to concerns about quality. Nevertheless, a good sample can help the study not only to obtain a representative population, but also account for some situations which other researchers might have overlooked. Rigour is an important criterion in that the sample selected for the case study would remain uncompromised by resource restrictions. The choice of cases, therefore, was based on two principles: the greatest amount of learnings would be obtained, and data quality would not be sacrificed under resource limitations. In designing the research method to maintain a high level of data quality and vigorous validation of the constructs of the theory, these basic principles are followed. Thus, convenience sampling was not considered.

Before the available resources were reviewed, the ideal scenario which would obtain the most information to verify the theory constructs was established. This is a very useful way to avoid any compromises in selecting inappropriate organisations. The KAT can be used to explain the basic nature and properties of KAs in organisations. Ideally, these cases would be drawn from any type of organisation that attempts to survive in unstable environments. It is assumed that in unstable business environments, such as those of leagile manufacturing organisations, changeable product specification requirements, unpredictable market demands with different types of products and imbalance in raw material supplies are issues of concern. Organisations, therefore, often need to seek solutions to cope with the uncertainties. Such uncertain situations provide more opportunities to deal with operation management problems and appropriate observations

could therefore be obtained. Leagile manufacturers often involve different types of operations: procurement, production and quality assurance, and marketing to respond to rapidly changing business environments with a very short production lead time. The studying of this sector might use minimal resources to acquire optimal information. The scope, however, was still very broad. The selection of the population was, therefore, based on the fact that the industry is facing fierce competition, hence their business strategies might need to change in order to survive, and that the industry itself is important to the region.

As textile and clothing is a major industry, this industry was ultimately selected as the research sample. The textiles and apparel industry is the first globalised industry that is comprehensive in nature, from production to retailing. It is also one of the oldest manufacturing industries, with factories that have been producing textile products on a massive scale since the Industrial Revolution. Having evolved over several decades, the industry has become highly standardised in the manufacturing process, but the products are widely varied. Manufacturers are in a very keen competition environment in which there are many product suppliers on a global scale. With the emergence of 'fast fashion', a term coined by Ferdows et al. (2004), the industry requires a short delivery time from the sketching to the delivery of the products within two weeks, along with expectations of reasonable, low costs without compromising the quality. Performing these functions well has become a necessity for survival in the industry. In starting with this industry to study the nature of KAs, it was expected that there would be fruitful results. This study had intended to invite firms with different production modes in order to examine the extent and nature of any variance. The sample was drawn from established textile or clothing product manufacturers in Hong Kong, regardless of their production facility locations.

3.9.2 Sample Selection

To select a sample which included a full spectrum of the different types of organisations, the spatial model of effectiveness criteria from Quinn and Rohrbaugh (1983) provided a holistic framework to cover the different types of organisations, emphasising their businesses in various ways through three value dimensions: organisational focus, structure, and means and ends (Quinn & Rohrbaugh 1983). Organisational focus involves the internal micro emphasis on the well-being and development of the organisation itself. The organisational structure is related to the level of flexibility. The third dimension is related to organisational means and ends, from the perspective of stressing on important processes, such as planning and goal setting, to final outcomes, such as productivity. Quinn and Rohrbaugh (1983) identified these three value dimensions in consideration of the four clusters of organisations: open system, human relations, rational goal and internal process model. The open system is the most popular measurement model for evaluating the effectiveness of an organisation (Quinn & Rohrbaugh 1983). This model places a great deal of emphasis on the flexibility of the organisational structure and the development and well-being of the organisation in response to the external business environment. In human relations, although flexibility is stressed, the emphasis is on the development of people within the organisation. The rational goal, on the other hand, pays more attention to the external focus and the business operation outcomes and productivity. The internal process model emphasises internal well-being which seeks stability and control.

In reference to the manufacturing operation process, organisations often adopt three approaches for making products in mass volume (Berger & Lester 1997, Enright & Dodwell 1997)**.** These are original equipment manufacturing (OEM), original design manufacturing (ODM) and original brand manufacturing (OBM). OEMs offer the manpower and production facilities to produce components or final products, which are purchased by a company that has given the design details and product specifications. Products are retailed under the company's brand name. ODMs design and

manufacture products that are eventually branded by another firm for sale. OBMs are organisations that sell an entire product under their brand name, regardless of where the product is made and who made the product. The external business environment of OEMs is relatively stable as long as they can provide sufficient manpower with appropriate production facilities to the business parties who purchase the products. The effective measure, therefore, comprises operational management and accuracy of information transmission, from the buyer's instruction to the workplace. The controls of the production lead-time and operation costs are the essential business success factors. Some organisations are inclined to peruse a rational goal model, in which their business partners require production forces to produce a wide range of products. In this situation, the effective criteria model might fall into human relations, in which the organisation must train its employees to develop new production skills. ODMs and OBMs, however, add value from downstream activities along the supply chain, and need to be more sensitive to the external environment in order to design products that fit the target consumers. Under this situation, a flexible and sensible response to the external business environment is needed. The effective criteria model should comprise an open system model.

In this study, the spatial model by Quinn and Rohrbaugh (1983) and the classification of the production mode to construct the sample framework were adopted. The field data required represented the general phenomenon in the organisational learning process. With the purpose of encompassing the entire spectrum of organisational characteristics within the industry, the firms were picked with both an individualised and universal approach. Each time that a firm was invited, its effective cluster, nature of business, production mode, ownership type, roles of key individuals who were responsible for operation of the organisation, and organisational life cycles were identified. So that each participating organisation was unique (Quinn & Cameron 1983, Quinn & Rohrbaugh 1983) to compare the specific institutional context.

Then, the number of cases was determined. The spatial model

suggests that there are four clusters of organisational effectiveness. The minimum number of cases, to cover all of these four clusters, would also be four. Besides that, external validity for analytical generalization is also taken into account. Yin (2009) indicated that replication logic in multiple-case studies serves this purpose. The selection of cases and determination of the number of cases for study were made under two considerations: (1) the prediction of similar findings collected from different cases, and (2) theoretical replication, the replication of previous work to produce contrasting results for predictable reasons. If the findings from additional cases would only predict results that have little increase in use, then there is no need to further employ any more cases. As the intention of selecting cases was to include the production modes; that is, OEM, OBM and ODM, each firm should fall into at least one cluster of the effectiveness measure model. In addition, extra firms would be recruited if theoretical replication was not attained.

Another consideration for the sample frame is the diversity of staff members in the participating firms. In order to understand and examine the learning attitudes among different levels of staff members within a firm, it was anticipated that different levels of staff would participate in different stages of the study. The principle considerations were that the interviewees should have the necessary knowledge and experience of the issues to answer the questions in an interview or contribute their knowledge in discussions. They should also have the capability to reflect and articulate, and should be ready to participate in the study.

The selection of specific participants to take part in the workshop was made by the senior management of the respective firms with the assumption that they would have a better understanding of their colleagues. The concerns were mainly about the insights that could be obtained from the participating organisations and their employees who were involved in the study to verify and refine the theory. The criteria were set and given to the firm to decide on those who would attend the focus group meeting and participate in individual interviews. As a whole, the participants should be

representative mid-management level employees, practitioners of the operation process which the organisations wanted to improve, and those who are the stakeholders of the particular issue that the participating organisations intended to settle at the single day operation management training workshop. All of the participants were informed that their learning activities would be observed before the workshop was conducted so that they could decide to withdraw from participation at any time or different stages of the study in the event that they felt uncomfortable.

To minimise the probability of inviting organisations without any internal or external staff training experience, screening questions were established to ensure that the contacted firms had provided some form of training in the previous twelve months or conducted organisational learning processes intended to acquire new knowledge that would support their employees in coping with their current problems at their workplaces.

Last but not least, the plan was to select organisations with a variety of management structures, such as management teams formed by employed CEOs, owners, founders, or the next generation of the owners or founders.

3.9.3 Firms Participation in the Research Study

The data collection process took eight months, from July 2009 to February 2010. The invitation process for the field study is depicted and shown in Figure 3.4.

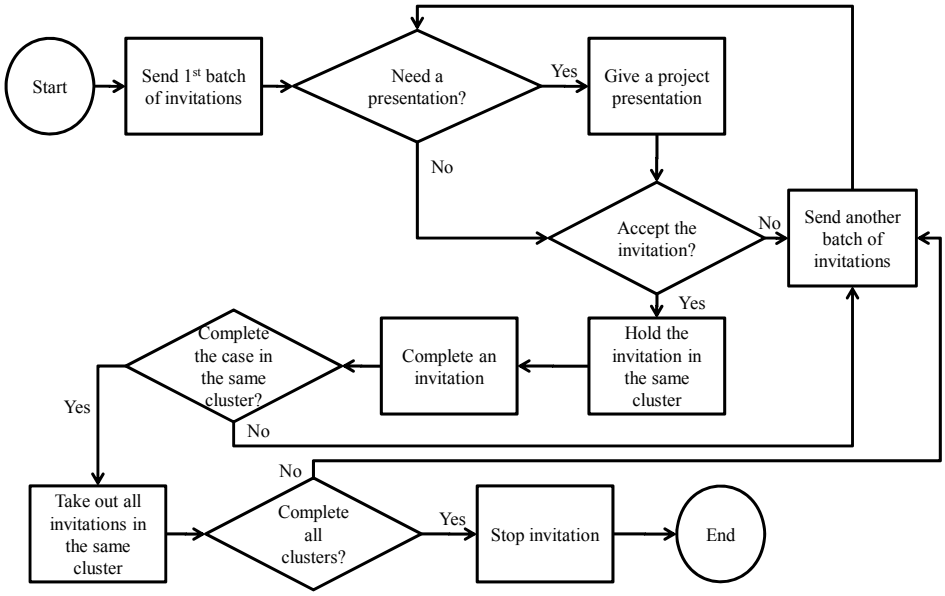

Fig. 3.4 Invitation flow

Forty organisations that satisfied the primary criteria were randomly selected. Each selected organisation was assigned priority according to the drawing order. Before the invitations were sent out, the background of each firm was verified in order to identify the nature of their business and the product types of the firms. As the sample plan was designed to study no more than one firm that produces the same product, the evaluation of each firm took over a month. The first batch of invitations was sent out in early July 2009. The total time spent on the invitation process was almost six months. The invitation process was completed in February 2010. With the selection criteria, responses were received from seventeen eligible firms. Among them, one firm originally confirmed their participation in the project, but later withdrew because they were experiencing a financial crisis and needed to restructure their organisation. The firm could not commit any financial resources to the project. Another firm had doubts about the study and expressed a large amount of skepticism. The invitation was consequently withdrawn. Two firms showed interest, but requested the postponement of the research activities for eight to ten months because it was their peak production period. The requests, however, were declined due

to time constraints. Two other firms indicated that they were not interested. Another two were conducting similar improvement training programmes. They did not want to confuse their employees and turned down the invitation. Five firms replied that they could not commit their staff members for participation in the project because during the collection period of the data, it was their peak season of production. Seven out of the seventeen invited firms asked for a briefing of the project before they made their decision. Four firms finally accepted the invitation and all completed the tasks for the study. The invitation responses and the pseudonyms of the firms and informants are listed in Appendices XII and XV, respectively.

Table 3.2 illustrates the sampling frame for the firms that were originally targeted for recruitment and also participated in the action research project which satisfied the criterion of theoretical replication. In the data collection process, there was a significant amount of confidential information discussed, such as cost structure, productivity performance, and business relations between suppliers and buyers. To ensure that the participating firms and informants would not be identified, they were given entirely fictitious names to preserve anonymity (Coffey & Atkinson 1996). The pseudonyms for the four participating firms are: Alpha Fashion Manufacturing Ltd., Beta Knitwear Ltd., Gamma Fabric Mill Ltd. and Delta Lingerie Apparel Ltd. A copy of the workshop rundown is attached as Appendix XIII.

Table 3.2: Sampling frame

	Effective cluster	**Open system**	**Human Relations**	**Rational Goal**	**Internal Process**
Type of production mode	OBM	Beta	Beta, Gamma	Gamma	
	ODM		Gamma	Gamma	
	OEM			Alpha, Delta	Alpha, Delta

OBM: original brand manufacturer
ODM: original design manufacturer
OEM: original equipment manufacturer

3.10 Summary

The vigor and objectivity of qualitative research is often questioned. This chapter has described the new research design which uses a created natural environment integrated with retrospective methods (CNERMs) to develop a multi-methodological approach that validates and verifies, in a rigourous manner to minimise bias, the constructs of KAT related to organisational knowledge processes and learning research. Data collected from the retrospective methods, such as interviews, surveys or group discussion, serve as a triangulation approach to validate the opinions and experiences shared by the informants. The process of designing observation instruments, sampling frame, and data collection procedures has been elaborated. The need to establish a natural venue is explained. The next chapter will propose a new theory about the ontology of KAs, which has autopoietic characteristics to self-produce components that sustain their existence, while at the same time, is an enabler in vitalising an organisation to cope with uncertainties. The hypotheses under the conceptual propositions of the constructs of the theory are also established.

Chapter 4 Development of New Theory and Hypotheses

In this chapter, a novel theory dubbed as the knowledge agent theory (KAT) has been developed to explain the ontology of KAs. With the literature review elucidated in Chapter 2, the constructs and assumptions of the theory has been conceived and elaborated. The inference of KA boundary properties and double neighbourhood relations of KAs at the individual and organisational levels under a topological approach provide the reason for the different levels of effectiveness in organisational learning. A KA model with completed list of the different types of KAs is also delineated. In order to verify the constructs of the theory, seven hypotheses are established under three conceptual propositions.

4.1 Introduction

In Chapter 2, several unanswered questions were raised with regards to KAs who play a role in activating knowledge processes in organisations. Many publications in the literature have highlighted that staff motivation is the key factor in mobilising participation in the knowledge process, which includes knowledge acquisition, transformation, implementation and storage. Some knowledge management researchers and practitioners have indicated that there should be an agent to carry out the tasks of knowledge production and implementation (Bukowitz & Williams 2000, Dalkir 2005, Drucker 1993, Womack & Jones 1996). Knowledge management is a relatively new academic discipline, where the dominant topics are mainly concerned with a more practical approach, knowledge storage and transformation.

In the latest research, knowledge processes are obviously the focal area. For example, the SECI model by Nonaka and Takeuchi (1995) emphasises the transforming of knowledge from tacit to explicit and vice versa within an organisation, while the TNKM model by McElroy (2003) addresses the quality of knowledge process outcomes, i.e. knowledge. The Cynefin model by Snowden (2002), on the other hand, brings out the issue of the development of sense making of an external environment from a

knowledge management aspect. However, the number of discussions on agents who act on the transformation of a problem into a solution for organisations is limited.

With reference to the definition of knowledge as stated in Chapter 2, the consideration of an organisation's knowledge is pragmatic and there are many interactions between knowledge and people. Hence, the next essential issues for knowledge management are to examine "what" organises and justifies skills and experience, "what forms of an entity" generate the capacity to act on the transformation of a problem into a solution, and "why" the entity transmits the knowledge to other concerned parties in order to make better sense of the external environment. Hence, the fundamental questions are concerned with defining a KA, why it exists and how it sustains its identity in an organisation. The intention of the KAT is try to answer these questions.

In this thesis, KAs are defined as an entity, which can be an individual, a team of members from the same organisation, or outsiders who work with an organisation to deal with collective issues. The outsiders could be business partners, stakeholders or consultants. These agents are willing to make an effort to acquire knowledge that has the probability of being retained in an organic status in an organisation via creating, retrieving, sharing, and implementing to help an organisation achieve something, which could be an innovation and/or a solution.

4.1.1 Constructs of KAT

The constructs of the KAT is illustrated in Figure 4.1. To avoid any confusion in this study, knowledge is defined as that contained within a KA who is organic, and bounded to strengthen the internal and external resources of an organisation. To cope with a changeable environment, internal resources refer to employees who develop a better sense of a new environment, processes that create ways of doing things to meet new requirements, production facilities with a better arrangement, and capital which provides better investment to prepare an area for change. The external

resources refer to business partners. In terms of operation processes, knowledge is for continuous improvement and constraint breakthroughs. The KAT constructs are explained and the hypotheses are established in the coming sections.

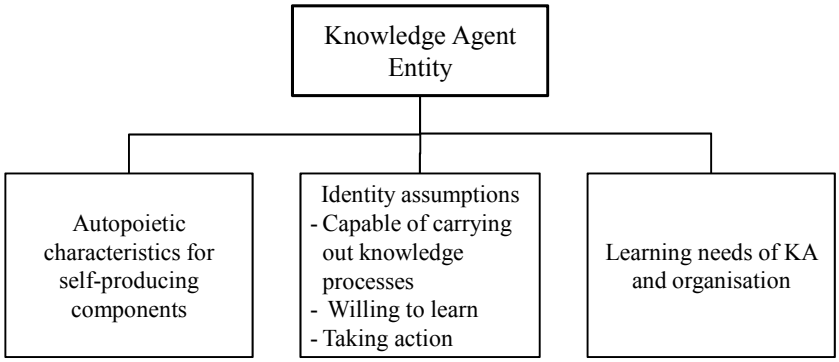

Fig. 4.1 Constructs of KAT

4.2 Knowledge Agent Theory (KAT)

4.2.1 Introduction

In this section, a theory is developed to explain the behaviours of a KA as a living system who exists in organisations to deal with collective problems or issues. To do so, the aims of a KA are revisited. Then the autopoietic behaviours, namely those that are self-producing, self-referencing and self-observing, are discussed. After that, the importance of identity is examined and the KA boundary properties are established. Lastly, the conditions to enable learning groups to become components of KAs are explored. The propositions and hypotheses are also established to answer the research inquiries.

Organisations exist to address problems and conduct activities that resolve issues (Buck 1971) to meet the goals under a function that is defined

by how much resource controllers agree about what constitutes a desired end state. They, therefore, carry out many functions with various sub-units with the aim to generate outputs that support their existence and maintain their stability. However, uncertainties with respect to the behaviours of the market, suppliers, competitors, new policies of governmental agencies and so on, mean that organisations must retain quick responsiveness and cognitive abilities to change under the constraints that they are facing (Cyert & March 1992). Consequently, management of organisational knowledge is an essential task that organisations carry out.

As discussed in Chapter 2, organisational knowledge comprises organic and inorganic forms. Without taking part in the transferring process by using knowledge to deal with problems or re-creating new knowledge, knowledge is in an inorganic form or stored in containers without specific instructions on how to manage it or for later use. Knowledge is alive when it is activated by an entity that is in a living form. Instead of looking at the whole business organisation as a single unit to investigate knowledge activation, this study specifically focuses on the simplest distinct unit which is a learning group to carry out organisational learning activities for the collective goals of an organisation. This group is named the KA entity. This new aspect of viewing the nature of KAs provides another explanation why organisations learn and why they do not learn based on the impacts made by the simplest unity, the KA.

It is asserted that the KA entity is a living system which possesses self-consciousness of ability to change and self-correction capacity in that improvement of operation performances can be continuously made. The autopoiesis theory and its key concepts developed by Maturana and Varela (1980, 1992) are used as the theoretical foundation to establish the conceptual model. Autopoiesis is the centre of the constitutive dynamics of living systems with self-producing machines. The constitution of the living systems of a KA entity is components which have self-producing mechanisms to produce the components of an entity and its boundary. The self-producing outputs are simultaneously the producer and products. The

operation processes of autopoietic systems could also be said to be circular systems. They are self-contained and self-maintaining dynamic systems of identity. With a self-referential and self-observing nature to support the existence and maintain the stability of an autopoietic operation system, the KA entity always produces and keeps the essential components running the operation systems and forming boundaries to distinguish itself from its business environment.

Proposition 1: The KA entity is a group of members who maintain a continuous learning capacity to deal with collective problems or issues.

Figure 4.2 shows Hypotheses 1, 2 and 3, which are formulated to examine the plausibility of Proposition 1. The constructs of the hypotheses are described in the following sections.

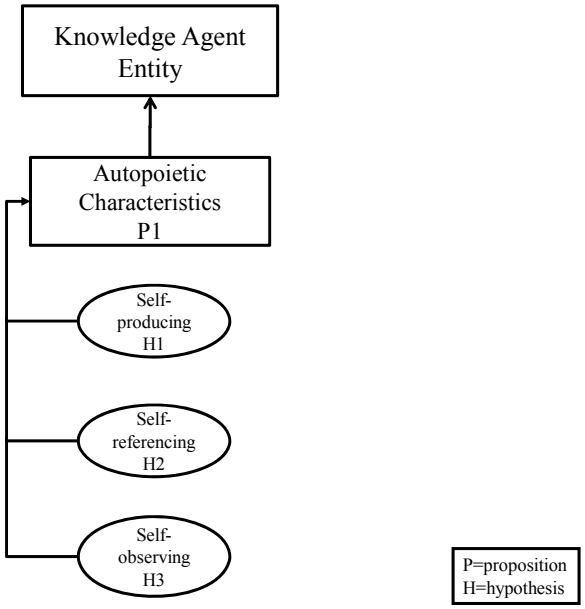

Fig. 4.2 Hypotheses 1, 2 & 3 to examine plausibility of Proposition 1

4.2.2 Self-producing System

The KA entity is asserted to be a circular unit. Its operations are continuously generating its own components to maintain a living system identity that carries out knowledge processes. The outputs produced by the entity comprise two types: (I) knowledge which would be implemented to

solve collective problems or change organisations for the better, and (II) memories of experiences in relation to learning processes and applications of new knowledge. The first type of output eventually becomes the inputs to operate the organisational business activities. They have positive impacts on organisations. Generally, most organisational learning researchers focus on the study of the effectiveness of the former on organisations (Easterby-Smith et al. 2004). The second type of output is the inputs of self-referential processes and circularly which act in self-producing activities within the KA operating system. The former are the cognitive resources that make sense to the organisation environment in order to deal with collective issues in organisations. The latter become the cognitive abilities that support the continuation of the KA entity identity and cognitive evidence to examine the membership with which the entity uses to make sense to its environment.

In the event that the existing structure of components may not be sufficient to hold an identity for learning, a signal will give to the original components to gain new cognitive resources. Otherwise, the entity will structurally couple with members outside the entity's boundary to integrate external members into the KA entity to sustain its role for learning. This circular process enables the KA to self-produce its components and constitute the boundary to hold its learning identity. The circular system gives the entity an important degree of independence or autonomy to act as a learning activist from its environment outside the boundary so that the business functions of various sub-units within an organisation do not disturb the knowledge process to generate these two types of outputs. Thus,

Hypothesis 1: A KA recursively uses learned knowledge (learning skills and useful knowledge or solutions) to generate new meanings of things (new goals, learning skills, applications of knowledge, solutions) as inputs of forthcoming knowledge processes (self-production).

4.2.3 Self-referencing

The autopoietic system is sufficient enough to characterise a living

system as the simplest unity which is a self-contained entity. Any changes in the structure of the components that are undergoing a particular arrangement are decided based on maintaining their self-producing nature. All interactions in the system are determined on its own, through self-referencing activities. This self-referential behaviour allows the entity to remember its previous interactions in knowledge processes and creates records to justify the producing of components that sustain the KA identity. The self-referencing property in general is composed of three parts: (1) the purpose of referential activities to the living system, (2) point of reference and (3) ways to link referred materials to the system. Obviously, the purpose of self-referential activities of KAs is to examine the conditions to sustain the living system property of a KA and distinguish the KA from his or her environment for other business operations within an organisation. The conditions of holding a living system property basically refer to the maintenance of a boundary and self-producing mechanism: its ability to develop components to construct a boundary as the KA. The ability to develop the components of a KA means that an entity has the capability to examine current cognitive resources and give signals to the entity to take forthcoming actions that will acquire and implement new knowledge. The purpose of self-referencing behaviour is to hold the distinction of an entity that is functioning as a KA to avoid any confusion in operations carried out by the KA and other subunits in an organisation that would take place.

Most KA members are in fact, playing multiple roles within an organisation, which on the one hand, activate the knowledge process in a KA entity that deals with collective problems to better the performance of organisation as a whole. On the other hand, they serve in different functional departments within the same organisation or external organisations in which the interest of local departments may have different universal aims. The players with multiple roles increase the opportunities of KA components to fall into a boundary zone, in which the different roles blur the original identity of being a KA. The self-referencing processes make use of the cognitive resources within an entity to examine the continuation of holding a

KA identity with the original components.

Cognitive resources are collections of memories and information generated from previous experiences and inventories of knowledge which are available for retrieval towards self-referential activities. Learning outcomes from previous knowledge and after new knowledge or information is acquired for bettering business performance are typical cognitive resources. Some are the procedural knowledge generated by memories of experiences from operation processes. The inventory of knowledge could be internally and externally acquired. Internally, they are the outputs of knowledge processes: procedural knowledge for operating cognitive processes by which to enhance and maintain learning capacity, and declarative and conditional knowledge which hold new meanings of existing knowledge and things that have happened or been experienced. Externally, new knowledge is brought in by new members who are integrated into an entity after structural coupling. These cognitive resources are acquired after cognitive processes, such as transformation, reduction, elaboration, and application for problem solving or decision making. They become the reference for an entity to examine its sustainability as the KA. Those cognitive resources are the information that an entity uses to evaluate the likelihood of its current status in maintaining the properties of being a KA.

KAs realise their functions in organisations through a particular arrangement of components within the boundaries to operate knowledge processes. KA members, through cognitive operation systems, generate new knowledge and experience of learning. The former provides solutions to an organisation in coping with changes. The latter gives evidence and reference to the agent to recognise, maintain and enhance the cognitive abilities of the members in the KA set in order to maintain the self-producing property. Self-referencing, therefore, is defined as a continuous process to distinguish the KA from his or her environment in order to avoid identity instability and at the same time, examine the structure of current components to ensure that the identity is kept under the triggers of its environment. The self-referencing process is to avoid entity disintegration. If there are any changes

in the components, it is purposively determined by the entity so that it retains its identity as the KA, not as an adaptation of its environment. This self-referential behaviour retains previous interactions as cognitive resources to allow the entity to examine the need to produce new components to sustain its KA identity. The outputs of self-referencing, therefore, are the inputs for self-observing (Bakken & Hernes 2003). Thus,

Hypothesis 2: The KA maintains awareness by reviewing components through reference to its cognitive resources, and outputs become inputs of self-observing activities in order to keep an identity for learning (self-referential).

4.2.4 Self-observing

The purposes of an autopoietic system are to: (1) simplify a living system so that an entity could avoid a complex situation which would interfere with its operation systems, and (2) stabilise the living system to self-produce its components triggered by the external environment. To ensure that the distinction is not lost from the environment and maintain a self-producing mechanism, the KA entity has a self-observing behaviour. Distinction as a separate entity in an autopoietic system guides the observations of the observed observer. That is, the entity observes itself within a boundary with its self-referential cognitive resources in a recursive manner to develop self-consciousness of its identity. Self-observing is therefore, a nervous system operation to detect any deficiencies in the self-producing inputs which obstruct a self-living system to possess the characteristics of producing the self-components of an entity. The cognitive resources, which are outputs generated from self-referencing activities for self-observing, are bounded but unlimited. Through recursive interactions, the cognitive resources held in an entity may generate new meanings to the current KA in examining its sustainability with the ability to determine solutions for collective issues in the forthcoming knowledge process.

When an entity observes itself to lack sufficient conditions that will maintain its identity with the current components, neighbourhood searching

and confirmation (Maturana & Varela 1980) within a convex region will allow the commencement of integrating new members who may hold the needed cognitive resources, either from inside the organisation or an external source. This process is called structural coupling. Changes in the structure of the components of a KA are to perpetuate boundary properties to maintain its identity for learning. Hence, self-observing activities give signals to the KA entity for producing the necessary structure of components to maintain boundary properties. It is the only process in the autopoietic system that allows interaction between members inside and outside the entity. The new meaning of the experience and outcomes of the knowledge process which are recursively applied to its own outputs become the memory which is reused as the inputs in self-referential activities. The referential activities give signals to the KA on currently available cognitive resources for learning. Then these signals become the inputs for self-observing to ensure that further actions will be taken when the current components are evaluated as insufficient to maintain the KA living system. Thus,

Hypothesis 3: The KA examines the need to conduct knowledge processes by observing its cognitive resources to solve collective problems or issues in order to sustain its identity for learning (self-observing).

The relations among the autopoietic characteristics are illustrated in Figure 4.3.

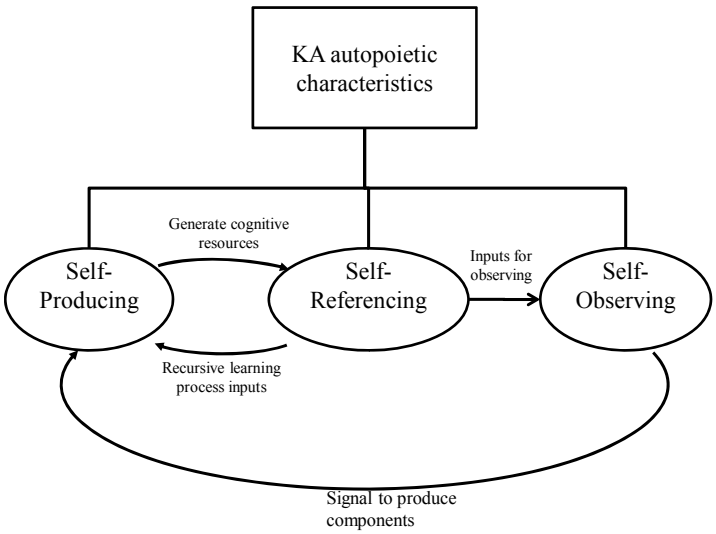

Fig. 4.3 Inter-relationship of the autopoietic characteristics

4.2.5 Identity

In the observations made by Maturana and Varela (1980), one essential feature of a living system is its individual autonomy. The living system has a boundary and is self-defined by its components. The components give an identity to the entity, which automatically creates its own necessary characteristics and boundary. Maturana and Varela (1980) labelled this structure-determined single entity as an autopoietic system. The system consists of particular components as inputs and generates necessary components to maintain the identity. The living system is closed and self-produces its components to construct its own boundary.

4.2.5.1 Boundary

A boundary represents a distinction or demarcation between an entity and the environment so that the entity can be identified and explained (Luhmann 2002, Mingers 2006, von Krogh & Roos 1995, Checkland 2006). It comprises a region that defines the particular characteristics of an entity. The purposes of a boundary are to separate, contain or include different elements or spaces, and regulate the functions and operations that are carried out inside its parameters. The distinction between an entity and the

environment is exclusively mediated by meaning, which constitutes the boundary. The outcomes of ongoing processes of including and excluding membership with explicit identities or differences ensure that actions taken by an entity are predictable. The boundary is also used to separate a complex environment outside the entity so that it is sustainable to carry out its functions. Without a boundary, it is not possible to define an object and subsequently, discussions on the construct and existence of an entity cannot be made. So, the importance of obtaining information on the identity of a KA entity is to define its boundary to help organisations in examining its existence. Then, the purposive actions of carrying out a knowledge process can be undertaken.

To define the boundary properties of KAs, some questions need to be addressed, which include the following. Is the boundary open or closed in nature? What are the forms of the boundary? Why does the KA have such forms? What are the components to construct a boundary? How is the construction of a boundary conducted? In the following section, the boundary is described from different perspectives in organisational studies, and the systems and mathematics are explored. Then, the boundary properties of KAs are defined.

4.2.5.2 Descriptions of the boundary

Sociologists often deal with issues on individual agency and interaction with systems and the social structure. Organisational identity is one of the areas that researchers are interested in studying. For instance, Seidl (2003) used the term, organisational identity, to elaborate the function of a boundary. He asserted that identity renders an entity a consistent system of actions and distinguishes it from its environment or other organisations. The formation of an identity is roughly divided into two parts. The first part stems from a substantive approach and the second has a reflective approach. The substantive identity is formed by shared rules, world-views and values, which constitute the structure of an entity. The reflective identity, in contrast, is the identity perceived by the entity in a collective manner by which the

values of individuals may differ from the shared beliefs about the entity. These two aspects highlight an important issue about the linkage of the social identity of individuals in organisations. The KA entity is the simplest social system within organisations. When it is treated as an individual in organisations, the relation and distinction must be clarified. Then, these two aspects may give some implications for defining the boundary properties of a KA entity.

4.2.5.3 Organisational studies perspective

Many organisation researchers are interested in working the classification of boundary into different forms so that they can analyse individuals and organisation interactions and relations (Carlile 2002, Hirschhorn & Gilmore 1992, Kogut & Zander 1996, Kim 1993, Rosenkopf & Nerkar 2001, Tushman 1977). Hernes (2003) described a boundary as having three forms: physical, mental and social. The physical boundary is essentially made of tangible entities which attempt to regulate productive activity via real objects, such as walls, to separate different functions within an organisation, or electronic media to create a boundary that governs access to communication and information. Another type of physical boundary consists of rules and regulations that govern the type of exchange that may take place between organisation members, and members of the organisation and the external environment. This description, which is similar to the substantive approach put forth by Seidl (2003), restricts the explicit depiction of entities and the implicit characteristics of a boundary are omitted. The mental boundary, on the other hand, extends the description of a boundary so that it is constructed by the particular knowledge or cognitive resources built in the minds of members which enable them to communicate, make sense of phenomena, and act and further their understanding. The boundary is invisible and only partially noted when interactions between members via communication are carried out. The social boundary enables members to distinguish themselves from others with a sense of identity. There are social relations that serve to remind members of their collective identity. Members behave in ways that they perceive as being expected of

them. In this manner, the boundary becomes a set of rules which restrict the behaviours of members inside the boundary.

Marshall (2003) described the boundary as four levels of restricted interactions between insiders and outsiders, namely, as a metaphor of containment, permeable membrane, socioculturally constructed object and a diminishing relevance of the boundary. The boundary as a form of containment comprises clear lines of demarcation between an insider and an outsider which are depicted as radically distinct with minimum interactions between the two. However, the absoluteness of the distinction is due to the lack of interactions between the two. This explanation has been challenged by contingency theorists in that the components inside the boundary eventually interact with those outside in order to respond to varying environmental conditions. To release the restriction of interactions, the boundary described by contingency theorists (Lawrence & Lorsch 1967, Mintzberg 1979, Morgan 1986) is likened to a permeable membrane that allows the interaction of components between those on the inside and the outside. When the environment is so changeable, interdependencies between different sets of an organisation are more important and there may be more mutual benefits gained. That is, the organisation boundary would rather be a loosely coupled network which in turn facilitates interactive learning, innovation, risk-taking and challenges to receive wisdom.

A socioculturally constructed boundary means that members are grouped according to shared values, beliefs and norms. However, these cultural characteristics are not fixed. They are the outcomes of dynamic, ongoing, and potentially contested processes of inclusion and exclusion, which are actively maintained and reproduced through continuing actions and interactions. In other words, the members are bounded by traditions, and at the same time, the traditions are formed by the dynamic activities of the distinctions between the external and the internal. Inside the boundary, members feel a sense of security, solidarity, and belonging. The loosest form of a boundary is the diminishing relevance of the boundary, which is in the form of networks. The networks have three types of contexts: horizontal

alliances between firms, vertical cooperation between upstream and downstream organisations, and multi-dimensional firms within a geographical region. The characteristics of a network boundary comprise sets of connected exchange relations among actors who are performing their activities (Håkansson & Johanson 1993). When the components of the sets are interacting, they learn about each other's capacities and needs. Besides that, the networks are unbounded. That is, the boundary can be extended without limits. However, this form of boundary is arbitrary and the least stable in that the networks can be broken up and at the same time, extended into new directions, which depend on the conflicts and common interests between members.

Ulrich (2000) categorised boundaries in a practical manner, which comprise three types in order to handle boundary judgment in a reflective manner as proposed by Schön (1983, 1987). The first type refers to the social role which is or should be involved in defining the system of concern. Hence, the components inside an entity are defined as those "who" are or should be included. The second type of boundary addresses role specific concerns that are or should be included. Through this aspect, the boundary identifies the issues of concern of those who are inside the first type of boundary. The third type relates to key problems that the entity addresses. That is, the types of solutions sought in response to the first and second types of boundaries. His argument is that boundary judgment depends on observation and the reference system that contains the values. Changes in boundary judgment may allow an entity to look at things differently via reflective practices to review and change the three types of boundaries. Ulrich's (2000) description of boundaries is more akin to dependent variables which respond to changes in the functions of organisations rather than providing a consistent identity for organisations with concrete boundary properties.

4.2.5.4 Management science: systems perspective

In his theories of distinction, Luhmann (2002) argued that every

observation designates something and distinguishes it therewith from other things. There are two levels of observation: what the world looks like and how the world looks like. How the world looks like depends on which lens is used to observe the world. Luhmann (2002), who adopted the Laws of Form from Spencer-Brown (1972), stated that the world is constructed by first drawing distinctions with boundaries. Boundaries are used to distinguish one observation from another. It is a response to how an observation of one entity is distinguished from another. While different manners of observation will affect how the world looks like, Luhmann (2002) used the term "form" to mark differences along with the distinctions that compel one to designate one or the other side, as either the being or the nonbeing of something. He indicated that in the form, there is an inside and an outside. The inside of a form has the possibility of autopoietically attaching further observations and descriptions. The outside is the side from which the form is reflected, the contingency of the other side is perceived, and conditions of connectability can be established. To separate the inside and the outside, there is a border which is the context of identity formation by self-producing systems. Without the inside, the outside cannot be determined.

Systems theorists (Midgley 2000, Mingers 2006) have specifically focused on the processes by which boundaries are constructed to determine different systems. Mingers (2006), influenced by Luhmann's theories of distinction, established a critical realism that defines boundaries in social systems as the limit of the extent of some units that distinguish an entity from its environment. When the components of an entity are contained within a space, but the boundary is not enclosed, the identity of that entity is undefined. Consequently, he suggested that boundaries are formed by the entity functions that need to be carried out and the entity members themselves. As the functions of entities are carried out by the members, boundaries do not restrictedly refer to a physical form of separation. In fact, physical structures can only spatially demarcate entities from their environment. They cannot produce the necessary components of boundary

formation. For example, walls can distinguish the regional location of different departments, but cannot identify the sort of wall that constitutes a particular department. Only processes and outcomes of entities illustrate the functions that can be named. For instance, the accounting department carries out all the tasks of cost determination, and profit and loss statement preparation, and analyses the performance of an organisation from a financial perspective, while the production department manufactures the goods. Indeed, the demarcations of boundaries are defined by the nature of components with which entities are not only separated from the environment, but also constituted by determinable principles.

In extending the work by Mingers (2006), social entities can be described as the arrangement of purposive actions that allow entities to pursue collective goals, controlling their own performances with boundaries to develop identities that are separate from the environment. Boundaries work as a type of enclosure where they constrain the flow of turbulence, and new opportunities and ideas from the outside. They maintain stability in time and space dimension which enables the components of entities to develop distinctive strengths in order to effectively act outside of themselves (Hernes 2003). Under this consideration, perhaps the most obvious form of a social boundary is that of membership. People are members in formal or informal groups. Formal groups have specific and relatively defined criteria for membership. In principle, these criteria provide a clear demarcation between those who belong and those who do not. Informal groups, on the other hand, are less precise. Regardless, a social boundary is formed from either or both formal or informal groups; at any point along the boundary, the inside can be differentiated from the outside. Hence, the function of a boundary is to separate an entity from the environment to distinguish its identity.

Mingers (2006) further elaborated on boundary formation from a general systems theory approach by modifying Boulding's (1956) hierarchy of systems in that systems form their own bounds according to their own operations. He categorised systems into seven levels from a static structure

that separates itself from its environment to self-awareness via recursive operations to make sense of the external environment. Thus, a boundary is set with reference of the levels of systems in which types of operations will be carried out. In a similar manner, Midgley (2000), delineated the relationship between a boundary and value judgment, and extended the concept to boundary judgment. Boundary judgment is the process of making distinctions of what exists in a first-order content to that which gave rise to boundary judgment in the first place. This means that boundary judgment focuses on how things ought to be. Unlike the definition given by Maturana and Varela (1980), Midgley (2000) argued that boundaries can be redefined as what ought to be through intervention. Both Mingers and Midgley stressed the importance of intervention to reset boundaries. Therefore, boundaries can be wider to enclose more groups into decisions to respond to environment changes. However, changes in the nature of boundaries also change the identities of entities which then become unstable and inconsistent which Mingers and Midgley did not take into consideration.

Bailey (2008) simply defined a boundary in the systems theory as a form of separation by systems from the environment. Once a boundary is established, the systems refer to the boundary properties for their actions in the future, and therefore, create a communication process in the simplest situation. Yet at the same time, Bailey (2008) argued that the roles of a boundary are to maintain openness in a manner that ensures both needed inputs and outputs are available while maintaining closure in a manner that prohibits harmful inputs from entering a system or any loss of valuable matter, energy or information through harmful outputs. Overall, his concern mainly was on the inflows and outflows of information between systems and the environment, according to the types of information inflows and outflows across social group boundaries in order to ensure that the system entity is not harmed by the flows of information.

To summarise the above, boundaries create entity distinction. From an organisational theory aspect, boundaries are explicitly and socially constructed with shared values, norms and collective goals. The interactions

of insiders and outsiders are restricted by reflective identity and levels of ambiguity of different forms when they deal with the contingency of external changes. From a systems management point of view, boundaries are determined by their operation process functions. Boulding's (1956) hierarchy of boundaries provides a framework for the sociological sciences to generalise relationships and the complexity of individuals and their environment in an empirical world into different levels to investigate their behaviours. The practitioners of systems thinking not only propose the types of boundaries to be investigated, but also what boundaries ought to be in order to holistically better the systems. As explained, the KA deals with collective problems of organisations. It needs to interact with the components within a boundary and the members who serve the organisation. Therefore, the KA is a social system. Giddens (1995), in his elaboration of the theory of structuration, suggested three criteria for social systems to consider.

1. To be considered as a society, there has to be an association with a particular time-space location along with a legitimate claim to make use of it. This can be interpreted in two ways. First, the formation of society serves specific functions. Simultaneously, the emergence of that society is at a particular time at a specific place with which the functions should be carried out.
2. A shared set of practices that involve both system and structure. Social systems are composed of patterns of relationships between actors or collectivities reproduced across time and space while structure can be seen as the rules and resources to formulate the systems as the media and outcomes of practices.
3. An awareness of a shared identity. Individuals may have separate identities, but at the same time, they have a shared identity that determines the collective actions to be performed. Conflicts may exist in individuals on shared identity in one group and that with another.

The KA is a social system which is embedded in an organisation and has legitimate claims on carrying out the functions of acquiring knowledge to solve collective problems. The criteria suggested by Giddens (1995), which include the consideration of time and space for the actors to build relations that will formulate an entity in which awareness of commonality and conflicts coexist, provide the foundation to determine the boundary properties for KAs. However, all of the above descriptions of a boundary do not give a satisfying explanation that defines the closure of boundaries in living systems.

The original research inquiry was to maintain the sustainability of organisations in a fierce business environment. In order to maintain sustainability, organisations have to acquire appropriate knowledge to deal with different issues or problems. Instead of involving all members within an organisation in learning, it is suggested that a learning group, dubbed as the KA entity and also known as the simplest living system, may have impacts on organisational learning.

Having reviewed the literature on knowledge management, it is asserted that the nature of a KA entity constitutes an autopoietic system which generates self-components to maintain the functions of acquiring knowledge. The first property of autopoietic systems is that they are autonomous with the base of the boundary. In relation to this property, three perspectives from publications in the reviewed literature are outlined. The first asks for a definition of a boundary. There is almost no controversy among sociologists and systems thinkers about this, and they accept that a boundary provides a distinction of a living system from its environment. The second perspective revolves around the ways to define a boundary in which the components inside and outside can be identified. Hence, researchers have created narrative descriptions about the behaviours of the components within an entity or predict their behaviours in different situations. System thinkers consider that an appropriate description of a boundary operation is one that separates an entity and its environment. The hierarchy of a boundary provides the framework or typology of systems to distinguish their

functions that will be carried out. Sociologists argue that boundaries are used for social identity determination and interaction characteristics between components that are inside and outside of the boundaries. The third perspective extends the discussion on boundaries into practical considerations. This perspective focuses on the changes in boundaries. The systems researchers use interventions to carry out boundary judgment. Among these three perspectives, the first one is very straight forward. It allows any entities, whether they have a title or a name, to be identifiable. The reason behind the need for distinction is to provide a basis for the second and the third perspectives on ways to make distinctions and solve problems caused by indistinctive boundaries.

The definitions of boundaries, as shown in the literature, are listed in Table 4.1. However, the descriptions are insufficient to provide a theoretical description of the boundary properties for autopoietic systems of KAs because the following is not known: (1) the conditions used to construct a boundary to maintain self-producing mechanism of components, and (2) how interactions could possibly happen inside and outside a boundary to enrich and enlarge the cognitive resources. In the next section, the definitions of a boundary from a topological perspective are reviewed.

Table 4.1: Definitions of boundaries

Forms of Boundaries	Perspective	Types of Boundaries	Emphasis
Explicit	Organisational studies		
	Seidl (2003)	Substantive	Shared values of all members
	Hernes (2003)	Physical	Explicit depiction of entity
	Hernes (2003)	Mental	Cognitive resources of members
Social	Organisational studies		
	Seidl (2003)	Substantive, Reflective	Shared values of all members, collective values held by an entity may differ from those of individuals
	Hernes (2003)	Social	Rules to restrict membership
	Marshall (2003)	Socioculturally constructed	Shared values
	Ulrich (2000)	Social	Who should be included in a defined system
	Giddens (1995)	Shared-identity	Shared identity to determine collective actions
Functional	Organisational studies		
	Marshall (2003)	Containment	Clear lines of demarcation
	Marshall (2003) Lawrence & Lorsch (1967), Mintzberg (1979) Morgan (1986)	Permeable membranes	Contingency
	Marshall (2003)	Diminishing relevance	Network, boundaries can be extended without limits
	Ulrich (2000)	Roles, Outputs	What should be done, what are the problems to be solved
	Hernes (2003)	Membership	Stabilise the operations within an entity
	Giddens (1995)	Formation of an entity	Time-space location to form society serves specific functions
	Management Science		
	Luhmann (2002)	Distinction	Being or nonbeing of something
	Bailey (2008)	Distinction by information flows	Communicate by the simplest means
	Boulding (1956)	Hierarchy of boundaries	Different levels of operation processes from static to self-awareness via recursive manner
	Mingers (2006)	Process and outputs	Critical realism, types of operations
	Midgley (2000)	Process and outputs	Value judgment

4.2.5.5 Mathematical perspectives

In mathematical language, the gathering of objects, which can be persons, types of tasks or purposive actions, into groups and elaborating on their notions by creating or assigning a name to them is called a "set" (Viro et al. 2008). When the characteristics or features of a set have been identified, then various objects that have been arbitrarily collected are called its elements or members of the set. Under this expression, a set consists of elements and also formed by them. A set can be defined as follows:

$A\ is\ the\ set\ that\ x \in A$ where x is the element belongs to A.

When there is more than one set in a space, several scenarios can take place. The sets can be intersected, in a union, or exclude the elements of one another, which is called the difference of two sets. For example, there are sets *A* and *B* in a space. When the sets are intersected, that means the intersection of sets *A* and *B* is another set, and they consist of common elements *x* of sets *A* and *B*. This is denoted by $A \cap B$ and described by the formula:

$$A \cap B = \{x: x \in A\ and\ x\ \in B\}.$$

Hence, $A \cap B$ is a separate set from sets *A* and *B*. If there is no interaction between the two sets of *A* and *B*, then their intersection is empty, i.e. $A \cap B = \emptyset$. In other words, the intersection set has no common elements with sets *A* and *B*. The empty set is an important notion for boundary and structural coupling in autopoietic systems which will be discussed in later sections. If two sets *A* and *B* are in a union, the set consists of all elements *x* that belong to at least one of the two sets. The union of sets *A* and *B* is denoted by $A \cup B$. It is described by the following formula:

$$A \cup B = \{x: x \in A\ or\ x\ \in B\}.$$

Again, it is another set of elements *x* inside this set that belongs to at least one of sets *A* and *B*. The difference in the two sets of *A* and *B* is the

elements from set A do not belong to set B. The set $(A - B) \cup (B - A)$ is the symmetric difference of sets A and B. This is denoted by $A\Delta B$ with the following formula:

$$A\Delta B = (A \cup B) - (A \cap B).$$

In this situation, there are no common elements shared with the original sets. The expression of the relation between different entities or components can be described by the set language with a relatively complete picture about the relations.

The topology shows the spatial relations between the parts and the whole in a space and the concepts of the elements that are included. Closely related to these concepts is the separation of the surrounding and a set in which the elements are in the interior, exterior and their neighbourhood between other elements within a boundary. Lewin (1936), in his assertion of making psychology a real science with topological concepts of boundaries, described a set as a region to determine a system. If every point in a system can be connected with every other point in this system by a path that entirely lies within it, this is called a connected system. In other words, the elements within a connected system are bounded or in a neighbourhood of the system. Boundaries, in the topological sense, are important for distinguishing a system and its nature as closed or open. Open systems are usually characterised as a set or region for each point of which there is a surrounding that entirely lies within the system. In closed systems, each surrounding of a boundary point contains points that do not belong to the system, i.e. they belong to the exterior. Hence, closed systems are therefore characterised as systems which exclude their boundary points, that is, their surrounding or environment. Any closed boundaries, however, serve to both separate and connect other systems (Lewin 1936). When boundary points are at the same time those of another system, that means the boundaries of these two systems are intersected.

Lewin (1936) explained boundary points as points beyond which one

cannot go without leaving the original system. Thus, the boundary points toward a second region which lies like an island entirely within the first region. Two situations in relation to the nature of intersected boundaries may occur. First, there is the likelihood that the elements in a system would meet both the system itself and the exterior, i.e., the surroundings or environment as an open system. Second, some elements in different sets are situated on their boundaries, which make it difficult to identify whether they belong to the interior or exterior, especially if the neighbourhood relation between the elements is ambiguous. In other words, conflicts may arise among elements on a boundary. Put it into another situation, there is a boundary zone in which the elements within the boundary will have difficulties crossing to another system. The resistance of a boundary zone is indeed a barrier in which it is less effective for elements that use the original amounts of efforts to overcome this obstacle than choosing another method against the barriers.

To comprehensively examine the nature of boundaries and their relations with neighbourhoods, Lewin's (1936) description of boundaries from a psychological perspective attempted to translate them into a topological space. That is, let *X* be the topological space, *A* be a subset of *X*, and *p* be a point of *X*. The point *p* is:

- an interior point of *A* if *p* has a neighbourhood contained in *A*;
- an exterior point of *A* if *p* has a neighbourhood disjoint in *A*;
- a boundary point of *A* if each neighbourhood of *p* meets both *A* and the complement of *A*.

Consequently, neighbourhoods are essential for examining the formation or existence of boundary points. A neighbourhood of point *p* in set *A* is an open set *S* that contains *p*. This means that a neighbourhood point can be moved to some extent without leaving the set. That is, if x_0 is an interior point of *S*, and x_0 has an ϵ-neighbourhood, i.e. $(x-\epsilon, x+\epsilon)$, then *S* is a neighbourhood of x_0. This is also equivalent to *p* which is an element of *X* in the interior of *S* if it is open. If point *p* is an element of *X* which is a closure point of *S*, each neighbourhood of *p* intersects *S*. Hence, the boundary of

subset S of a topological space X is the set of points which can be approached from both S and outside of S; that is, the set of points in the closure of S does not belong to the interior of S. In other words, the boundary of subset S in space X is the set of point p of X such that every neighbourhood of p contains at least one point of S, the interior and at least one point not of S, the exterior, which is denoted as $= \bar{S}\Delta S^o$; where ∂S is the boundary set or boundary zone, $\bar{S}$ is the closure and S^o is the interior set, which is the difference of the closure and the interior. That is,

i. $p \in S$;
ii. there is a neighbourhood U of p such that $p \in U \in S$;
iii. a point $q \in X$ is said to be a boundary point of S if any neighbourhood U of q intersects both S and S^o; and
iv. the collection of all boundary points of S is called the boundary (Krantz 2010).

The neighbourhood relation explains a situation where at least one component of a set in a system meets both system X and its environment. That is a boundary point. Then structural coupling may occur if the environment is triggered. In the case where the neighbourhood of point p is not simultaneously contained in set S and not set S, there is no interaction between the interior and exterior.

The topological expression of a boundary provides an important concept of neighbourhood which has not been explored in the boundary literature on organisations. To identify entities, which are social systems, boundaries must be formed and systems closed. Open systems, on the other hand, lift the identity, and the meaning or responsibilities of the entities become unclear.

In summary, the mathematical and topological explanations of boundaries provide comprehensive definitions of sets and their relations in space under different conditions. Within one set, the elements are collected with characteristics or features that can be distinguished from the space. All

elements have commonality. New sets can be formed with other sets when they intersect, are in a union or excluded. Whether a set is open or closed depends on the boundary. That is, if the elements construct boundary points which only belong to the system, this is a closed system, while boundary points which have a surrounding or exterior that entirely lies within a system is an open system. The extension of the definition of neighbourhoods in topology explains the linkage between elements within and not within a set. However, there is another problem that is found with social systems, which is social interaction that constitutes a situation with double contingency. The KA, although is a self-producing system, requires social interaction within and outside a system. A self-producing system is self-contained to generate components of an entity that will maintain distinction. The KA, on the other hand, helps organisations to work out solutions for collective issues that require amendments or corrections. Consequently, the KA has to connect to the outside world.

Double contingency is a situation recognised by the parties who interact with each other. Parsons (Vanderstraeten 2002) identified two types of contingency factors, namely, the contingency of what an actor actually carries out in the context of an elementary selection, and that of the reaction of everyone else to what is being carried out (Vanderstraeten 2002). The KA entity acts as a social system because the outputs of operation processes are the inputs for other business operation processes in organisations. There is therefore the need to investigate the factors that allow internal components to work together and connect to the outside world in a more concrete manner.

3.2.5.6 *Double contingency problem in social systems*

In his assertion about social systems, Luhmann (1995, 2006) raised the problem of double contingency between individuals and entities in which their interactions occur with uncertainty. Double contingency occurs because the likelihood that different entities meet each other at an appropriate time and then interact with one another to deal with an issue is uncertain. This is because one side does not know the actions likely to be

taken by the other side, and therefore, they are in doubt on how to proceed if they are in the dark about the decisions of the other side. The term “double contingency” was first coined by Parsons (Vanderstraeten 2002). His concept of double contingency comprises two different aspects. On the one hand, there is the potential hazard of conflict between individuals who confront each other. Individuals do not interact with one another. On the other hand, there are accomplishments that could lead to cooperation and sharing of norms and values in a shared symbolic system. Parsons (Vanderstraeten 2002) argued that the interaction of entities is dependent on the integration of the mutual expectations of both entities. This means that the expectations and actions of each component or participant become oriented to the expectations and actions of the other. To solve the problem of double contingency, entities need to anticipate each other’s future expectations and actions, and compromise via consensus, norms and values, to allow the entities to interact with each other and avoid such circularity. The argument by Parsons (Vanderstraeten 2002) focuses on the importance of values and norms under the predominant assumption of a mutual dependence of expectations and actions from the ego and alter.

Luhmann (1995, 2006) expanded on Parson’s double contingency concept as a problem that motivates the constitution of social systems in which different entities interact under at least two autonomous systems which make their own selections in relation to one another. That is, different entities by whatever accident have come to work with one another after they have created sufficient transparency to avoid an unstable or unpredictable future. The individuals, however, remain separate to hold their own selves. They interact with each other just to concentrate on what they can observe as inputs and outputs in the other as a system in an environment. Therefore, even if they may not know each other at the beginning, they would begin by reciprocally signaling their own indications of the most important behavioural foundations, such as intentions; that is, situations that open up opportunities to select aspects that have further usefulness for interacting with others.

There are two considerations under double contingencies. First, there is the need to consider the likelihood that different entities will meet each other at an appropriate time to deal with an issue together. Second, there is the need to consider the ways that entities would interact with each other. Parsons (Vanderstraeten 2002) suggested that norms and values would provide the means for individuals to compromise and interact with each other while Luhmann (1995, 2006) argued that individuals can interact via communication to understand the expectations of each other and self-commit to take action, but at the same time, maintain their self identity. Although Luhmann and Parsons do not provide the same solution for the double contingency problem, they have a common suggestion, which is to allow different entities to meet at a common point. That is, the components of an entity interact with outside components on its boundary zone within a common space under which a neighbourhood relation between the entity and the outside is contained.

4.2.5.7 Neighbourhood

Sociologically, neighbourhoods can be simply defined as a set of social networks in which there is a boundary. Members seek to realise common values and maintain effective social interactions. It is a collection of components with commonality (Dietz 2002) that probably occupy spatially and/or temporally defined areas bounded by social, political or cultural forces. The social interaction within a neighbourhood generates a compositional effect that will influence the behaviour of individuals or a single entity with other entities. In terms of social aspects, the members have interactions and shared expectations, routine activities, and a departmental sense of belonging. Politically, members come together to share a common view on benefit allocation or shared resources. Culturally, shared-values connect members and their perceived acceptable behaviours of the self and members within boundaries (Sampson et al. 2002).

The concept of neighbourhood allows us to understand that within an entity, even if differences are held among members, commonality on some

aspects with tolerated diversities can bond members together into a unique entity. Anything that the members have in common can establish a neighbourhood relation. It is not necessary to be restricted by shared-values as suggested by some of the organisation researchers. The seeking of solutions for some outstanding or defined issues or problems can lead to commonality between members from different business units. Individuals, however, may have their own agenda behind solution seeking actions. The neighbourhood is built under common goals in which the existence of diversity is tolerated.

For example, a person is available to work with an organisation. S/he has the abilities and wants to achieve the objectives when s/he offers his or her time for work. Learning to change or self- improve may be his/her aim. From the perspective of the goals of his/her organisation, preparing for change is a response to new demands in the market. Then, s/he has a neighbourhood relation with the organisation: to make changes. However, the commonality, that is change in the business operations, may not be sufficient enough to carry out the knowledge process. This is because the objectives of the organisation may differ from those of this individual. Understanding of salary compensation may also differ between the two. When both parties accept the different views on compensation and focus on determining the solutions for change, a neighbourhood relation is established. Otherwise, no relation is built between these two parties.

To summarise, a collection of members use boundary properties to separate their environment within a space, and at the same time, establish a neighbourhood relation with the locals and their space, i.e. the organisation, and become a particular set. When there are no elements contained inside or on the boundary due to a lack of neighbourhood relations, the set is empty.

4.2.6 Boundary Properties of KAs

In Sections 4.2.2 to 4.2.4 the autopoietic characteristics of KAs which are composed of a self-producing system, self-referencing, self-observing and their inter-relationship to self-produce their own components,

were conceptualised and illustrated in Figure 4.3. Proposition 1 was presented with the proposed Hypotheses 1 to 3 to verify the autopoiesis of KAs. In Section 4.2.5, a discussion on the theoretical description of boundaries was carried out under different perspectives prior to setting the boundary for autopoietic systems of KAs. In this and the next section, the boundary properties of KAs and the double neighbourhood relations among members who are KAs, their local business units and organisations which bond the members of a learning group to learn effectively are described. Propositions 2 and 3 which focus on the identity and neighbourhood relations are respectively presented.

The KA is defined as an entity, who may be an individual, a team in which the members are from an organization, or outsiders, and willing to put forth effort to acquire knowledge that can probably be retained as a living system in an organisation via creating, retrieving, sharing, implementing processes to manage knowledge in order to help the organisation achieve something, which could be an innovation or a solution. In other words, the KA is capable, willing to put forth effort and take action to acquire knowledge in order to maintain its identity as an agent to learn for bettering the performance of an organisation. It is, therefore, a social system that deals with collective issues in organisations (Simon 1991).With the intent to maintain the functions and identity as a KA, the KA has to assert that it is autopoiesis in nature, yet at the same time, holds the characteristics of social systems in order to interact with members inside or outside the KA entity environment. This embodies the idea that there is a set of elements connected together which form an entity. This entity then shows that under a range of conditions, it can maintain its own identity. The boundary properties of KAs in an organisation, therefore, are components that:

- are capable of carrying out the requirements of a knowledge process,
- are willing to put forth effort on the knowledge process,
- plan to conduct a knowledge process, and

- are members in dual-systems that comprise both autopoietic and social characteristics, whether these are formed by an individual or a group of individuals.

The boundary of a KA is closed so that the components inside can be separated from the environment to reduce turbulence or noises. Otherwise, the KA cannot be defined or distinguished from other business units within an organisation. Without a proper identity, there are no grounds to discuss its properties and effectiveness in organisational learning. Knowledge is the output of the processes conducted by a KA and become the input of other business operations in an organisation. Thus, the KA needs to interact with other entities as a social system.

Proposition 2: The KA set has boundary properties to distinguish a group of members who carry out knowledge processes in an organisation that deals with collective problems or issues.

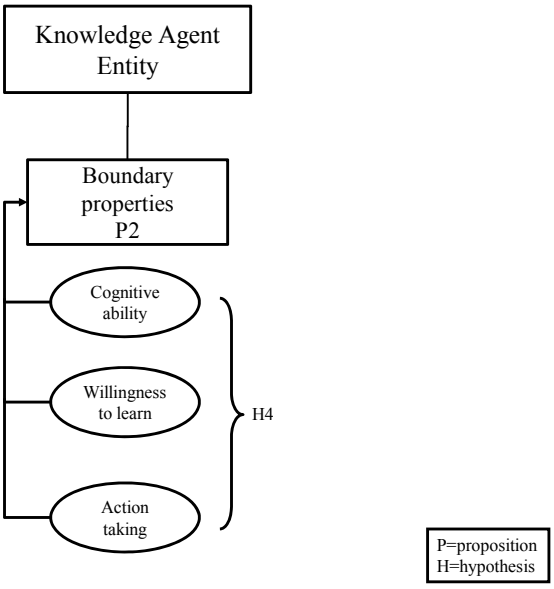

Fig. 4.4 Hypothesis 4 to examine plausibility of Proposition 2

Figure 4.4 shows Hypothesis 4, which is formulated to examine the plausibility of Proposition 2. The constructs of the hypothesis are described in the following sections.

To consider the functions and autopoietic nature of a KA, the boundary is defined as a set of point *p* in a convex region of *X* in that every neighbourhood of *p* contains at least one point of the interior and at least one point of the exterior with the following properties:

1. cognitive abilities to acquire knowledge,
2. willingness to put forth effort on knowledge processes, and
3. takes action to plan and implement knowledge processes to solve problems.

4.2.6.1 Cognitive abilities to acquire knowledge

In general, cognition refers to the process of acquiring and using knowledge to solve problems and make decisions (Mingers 2006, Reed 2010). Cognitive activities include information processing, knowledge application, and preference changes. Information processing is a mental activity that frames the enquiry of an issue or problem related to the performance of organisations and sorts out information into meaningful knowledge. Knowledge application in a collective sense is to practically make use of knowledge in action by aiming to carry out purposive activities in organisational operational processes. Preference changes are the decision activities after new knowledge is acquired. These changes could be for the short or long term.

Cognitive abilities are mentally-based skills which are used to conduct tasks from the simplest to the most complex. They have more to do with the mechanisms of how the KA is aware, learns, remembers, problem-solves, and pays attention to collective issues rather than just carry out tasks with some actual knowledge. This implies that cognition is a sensory input that makes contact with the external world and decisions, regardless whether the decisions are conscious or unconscious. The performance level of cognitive abilities, which refer to all processes by which the sensory input is transformed into a representation of the work, include reduction of information lost and elaboration of memories to share experiences and apply to work, but is not the scope for study and will not be further discussed.

4.2.6.2 Willingness to put forth effort on knowledge processes

The KA is a social system in which the components that are inside and outside the boundary may need to interact with one another. Consequently, another property of the boundary set is that the members distinguish themselves from the outside and are willing to put forth effort towards knowledge processes in organisations; thus they are not forced to become learners. Willingness is internally driven; it is the taking of actions based on attitudes towards or apart from their beliefs. An attitude is a hypothetical construct that represents an individual's degree of "like" or "dislike" for something. Attitudes, however, are judgments. Most attitudes are the result of either personal experiences or observational learning from the environment. Attitudes are related to social cognitive perspectives which impact social information processing. The willingness to take part in a knowledge process is the impact of selective exposure and attention processes towards new information which are separate steps in information processing (Fabrigar et al. 1999). Exposure involves the seeking of information in an active manner, whereas attention processes involve attending to previously exposed information.

4.2.6.3 Taking of action to plan and implement knowledge processes which solve collective problems

The third property is the commitment of those who have these two mentioned properties to create an action plan for knowledge process implementation that deal with organisational issues. The purposes of organisation existence are to provide solutions and pursue stability when they are facing unstable environments. The KA aims to learn to carry out action and changes. It is the group that carries out the learning task for the knowledge process to meet these purposes. The KA is a self-living system. It self-produces its components. Self-producing itself is an action. This characteristic is therefore naturally embraced in the boundary properties. The actions to be taken for knowledge processes are internally driven by self-referring and self-observing. These are explicitly expressed in actions

that will memorise or de-memorise existing knowledge, and re-arrange old and new information in knowledge processes.

Taking action is an essential property of the KA boundary because any actions that take place will generate outputs into the form of experiences, corrective action plans, new findings, or decisions. The results of the actions will obviously affect the stakeholders and the performance of the organisation as a whole. For the KA, the outputs or results are explicit artifacts which confirm that it has the boundary properties to maintain its identity as a learning group that is producing solutions for collective issues. Identity is an important characteristic for self-observation in living systems. The functions of the KA are to learn and apply knowledge which are the provisions for self-maintenance because self-living systems often have a continuing basis and act as an instrument for continuing actions (Argyris & Schön 1978).

Self-referencing activities need cognitive resources as inputs. Actions taken through experience in knowledge processes comprise an important cognitive resource for self-referencing. Therefore, action serves as the means of exploring a situation, producing information which is used for the design of future actions (Argyris et al. 1985). The stream of action results from reflecting with a view to future action on acting again. This dynamic process is referred to as reflective conversation with the situation. Without actions, self-living characteristics cannot take place on a continuing basis because the self-referential condition does not exist. Thus,

Hypothesis 4: Members of a KA set have cognitive abilities to acquire knowledge, are willing to put forth effort on knowledge processes and take action to plan and implement knowledge processes to solve problems.

4.2.7 Double Neighbourhoods

The boundary of a KA is closed. This does not mean the agent acts without connection to the outside world. To connect with others, the KA

relies on neighbourhood relations to reduce boundary zone friction. Boundary zone friction is the force that resists the components inside an entity which is connected to the outside because of role ambiguity among different business units. In boundary zone, neighbourhoods may allow insiders to connect with outsiders in a situation in which differences in objectives between individuals and the collective in their local regions are tolerated. When tolerance exists, the external and the internal can be connected and interact. The boundary zone is a connected region which links the inner and outer regions and provides a path for components between these two regions to cross. Neighbourhood plays a role in reducing friction. The structural coupling of the external environment in closed systems can be carried out when there is a neighbourhood in the boundary zone. Thus,

Proposition 3: The KA entity is a KA set bonded together through commonality and tolerance of differences which creates separation from the environment in learning to deal with collective problems or issues.

A boundary separates the external and the internal. In a boundary zone, friction could be reduced if there is a neighbourhood relation between the interior and exterior. Neighbourhoods contain a path that allows the internal and external to connect, when they have commonalities and differences are tolerated. Commonalities are when more than one element from different entities shares the same attributes of something (Dietz 2002, Sampson et al. 2002). For example, in a business organisation which comprises several functional business units, such as the production, financial and procurement departments, a common scenario is the late arrival of materials, a factor that affects productivity and on time delivery performance of finished goods in the production department. The tardiness also raises other issues that are related to the cash flow arrangement, for instance, material payment settlement and sales revenue receivables. So, it becomes a matter for both individuals who work in the production department and the financial department in that they want to resolve this dilemma. If late delivery is an indicator of the performance of the procurement department,

then the tardiness of the materials in arrival becomes a problem which the procurement department needs to address in order to improve performance. The commonality of these three business units is they have to deal with the subsequent late shipment of materials. To reduce the late delivery of materials, the resultant actions needed to be taken may reflect the different goals of each unit. However, the commonality is sufficient enough to link them together to establish a neighbourhood relation to perform the functions of a KA.

A KA entity is formed in organisations when double neighbourhood relations between the KA set and two internal parties: (i) potential components who are members of the organisation, (ii) the organisation itself, and occasionally external KAs, are formed.

4.2.7.1 Primary neighbourhood

Members of a learning group who have the properties of a KA boundary potentially become the components of a KA entity. The likelihood that an entity becomes a KA to carry out the knowledge process depends on the completion of double neighbourhood relationships. The primary neighbourhood is the relation between the KA set and individuals. The KA set is a group of members who hold the three aforementioned basic properties. It becomes a social system because all of the learning activities involve different units within an organisation. Thus, commonalities are needed to link the set and individuals together. If individuals perceive that the outputs of a KA entity conflict with their formal or informal groups in an organisation; that is, local interests are not compatible with those of the KA entity, the linkage may break. On the other hand, when local interests are tolerated, a neighbourhood relation exists. This is defined as a primary neighbourhood relation which links the KA set to individuals[1].However, a primary neighbourhood is insufficient to allow for the existence of KAs. A

[1] Primary neighbourhood function:

If x_0 is an interior point of *S*, and x_0 has an ϵ-neighbourhood i.e. $(x - \epsilon, x + \epsilon)$, then *S* is a neighbourhood of x_0, where x_0 is a member who has the boundary properties, *S* is the KA set, ϵ-neighbourhood is the commonality between the member and the KA entity in which ϵ is the tolerable difference.

secondary neighbourhood at an organisational level is needed.

4.2.7.2 Secondary neighbourhood

A secondary neighbourhood is an agreement between the KA set and an organisation with which a group learning is needed to allow organisation changes for betterment. Generally, organisations conduct different tasks to achieve different business goals in the short or long term. When an organisation is treated like a single unit, it commits to providing resources for changes and bears short term negative effects during the change processes. Then, the organisation holds a secondary neighbourhood relation with the KA set. When both individual and organisational neighbourhood relations occur, a KA entity is formed and its functions would be legitimate. The secondary neighbourhood function is shown in the footnote[2].

If an organisation lacks commitment in allowing members to learn, the secondary neighbourhood at the organisational level cannot be sustained. This is because organisations take actions to override the aims of organisational learning and only seek practical and immediate solutions, which Argyris and Schön (1978) called single loop learning in theory-in-use behaviour.

4.2.7.3 Neighbourhood relations with external parties

The components of a KA entity are not restricted to internal members. The KA can involve an external party to carry out the learning group functions. Consultation firms are a typical type of learning organisation that often explore, absorb and transfer new knowledge to their clients. They may become KA components to offer services to organisations that require a solution for collective problems. Although external learning agents hold KA boundary properties, the agents also need double neighbourhood relations to bond to the potential external KA components with an existing KA set which are simultaneously composed of organisation

[2] If x_0 is an interior point of X, and x_0 has an $\epsilon -$ neighbourhood i.e. $(x-\epsilon, x+\epsilon)$, then X is a neighbourhood of x_0, where x_0 is the member who has the boundary properties, X is the organisation, $\epsilon -$ neighbourhood is the commonality between the KA entity and the organisation in which ϵ is the tolerable difference.

members and the organisation. However, the establishing of double neighbourhood relations is not the same as that between an organisation and its internal members.

To integrate an external party into the KA set, the problem of double contingency must be solved. The first contingency is whether organisation members who are on the organisation boundary can meet the external party. The second contingency is whether members on the boundary would forward a new referential message sent from the external party to the organisation to establish a neighbourhood relation. When the double contingency problem is eliminated, a primary neighbourhood relation may then develop. The primary neighbourhood relation between an external learning agent and the organisation is not same as that between internal members and the KA set. The primary neighbourhood relation with an external learning agent is for the purpose of finding commonality between the organisation and external agent in two orders: the first order is with the organisation; the second order is with the internal members of the KA set.

In a first order neighbourhood relation, the organisation commits to reserving resources to establish a KA entity with an external party and tolerates organisational objective differences between the two entities. If the internal members of a KA set establish a neighbourhood relation with the external agent, then the second order neighbourhood will follow. That is, both the external party and internal members of a potential KA entity share a common expectation. Thus, the external agent in a knowledge process not only transfers the available knowledge, but needs to work together with internal members to create and apply the knowledge. The first neighbourhood relation reduces the friction of the external agent as s/he enters the organisation to form the KA entity. The dual-order, i.e. the individuals and external agent, and the organisation and external agent; of the primary neighbourhood relation with an external KA is illustrated in the

footnote[3].

Figure 4.5 shows Hypotheses 5 and 6, which are formulated to examine the plausibility of Proposition 3. The constructs of the hypotheses are described in the following sections.

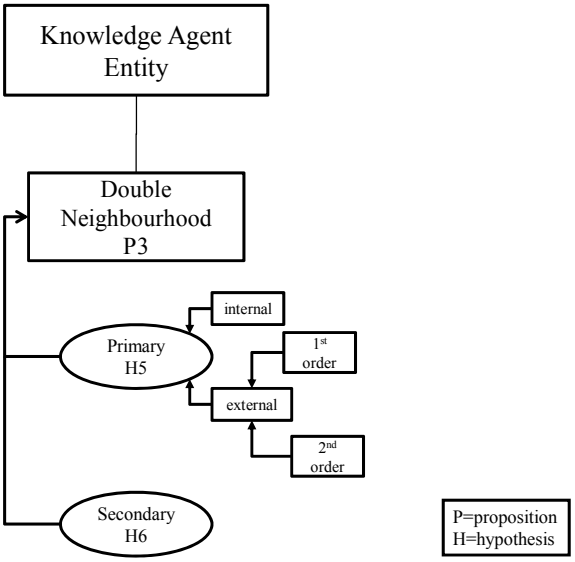

Fig. 4.5 Hypotheses 5 & 6 to examine plausibility of Proposition 3

4.2.7.4 Different forms of learning groups

A learning group is defined as a group of members who carry out the knowledge process in an organisation with the intention to deal with

[3] First order neighbourhood relation:

If y_0 is a boundary point of $\boldsymbol{X}$, and y_0 has an $\epsilon -$ neighbourhood i.e. (y-ϵ, y+ϵ), then $\boldsymbol{X}$ is a neighbourhood of y_0, where y_0 is the external party who has the boundary properties of the KA, $\boldsymbol{X}$ is the organisation set, and $\epsilon -$ neighbourhood is the commonality between the external party and the organisation in which ϵ is the tolerable difference.

Second order neighbourhood relation:

If y_0 is an interior point of S', and y_0 has an, $\epsilon -$ neighbourhood i.e. (y-ϵ, y+ϵ), then S' is a neighbourhood of y_0, where y_0 is the external party who has the boundary properties of the KA, S' is the KA set that contains the internal members, and $\epsilon -$ neighbourhood is the commonality between the external party and the KA set in which ϵ is the tolerable difference.

collective issues. In the following scenario, learning groups are described, who are at various levels of completing the boundary properties that are held by members. The neighbourhood of the members inside or on the boundary zone will also be further discussed in terms of its relation with structural coupling outside the boundary and how the neighbourhood forms the KA set to become an autopoietic self-living system and maintain identity and distinction.

Elements contained in a system have no duration restriction or guarantee, and therefore, the system is constantly pressured to produce new elements for survival (Seidl & Becker 2006). To ensure that the KA entity carries out the knowledge process for organisational learning, the boundary properties cannot be changed. Instead, the components of the KA entity are kept in a fluid status because knowledge requirements are often dynamic. A KA entity could be solely constructed with internal members.

External members may also be recruited to enrich the cognitive resources of a KA entity for learning. As discussed, individuals in organisations play various roles in different situations and time, so neighbourhoods are important links to the formation of a proper KA entity in which the different beliefs of its components are tolerated, so that they can work together for collective issues.

Basically, any learning group, which has complete boundary properties; that is, the cognitive abilities to acquire knowledge, willingness to put forth effort towards a knowledge process, and takes action to plan and implement knowledge processes to solve collective problems, has the potential to come together and become components of a KA entity. When the potential members and the organisation have double neighbourhood relations with a KA set, the KA entity would then be activated.

A proper KA entity is a group of internal and/or external members with boundary properties and double neighbourhood relations at the local level (the individuals in their department) and the universal level (the

organisation)[4]. When learning groups do not completely fulfil the conditions for becoming a proper KA, other types of KAs may still exist in organisations to conduct knowledge processes, but the likelihood of obtaining positive solution values are questionable.

Under the consideration of the completion of double neighbourhood relations, learning groups are classified into four KA categories: proper, quasi-, pseudo- and none. Proper KAs have both boundary properties and double neighbourhood relations. The idea of neighbourhood is about the "closeness" of an arbitrary collection of sets in which the neighbourhood of a component is a set named as the KA entity which contains all points sufficiently close to that component (Trench 2003). Then that person becomes an interior component of that set. If the points are insufficiently close, the differences between the potential members and the neighbourhood set are not tolerated, and the neighbourhood relation is delinked. Hence, a proper KA is the only one with full KA properties. Other types of KAs have the forms with incomplete neighbourhood relations or boundary properties.

Members in quasi-KAs have KA boundary properties, but the double neighbourhood relations are not fully established. Thus, these organisations only experience impacts at the local basis. Pseudo-KAs, however, are not real learning groups. Most of the time, the members are appointed by organisations without at least one of the three properties that comprise a boundary. In this situation, either the KA set is a deleted set or the knowledge process is outsourced to an external KA without completely establishing a double neighbourhood relation. Among these four types of KAs, only proper KAs carry out learning functions for change to respond to an external environment that help organisations achieve collective goals via knowledge processes. Thus,

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[4] The neighbourhood relations:
Let K be a KA set and K' be an external KA set. X is denoted as the organisation in which the internal KA exists, i.e. $K \subset X$, but $K' \not\subset X$. Therefore, a boundary set of K is $\partial K = \overline{K} \bigcap \overline{(X \setminus K)}$ and the boundary of K' is $\partial K' = \overline{K'} \bigcap \overline{(X \setminus K')}$. However, K is a non-empty set if there exists a set of points p of X such that every neighbourhood of p contains at least one point of K and at least one point not of K .

Hypothesis 5: The members of a KA set which has been formed by internal individuals of an organisation have commonality and tolerate differences to establish double neighbourhood relations at the local unit and organisation levels.

Hypothesis 6: The members of a KA set which include internal people and an external agent have commonality and tolerate differences to establish double neighbourhood relations at the local unit and organisation levels.

However, there are two situations where either a KA set does not exist or the neighbourhood relations do not exist in an organisation, even if there are attempts to retain organisational learning.

4.2.7.5 Deleted KA set

Apart from the primary and secondary neighbourhoods, the neighbourhood relation between the individual members in a KA set has to be taken into account. Even if there are individual members who hold the boundary properties of a KA set, they would not become the components of the KA entity if conflicts exist between individuals and the role as the KA. In such situations, the KA set will not establish any neighbourhood relations at the individual and organisational levels. The potential KA entity then becomes a deleted set.

4.2.7.6 Deleted neighbourhood

Similarly, neighbourhoods may be deleted. Boundary zone ∂S is denoted as $\partial S = \bar{S}\Delta S^o$, where there is a neighbourhood relation between the external and the internal. With reference to the example given, the financial department has commonality with the other departments in that they all suffer from the delay in material delivery. In the case where the department is not willing to put forth effort to solve the problem, or perceives that the problem should be resolved by the purchasing department, then even if there is a commonality between the potential KA and the department for establishing a neighbourhood relation, the department does not have the

boundary properties of a KA, i.e. willingness to put forth effort for knowledge processes. In this situation, the department only contains a deleted neighbourhood. A deleted neighbourhood of point x_0 is a set that contains every point of some neighbourhood of x_0 except for x_0 itself, such as $S = \{x|0 < |x - x_0| < \epsilon\}$. The deleted neighbourhood consequently means that no KA entity exists in an organisation and therefore, knowledge processes cannot be carried out.

4.3 KA Model

In previous sections, the constructs of KAT were theoretically developed. Learning groups that conduct knowledge processes for organisations to solve collective problems, however, may not fully hold the autopoietic nature to become a proper KA. With the consideration of the completeness of holding boundary properties and double neighbourhood relationship, a KA model is developed and shown in Figure 4.6. In this section, four categories of KAs, namely proper, quasi-, pseudo-KAs and no KA exists are established. The full spectrum of KAs illustrated in Table 4.2 which is shown at the end of this section gives a holistic picture to explain why organisations do not learn under the incomplete condition of learning groups as a self-living system.

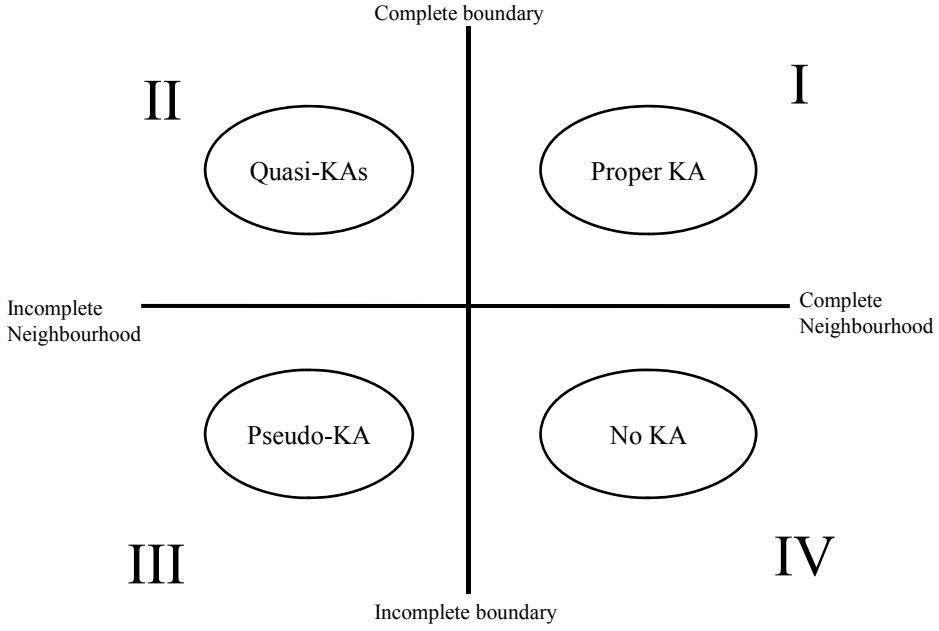


Fig. 4.6 KA Model

4.3.1 Proper KAs: Unblocked KAs

Unblocked KAs contain the whole functions of being a KA entity. Their boundaries are closed in order to maintain autonomy and identity. To keep their functions of conducting knowledge processes, unblocked KAs often carry out self-referential activities to trigger the external world. The double neighbourhood relation between the external and internal parties is therefore important for self-producing and self-observing activities. When a KA is unblocked, it has the following properties:

1. internal members hold all the boundary characteristics and double neighbourhood relations within an organisation,
2. external members hold all the boundary characteristics,
3. there is commonality between the organisation and the external members where differences are tolerated, and
4. there is commonality between the external and internal members where differences are tolerated.

The external members integrate into a KA entity in order to carry out two functions. First, they transfer new knowledge to the agent to increase the cognitive resources of the KA. Second, they are recruited as participants in knowledge processes to activate organisational learning. The self-referencing process makes use of the cognitive resources within the entity to examine the continuation of holding the original components to maintain its KA identity. To enlarge the cognitive resources of the entity, the KA conducts self observation to identify the need to integrate other resources to actualise the capability of self-producing KA components for learning. External KAs, therefore, are recruited to increase knowledge.

In unblocked KA entities, external members are admitted as components of the KA after the primary and secondary neighbourhood relations are established. First, commonality is found between the organisation and the external KA; at the same time, differences in the goals

of these two entities are tolerated. Then, the organisation becomes a neighbourhood set of the external KA. Second, the external KA becomes the neighbourhood set of the internal members which eliminates conflicts of interest, if any, so that the friction among external members with the entry of the agent can be reduced. Having established an external double neighbourhood, the KA boundary is structurally coupled with the external KA. The cognitive resources of the KA can thus be extended. Besides that, the double neighbourhood relation also resolves the double contingency situation in that the two separate entities work together to achieve something towards the collective goals of the organisation.

4.3.2 Quasi-KAs

Quasi-KAs are learning groups, but do not learn effectively. Members in quasi-KAs have boundary properties. However, the double neighbourhood relation is not fully established. In other words, either commonality is not found or differences between members are not tolerated. Hence, the knowledge process will only be locally carried out and the impacts fail to extend to the organisational level. There are four sub-groups of quasi-KAs: blurred, blocked, un-recognised and local learning groups.

Blurred KAs

When a second order neighbourhood relation cannot be established; that is, the external KA and the internal members fail to find a commonality or tolerate differences, the former does not integrate into the organisation to become a component of the KA entity. In this situation, the cognitive resources cannot be integrated into the learning group that is composed of internal members. The external KA does not impact the learning process. That is why intervention as suggested by Mingers, Midgley or other researchers is insufficient to mobilise learning processes. Organisations that integrate with external members cannot expect to increase cognitive resources, or determine whether the contribution of knowledge process outputs is from integrated outsiders or internal members themselves. Sometimes organisations find it difficult to identify that the root cause of

low impacts obtained from an external KA stems from the incompletion of second order neighbourhood relations.

Blocked KAs

When a KA entity exists in an organisation which only contains internal members, it is not triggered by the external environment and no structural coupling will be implemented. The KA only has double neighbourhood relations at the individual and organisational levels. Components within the learning group have complete boundary properties, but only find commonality and tolerated differences between the KA set and the internal members, and between the organisation and the KA set.

The KA is forced to only involve internal members. This may be caused by three factors: (1) the self-referencing results do not show extra cognitive resources, which include new knowledge, skills, etc. from the external KA which is needed to maintain its identity, (2) the first and second order neighbourhood relations have failed to be established, or (3) the self-referencing activity is inactive or disabled. In the first two scenarios, the KA is temporarily closed. In the first scenario, the self-referencing process recursively examines the likelihood of structural coupling with members outside the entity. When the agent receives notification that some autopoietic properties cannot be maintained, it will search the neighbourhood location and integrate new members to form new components. This self-producing process will generate new components of the autopoietic entity. The KA will become unblocked again. In the second scenario, the KA may continue to search for external KAs until first and second order neighbourhood relations are attained. In the final scenario, the KA is dissolved because it cannot hold autopoietic properties.

Un-recognised KAs

When a learning group is formed by internal members and function as a KA, but a secondary neighbourhood relation is not established, this is known as a un-recognised KA. That is, the organisation does not have any

commonalities with the KA set or the differences between these two sets cannot be tolerated. In this situation, even if the learning group tries to activate the functions as a KA entity, the processes are ineffective. The aim of a KA entity is to solve collective problems or issues. Individuals who commit to carrying out knowledge processes unavoidably involve other members or units within an organisation. Without a neighbourhood relation with the organisation, it is doubtful whether there are resources to carry out knowledge processes. Hence, a quasi-KA in a un-recognised form may occur for a relatively short period of time, but the impact would be limited and agent learning activities may not last long.

Local learning groups

Unlike the unblocked KA, learning groups are categorised as such when they hold all of the KA functions except for primary neighbourhood relations. Individual members do not have commonalities or conflicts of interest with the local unit and the KA set. Therefore, members only carry out the knowledge process in a restricted manner in their individual workplace without involving other members in an organisation. This type of KA cannot effectively solve collective problems. Thus, it is not a proper KA.

4.3.3 Pseudo-KAs

Argyris and Schön (1978, 1989, 1996) argued that many actions of managers are governed by four rules in Model I of theory-in-use behaviour, namely: (1) to unilaterally design goals and try to achieve them, (2) to maximise winning and minimise losing by controlling the task with as little dependence on others as possible, (3) to minimise the generating or expressing of negative feelings in public, and (4) to withhold their own thoughts and feelings, be rational and objective, and suppress the vocalisation of feelings by others. The attitudes of management towards the control of activities conform to these expectations because there is the belief that stability is important, although change is necessary. Thus, initiatives are restricted under the consideration that present practices cannot be altered or rules cannot be violated (Pugh & Hickson 2007). The problem with the

malfunctioning of a KA is that the entity itself either cannot exist in the organisation or is undistinguishable as the boundary is not there, as stated. Unlike the other types of KAs mentioned above, pseudo-KAs are unities established in organisations which are perceived to be proper KAs. However, their generated outputs are incompatible with expectations. The organisations fail to learn which result in no changes. As pseudo-KAs are not real KAs, they do not have autopoietic characteristics. Consequently, they do not know that they are pseudo in nature. This occurs in organisations because a secondary neighbourhood exists.

Pseudo-KAs occur in organisations because the organisations are aware that a learning group is needed to resolve collective issues. Hence, these organisations take an active role in forming the group and therefore, a secondary neighbourhood exists. However, if the members who are internally or externally recruited into the learning group do not have at least one of the three properties that comprise a boundary, a proper KA cannot be actualised. There are two types of pseudo-KAs. The first is the delegated KA in which internal members are delegated to form a learning group. The other one is the non-integrated KA in which the external KA does not have the cognitive ability to understand the needs of the learning group or the organisation.

Delegated KAs

Delegated KAs are entities which are formed by internal members appointed by their organisations to establish a learning group, but the primary neighbourhood relation is not established, and the members do not have at least one of the three properties that comprise a KA boundary. Since the members of the learning group often have multiple roles in the organisation, the members of the delegated KA may not be willing or take actions to change when there are conflicts of interest. The governing values or assumptions behind the actions are not changed. Argyris and Schön (1978) called this single loop learning. The incompletion of boundary properties inhibits the functions of the agent in generating new knowledge. The KA set

is not a neighbourhood set of the recruited members. The neighbourhood location involves differences between the KA set and individual members which cannot be tolerated. The possibility of eliminating collective problems is lower than the expected outcomes.

Non-integrated KAs

Sometimes double neighbourhood relations with external members at the individual and organisational levels are established in a KA set, but the KA set is not yet a proper KA. This is because the external members do not have complete boundary properties, i.e. the cognitive ability to understand the needs of the organisation is deficient. Therefore, even if double neighbourhood relations exist among all related parties, the agent is still pseudo in nature. The new knowledge learned by the components of internal members might not be able to resolve the problems as that knowledge is not relevant. This results in corrective actions which will be generated, but the outcomes are less than expected. The root causes of the problems still remain. The organisation, however, may not be aware that the learning group has not learned from the external agents. When the KA components of the internal members hold the neighbourhood set to search for cognitive resources from an external source, the agent may have opportunities to integrate appropriate external members who have the cognitive ability to understand the problems and provide appropriate knowledge to extend the cognitive resources of the KA. Then, the non-integrated KA may transform into an unlocked KA.

In the situation that internal members do not have a second order neighbourhood relation with external members, and/or a primary relation with the KA set, the learning behaviour would be the same as that of a blocked KA. However, the organisation may not be aware that the learning group does not learn. Thus, it may not have any intention to search for other external members to extend the cognitive resources of the KA.

4.3.4 No KA exists

When an organisation does not have a KA, the knowledge process is either outsourced or the KA set is empty when no members are suitable enough to carry out the knowledge process. The former is called a delinked KA while the latter is called a deleted KA set. Delinked KAs occur when external KAs are employed to solve a collective issue, but no internal members are involved in the process. In other words, the knowledge process is incomplete as no knowledge is transferred from the external source to internal members. The organisation does not learn. This means that if the problem occurs again, the organisation does not have any memory of the solution. Thus, resources spent on previous events do not bring forth any benefits into the future.

Deleted KAs exist in a specific time and particular situation, and the organisation needs to activate a KA entity, but no internal or external members at that moment are suitable enough to be the components. Under this situation, the organisation is aware that the agent entity is an empty set within the organisation. The organisation may continue to search and recruit individuals to actualise and activate the functions of a KA. Table 4.2 summarises the types of KAs.

Table 4.2 Types of KAs Part I

Types of KAs	Potential components of KAs			Neighbourhood relation with KAs				√ - exist x – not exist
	Boundary Properties			Primary neighbourhood			Secondary neighbour-hood	
	Cognition	Willing-ness	Action	1st order Org.	2nd order Local (Indiv.)	Dealing with collective goal Local (Indiv.)	Universal (Organisation)	Neighbourhood establishment actions
Proper KA								
Unblocked	√	√	√	√	√	√	√	All neighbourhood relations established. Self-referencing and self-producing activities maintain.
Quasi-KA								
Blurred	√	√	√	√	x	√	√	Conflicts of interest may occur between the external and internal potential components.
Blocked	√	√	√	x	x	√	√	No external parties are recruited. Self-referencing activities may create structural coupling that involves external party. Double contingency problem occurs. No external parties are available.
Un-recognised	√	√	√	--	--	√	x	Individual members activate KA role. However, organisation does not include knowledge management as business activity. Problems within the local unit that does not connection to other departments may be solved, but collective issues still occur.
Localised learning group	√	√	√	√	√	x	√	Members from local departments have conflicts with the KA set which are not tolerated. Solutions generated are for only settling local problems.
No KA								
Delinked (outsourcing)	--	--	--	√	√	x	√	External knowledge agent is employed, but no internal members participate in the problem solving processes. The organisation does not gain any knowledge.
Deleted (empty set)	--	--	--	--	--	√	√	Members within the organisation admit that KA is not needed and no members hold the properties to be components of a KA.

Table 4.2 Types of KAs Part II

Types of KAs	Potential components of KAs			Neighbourhood relation with KAs				√ - exist x – not exist
	Boundary Properties			Primary neighbourhood			Secondary neighbour-hood	
	Cognition	Willing-ness	Action	1st order Org.	2nd order Local (Indiv.)	Dealing with collective goal Local (Indiv.)	Universal (Organisation)	Neighbourhood establishment actions
Pseudo-Knowledge Agent (properties held by internal members)								
Delegated	x	√	√	--	--	x	√	Only neighbourhood relation between learning group and organisation is found.
	√	x	√					Single loop learning. The agent is taking corrective actions to meet the local requirements. Root of problems at collective level is not eliminated.
		√	x					Conflicts of interest may occur between the internal potential components and their identities in other situations.
		x	x					
Pseudo-Knowledge Agent (properties held by external members)								
Non-integrated	x	√	√	√	√	√	√	Recruited external members have no cognitive ability to understand the needs of served organisation. Behaviour similar to blocked knowledge agent but internal components may learn via structural coupling to absorb new knowledge.

4.4 Identity and Autopoietic Properties

The KA set is not a static unity. The self-observing behaviour with cognitive resources obtained from autopoietic processes renders the entity to produce components with outsiders who are not within the boundary via structural coupling. Neighourhood relations within the boundary zone, however, are easier to delink. The KA will subsequently find it easier to act as a quasi- or pseudo-KA. To overcome this paradox, the entity recursively self-refers its neighbourhood condition towards individual and organisational levels in order to ensure the commonality between components can override their differences. Without self-referential activities, the existing KA lack information on two issues. First, the KA is not aware of the changes in the components within the boundary. In other words, the existing KA boundary properties are incomplete. This may happen when the neighbourhood link is broken and conflict between organisation and individuals, internally or externally, emerges. The original components are no longer willing to put forth effort to carry out knowledge processes and/or do not carry out the means to solve problems. The former could be caused by incidents such as when members feel that compensation has been unfair or there have been unfavourable outcomes generated in previous knowledge processes, which means that the learning group members have lost their willingness to commit to learning for collective issues. In the latter, there are conflicts between the local department of the members and the KA set so that the members stop implementing the action plan for solving the collective problems. Under either situation, the learning group becomes a pseudo-KA. The identity of the KA may then be lost without giving any indication to the organisation.

Second, the awareness of the need for structural changes in the components in order to respond to changes in the business environment is not known. This means that the existing KA entity does not have complete boundary properties, in particular, the taking of action to plan and/or implement knowledge processes. Acquisition of knowledge is the action of

knowing. As defined, the KA is a unity for acquiring knowledge that will help an organisation to address collective issues. It is self-contained in nature. Yet at the same time, it is a composite unity that integrates with the organisation so that its self-producing outputs become the inputs for the purpose of supporting a larger entity in operation. The KA cannot stand alone; otherwise, it will have a meaningless existence. Therefore, the KA needs to interact with other components to form the composition. The self-referential activities, through the establishment of double neighbourhood relations, provide relatively more opportunities to the entity in extending cognitive resources.

The KA, although a closed system, is often entangled into unpredictable or unsuspecting situations. The possibility of allowing an agent to acquire signals from the outside world is through neighbourhood relations by self-observation with cognitive resources because the KA is also a composite unity constituted by components of different structures which is treated as a simple unity to realise the autopoietic system. With neighbourhood relations, the original components have opportunities to interact with members who primarily do not belong to the KA set. So if needed, the KA may even spatially and temporally restructure its components to maintain boundary properties under the consideration of the current situation. Without such self-referential and self-observing behaviours, the system disintegrates due to loss of original identity in that it cannot generate awareness of making decisions on what to produce.

The KA compares current and expected cognitive resources via the establishment of neighbourhood relations so that the boundary properties of the KA can be kept. The neighbourhood linkage, as previously discussed, is unstable which is insufficient to maintain the KA identity. The bonding force that joins members together from different locations will be weakened or broken by the local interests of individuals or functional departments of members. The KA will become a pseudo-KA if the neighbourhood falls into a non-convex region where although commonality of learning exists, local interests override the commonality or differences are not tolerated by other

component members. The links between the KA set and other parties are broken. The outputs of self-referential activities provide cognitive resources to the KA to examine neighbourhood relations and eliminate the possibility of the current KA in becoming a pseudo-KA. At the same time, a recursive review of cognitive resources enables the current KA to produce new meanings of existing things. The new meanings stem from comparisons of current components and requirements of structural coupling with external members inside or outside the organisation. Thus, the autopoietic properties maintain the KA entity as a living system that carries out the function of a learning group for organisational changes.

Hypothesis 7: The learning group is a KA entity which holds autopoietic characteristics, boundary properties and double neighbourhood relations.

4.5 Conclusion

In this chapter, KAs are theorised as entities that have autopoietic properties and self-produce components for continuation. The members of KA entities have cognitive capacities and circularity to reflect on their experiences in order to continuously learn. The outcomes of its self-producing system are: (1) solutions and knowledge that bring positive impacts and usefulness for the organisation to make better decisions and effectively carry out operations, and (2) experience gained in the knowledge process which helps the KA entity to review needs in learning and justify the structural coupling of new members to the KA set. Basically, the components of the KA are constructed by members who have the cognitive ability to learn new knowledge, willingness to participate in learning processes and take action to change. In most situations, the components of the agent are constructed by members in the same organisation. Occasionally, the components are also from external organisations. The constitution of a boundary that allows the existence of the KA relies on double neighbourhood relations. The self-referencing process increases the cognitive resource base from memorised knowledge or experience,

recursively accumulated within the agent to justify whether the components sufficiently maintain the properties of self-producing via the self-observing circular selection path of structural changes with the outcomes of previous interactions of components in the knowledge process. Since the KA is a composite unity, it continuously checks the component structures to avoid the possibility of becoming a quasi- or pseudo-KA, or an empty set. At the same time, it also uses neighbourhood relations to extend cognitive resources acquired from the external KA in order to ensure that its identity will not be lost. The constructs of a KAT is depicted in Figure 4.7 and the hypotheses under the three propositions are summarised in Table 4.3. In moving toward verification of the KAT constructs and investigation of the hypotheses (Figure 4.8), the next chapter will discuss the findings and evidence obtained from an empirical study to testify the propositions and hypotheses on the KAT and the behaviours of learning groups in leagile manufacturing organisations.

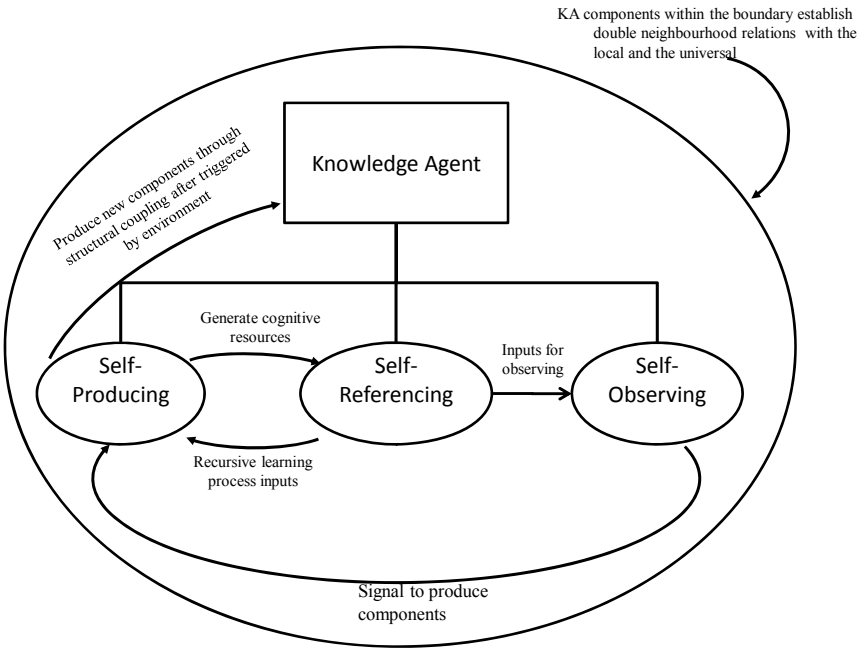


Fig. 4.7 Constructs of KAT for organisational learning

Table 4.3: Summary of Propositions and Hypotheses

Proposition 1: The KA entity is a group of members who maintain a continuous learning capacity to deal with collective problems or issues. Hypothesis 1: A KA recursively uses learned knowledge (learning skills and useful knowledge or solutions) to generate new meanings of things (new goals, learning skills, applications of knowledge, solutions) as inputs of forthcoming knowledge processes (self-production). Hypothesis 2: The KA maintains awareness by reviewing components through reference to its cognitive resources, and outputs become inputs of self-observing activities in order to keep an identity for learning (self-referential). Hypothesis 3: The KA examines the need to conduct knowledge processes by observing its cognitive resources to solve collective problems or issues in order to sustain its identity for learning (self-observing).
Proposition 2: The KA set has boundary properties to distinguish a group of members who carry out knowledge processes in an organisation that deals with collective problems or issues. Hypothesis 4: Members of a KA set have cognitive abilities to acquire knowledge, are willing to put forth effort on knowledge processes and take action to plan and implement knowledge processes to solve problems.
Proposition 3: The KA entity is a KA set bonded together through commonality and tolerance of differences which creates separation from the environment in learning to deal with collective problems or issues. Hypothesis 5: The members of a KA set which has been formed by internal individuals of an organisation have commonality and tolerate differences to establish double neighbourhood relations at the local unit and organisation levels. Hypothesis 6: The members of a KA set which include internal people and an external agent have commonality and tolerate differences to establish double neighbourhood relations at the local unit and organisation levels. Hypothesis 7: The learning group is a KA entity which holds autopoietic characteristics, boundary properties and double neighbourhood relations.

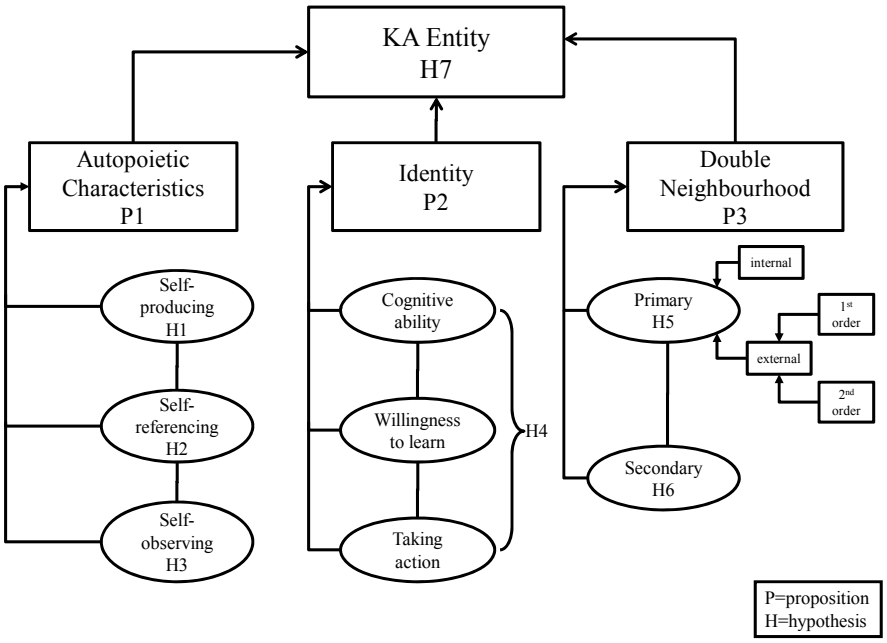


Fig. 4.8 Research Framework of KAT: Propositions & Hypotheses

Chapter 5 Research Data Analysis, Findings and Discussion

5.1 Introduction

In this chapter, the data collected from the four firms in the field study under the new method CNERMs are analysed. To begin with, variables of the KAT are identified and validated by collecting evidence from different sources to triangulate the data and eliminate bias. Then, the constructs of KAT is verified to answer the research questions about the likelihood of KAs to be self-producing living entities. The participating firms are specifically selected as they have the patterns of a spatial model (Quinn & Rohrbaught 1983) which includes all three types of production modes per the replication logic (Yin 2009). The findings are discussed in light of the hypotheses in Chapter 3 on the learning behaviours of a proper KA who carries out knowledge processes and generates positive impacts to organisations.

5.2 Background of Participating Firms and External KA

5.2.1 Background of Participating Firms

The general background of each participating firm is described in Appendix XIV and summarised in Table 5.1. At the focus group discussion, each firm selected a key collective problem to address at the operation management training workshop which was based on the following characteristics: (1) an issue that exists in the firm which has affected overall performance; (2) the results have high stakes, that is, outcomes which the executives believe will significantly affect the firm's performance; (3) involves as many of the functions of the firm as possible; and (4) an issue that should be considered representative of the "major" issues encountered by the firm. The problems studied in the workshops included shortening of the total production lead time, refining of procurement systems, reducing of the lead time to make samples and reexamining the product engineering functions. The participants of each firm are listed in Appendix XV and their collective problem of each firm is described as follows.

Table 5.1: General background of participating firms

Firm	Production mode	Product	No. of employees	Production base	Primary markets	Monthly production capacity
Alpha	OEM	Lightweight apparel	3,500	Shenzhen, Jiangsu, Cambodia	U.S., Europe, Japan	888,000pcs
Beta	OBM	High end knitwear	1,300	Shenzhen, Guangzhou, Shanghai, Vietnam	Europe, Japan	203,000pcs
Gamma	ODM, OBM	Denim, bottom-weight greige, bi-stretch fabrics	300	Hong Kong	U.S., Europe, Japan, Hong Kong	2 millions yards
Delta	OEM	Lingerie apparel	700	Dongguan	U.S., U.K., Canada	220,000pcs

Current problem at Alpha Company: Declining productivity

Alpha Fashion Manufacturing Ltd. (Alpha) has set a strategic plan in that the Shenzhen plant which houses the headquarters will be developed as a centre for product engineering. The production management model would be used to train operators of subsidiaries and sub-contractors to give them the necessary skills. At the time that the firm was invited to participate in the research study, they had been facing the problem of continuous declining productivity of more than twenty percent for the last two years.

The top management at Alpha realises that the firm needs to change to cope with the new leagile business environment, particularly for its current client who is renowned for offering fast fashion items in the global fashion market. In the last two years, they have implemented numerous action plans for the sampling room, merchandising department, production, quality assurance and procurement. The lifetime of most of the action plans were only a couple months. The firm expected to gain new operation management knowledge that will raise productivity to 1.2 million pieces of apparel per month, which at least comprises the same among that they had two years ago.

Collective issue at Beta: Desire to become a core high end knitwear supplier in the global market

Beta Knitwear Ltd. (Beta) is a knitwear exporter that serves the high end knitwear fashion market in Japan and Europe. After the global financial crisis in 2008, the order numbers reduced by more than one third and the unit price was lowered by 15%. The firm decided to explore new markets in Europe to replace the primary customers in the Japanese market. Beta now receives orders from France, Spain and Germany. The unit price bounced back to that before the financial crisis. Beta realised that to maintain business competency and take the place of the Italian suppliers to become a core producer in high end knitwear, the firm should integrate the trading unit with the production unit in Shenzhen to shorten the total product development and production lead time.

When the field study of this research was conducted, Beta started their strategic plan of integrating the trading unit with the production unit. The idea of integrating the trading and production units into one single entity became an important business strategy that aimed to maximise the production capacity and reduce the total lead time. This new business strategy has propelled Beta toward radical changes and involves issues between the trading and production units that have unavoidably brought about many challenges to Beta: the willingness to exchange information, profit sharing, cost distribution, etc. Therefore, Beta established a learning group to participate in this study as they expected that the new knowledge would provide them a smooth integration.

Gamma Fabric Manufacturer: Bettering supply chain management

Gamma Fabric Mill Ltd. (Gamma) is a fabric mill with production facilities in Hong Kong. It is a market leader in manufacturing bi-stretch, technical denim and advanced cotton fabrics. The monthly production capacity in 2009 reached two million yards. Similar to their rivals, they realise that there is the challenge of high labour costs in the production of goods in Hong Kong. Consequently, the firm has been trying to strategically

eliminate total costs in order to save on the costs in acquiring materials, shortening the production process time and reducing costs in core operations, supportive operations and quality improvement.

The parent company of Gamma also owns another business unit in cotton yarn spinning in China. The spinning unit is the sole cotton yarn supplier to the firm. The latter was in the same premises as Gamma before the production facilities moved to China a year ago. Gamma foresaw that the relocation of the yarn production facilities may generate some deficiencies in the production processes later. During the time that Gamma accepted the invitation to participate in the research study, the firm was working on bettering the yarn supply management and continuously improving product performance. To seek new ideas and knowledge for achieving their most recent improvement plans, the firm intends to take the opportunity to review their supply chain management in order to reduce disruption.

Current problem at Delta: Increase in costs and high labour force turnover rate

Delta Lingerie Apparel Ltd. (Delta) is a typical OEM that produces lingerie apparel for both large and small lingerie retailers primarily in the US. Except for the sales and finance departments, all of the operations are located in the production plant in Dongguan, a county in Guangdong, China. Like most apparel manufacturing firms, Delta also has several sub-contractors who are dispersed in different counties within Guangdong. Delta has been changing its production operations and skills to response to the changes in the leagile business environment which include: a short delivery time, small quantities per order, and a wide variety of each product collection. The new market environment has caused the firm to bear higher production and raw material costs. Under this situation, Delta often works on reducing the overall costs in order to maintain competency. However, the firm has only focused efforts into reducing production costs. This is because the managing director believes that after the quota system phased out in 2005, cost is the key factor to remain competitive. Thus, he has not come

across any other operations which may affect the overall performance. In his mind, the garment industry is a sunset industry in Guangdong after the quota system was phased out. Consequently, there is not much room left for him to improve things.

5.2.2 Background of External KA

Benjamin, a management consultant, was invited to act as the facilitator to conduct the operation management training workshops for the participating firms. He is a strategic consultant uniquely positioned to help firms strategise and improve productivity and performance. He has developed a new model known as “streamline management”, which enables enterprises to simplify processes, shorten lead-time, increase delivery on time rate and improve quality to reduce total costs. His clients are mainly but not restricted to the soft goods industry. His facilitation work show how he has integrated into the learning groups of the firms in the sample for learning.

5.3 Determination of Solution Values

In the field study, an operation management training workshop was designed in a created naturalistic environment so that with the natural behaviours of the selected learning group during the knowledge process could be observed. With the involvement of an external agent, a comparison of the changes in the solution values generated by the participating firms on dealing with their collective problems before and after the workshop was carried out. The observations and survey findings from the workshops, post-workshop interviews and meetings were integrated and categorised into two types: new insights of solving collective problems generated after the workshop, and actions taken based on the application of new knowledge introduced at the workshop (Edmondson 2002, Walton 1975). The self-weight learning impacts before and after the workshop are summarised in Tables 5.2 and 5.3, respectively. The data indicates that after the workshop was conducted, the solution values have been changed in the different participating firms under various situations.

Table 5.2: Self-weighting of learning impact in the last 12 months before the research

Before the workshop	**Alpha**	**Beta**	**Gamma**	**Delta**
No. of informants from interview	7	8	8	8
No. of informants from focus group	7	11	8	8
Action plans generated through previous knowledge processes	- 5S - ERP systems - Communi-cation method - Sample making flow	- Explored new market opportunities - Developed new laundering technologies and knitting techniques	- 6 sigma QA management - Machinery maintenance - Production facilities re-engineering - QA training programme - Production planner training - Workplace safety	- Product engineering - Material quality control system
Results	- Did not improve productivity* which had fallen 26% in previous year.	- Sales amount recovered to level before the global financial crisis in 2008 - Technologies met requirements of new designs	- Cost of quality decreased - machinery break-down rate dropped - Increased 90% of sales in low twist products developed by Gamma - workplace accident rate was zero	- Inspection cost increased but the product defect rate remained high - Production lead time shortened from 30 to 27 days. The shortest lead time attained was 14 days
Solution value descriptions	All informants indicated their experience in previous knowledge processes had no positive impacts on the firm.	- Informants from production unit were satisfied with the results. - Informants from sales unit were satisfied with the sales performance. - Top management was not satisfied with the collaboration between sales and production unit.	All informants weighted the results of the action plans, and indicated that they had extensive impact on firm in the past twelve months and would contribute to the future development of the firm.	- Informants from production department were satisfied with the results of the production lead time. - Informants were dissatisfied with the raw material supply management. - 70% of the orders were delayed by the production process caused by poor quality of materials.
Solution value	No impact	Positive solution value obtained at the local level	Positive solution value obtained at the universal level	Positive solution value obtained at the local level

*productivity = $= \frac{\text{total SAM}}{\text{no. of workers}}$

Table 5.3: Self-weighting of learning impact after the workshop

After the workshop	**Alpha**	**Beta**	**Gamma**	**Delta**
No. of informants from survey immediate after the workshop	22	16	21	22
No. of informants from interview	8	7	7	8
No. of informants from consultation meeting	4	3	4	5
Solution value descriptions and indicators	i. Increase of 30% in productivity* in the sewing department ii. Completed the restructuring of production facilities iii. 3 out of 6 action plans established in the workshop were carried out, and involvement across departments pending	i. Half of the action plans were implemented ii. The flow of production was forecasted to be shortened to more than 20% iii. The relationship between the factory and sales department was closer iv. The plan for a calculation method to improve yarn consumption was pending v. Positive solution value obtained at the local level	i. All action plans were implemented ii. All informants weighted the results of the action plans which had a positive impact on the firm iii. The firm provided more information a year after the workshop a. A customer satisfaction survey indicated that 82.7% and 73% rated product quality and delivery performance were at satisfactory or above, respectively b. Sales increased 10% a year after taking part in the research	i. Three operation flows in the production department were implemented ii. Two training programmes for sales personnel to understand the materials requirements were planned iii. Reports by material suppliers for quality, quantity conformance and delivery were started and given to clients for better vendor management iv. Positive solution values at the universal level were predicted for the following year
Solution value	Positive solution value obtained at the local level	Positive solution value obtained at the local level	Positive solution value obtained at the universal level	Positive solution value obtained at the universal level

*productivity = $\frac{\text{total SAM}}{\text{no. of workers}}$

After integrating the self-weighted solution values with observations and survey findings, three types of solution values were determined for the firms in the sample frame. The findings are summarised and analysed for two periods of time: (1) before the workshop, and (2) after the workshop. The three types of solution values include those with: (1) no impact, (2) local impact, and (3) extensive impact, which are used to infer to the types of KAs who are carrying out knowledge processes. No impact from organisational learning indicates that the outcomes of the knowledge process did not generate any potential usefulness to the collective issues. Sometimes negative aspects would occur after changes. This happens when the participants misinterpret the outcomes of the knowledge process or the process is inappropriately conducted which worsens the situation. Local impact means that the outcomes of the knowledge process bring about positive potential value at the local level in individual departments or functional units, but the impact does not extend to dealing with systematic problems inherent in an organisation. So in the short run, individual departments or operation units improve their local performance. In the long run, the increment of improvement diminishes because the underlying systematic problems have yet to be solved. The third type of solution value is extensive impact, which shows that the gained knowledge comprehensively benefits an organisation for different departments via elimination of latent systematic problems, and minimises negative influence from external changes.

Before the involvement of the external KA in the knowledge process through the workshop, the field data showed that Alpha did not experience any positive impacts from the changes made in the operating processes during the past twelve months. Alpha is the only firm in the sample frame in which the proposed solutions generated from its previous knowledge process failed to bring about any positive benefits or achievement of the collective goals. In Beta and Delta, local impacts were found. Gamma, among the other three firms, is the only firm in the sample frame that has experienced extensive impacts. After the involvement of the external KA in

the knowledge process through the workshop, the observed data indicated that local impacts are found in Alpha and Beta. The findings illustrate that some changes have been made at Alpha and the changes in the learning behaviours before and after the workshop could be seen. Beta, however, retains the learning outcomes to generate local impacts only. In other words, the association of changes in solution values with the external agent is not strong. Gamma maintained their cognitive abilities and extensive impacts were found while Delta experienced obvious changes in that extensive impacts were found after the workshop. A summary of the solution values before and after the involvement of the external KA through the workshop is shown in Table 5.4 and the findings are discussed as follows.

Table 5.4: Solution values in the sample before and after external KA involvement

Solution value	**Before involvement of external KA**	**After involvement of external KA**
No impact	Alpha	Nil
Local impact	Beta, Delta	Alpha, Beta
Extensive impact	Gamma	Gamma, Beta

5.3.1 Solution Values: No Impact

The field data did not indicate positive impacts of the changes made in the operating processes during the past year which targeted overall productivity improvement at Alpha. The qualitative data obtained from the informants in the pre-workshop interviews and the focus group meeting on their learning experiences from previous knowledge processes support the findings on the decline of productivity. The informants described their learning activities in the last twelve months in mainly two areas: (1) regular learning activities, and (2) new operation process implementation. With regards to regular learning activities, a weekend study group was arranged. The intended purpose was to allow senior staff to transfer procedural and conditional knowledge to the junior staff. However, the informants did not find that this was much help in reducing the poor quality of goods produced. The instructors of the study group are the staff members who have work

experience with particular operation processes. The learners, who are mainly the front line operators, indicated that the knowledge given does not eliminate operational errors, such as inaccurate information for material procurement, incomplete instructions for product construction or unclear quality requirements which are transmitted from one department to another. The instructors were not clear on the needs of their learners. Sometimes, the instructors just pointed to the carelessness of the front line operators.

Alpha tried to alter their business operation processes to improve overall performance. Many such examples can be found from the field data. One is a workplace improvement programme managed by Ivan, the managing director. The firm recruited an external consultancy establishment which is a statute organisation to promote productivity excellence. The external agent introduced the "5S practice", which is a workplace management concept, to Ivan. The programme, however, failed to smooth out the operational flow. The informants complained that extra work has been done, but the housekeeping is still carried out in an improper way. Another example is the implementation of a new enterprise resource planning (ERP) system. The operational director, Henry, had installed a new ERP system which was expected to eliminate information errors. He thought that the system could also eliminate the deficiency of communication between the sampling and the merchandising departments. In addition, Henry urged the front line staff in these two departments to directly communicate with each other, so that this would reduce the workload of Kevin, the manager of the sampling department, and allow him to focus on information coordination.

However, the informants indicated that these have failed to bring about any positive benefits to the overall operations. Kevin described such actions as "useless". He explained:

"I am instructed to drive in a roundabout but cannot find the way out. This is not an exaggeration. I tried to follow the instructions [of the operation director] to change the data input procedure. Having done so for not more than two days, we [sampling room] were asked [by the operation director] to use another method. My subordinates refused to do

everything again and said, 'We are waiting for your final instructions'. "

The production manager, Jade, also described a stressful experience in her interview on how she felt frustrated about the working relation between the sampling and the merchandising departments:

> "Lately, I have found that the construction of a product has become unusually complicated to produce in the production line. I talked to the sampling room supervisor on why the technician did it that way. The answer shocked me. The technician tried convinced the merchandiser to explain to the client that we needed to make some adjustments which would not affect the appearance of the final product. The merchandiser did not listen to him and insisted on following the client's instruction to make the sample. What Henry suggested, the "so-called" direct communication channel between the technician and merchandiser is totally useless. These two departments are still at war as usual. I am really the victim."

In addition, Kevin blamed the ERP system. He said that he was confused about the alterations in the information flow after the new ERP system took effect. His department was requested to adopt a new material requirement programme to estimate the consumption of materials. Having attended dozens of meetings to discuss the information flow with the information system engineering department, Kevin was still unclear on how the estimated data for the yardage consumption of new items inputted into the new system could help the merchandising department shorten the material procurement process lead time. He complained that the extra work done so far was a waste of his time:

> "Three months ago, when the system engineer asked me to prepare a flow to input the data about the paper pattern and material yardage estimation, I spent dozens of nights to fulfill the request. Then he said that I had to change and use another way to carry out the work because the merchandising department was not able to obtain the proper information for quotations. I am not complaining, but I don't understand why the company always keeps changing, yet the accuracy of price quotations to the customers is still an issue. I am sick of the changes."

Similar descriptions of painful experiences with new system implementations in the last twelve months to deal with issues across departments were often provided by those at Alpha. According to the self-

weighted results of the changes that the firm had implemented in the last twelve months, no impact has been noted in improvement. Most of informants stated that they do not see the potential usefulness of the new arrangements or learning activities. Another finding is the decline of productivity in more than 26%. The analysed field data showed that Alpha did not learn. Hence, there is doubt that a learning group exists at Alpha which would have the theorised properties of a KA entity to carry out the knowledge process. The collected data would have to be further analysed on the learning behaviours of the learning group at Alpha and the association of the constructs of KAT.

5.3.2 Solution Values: Local Impact

There is a local impact when the outcomes of a knowledge process bring about positive potential value at the local level in which individuals, groups of people or departments learn to deal with local issues. In the short run, the improvement of local performance may excite the organisation or persons involved. However, the impact cannot extend to a wider scope within the organisation to solve problems that are inherent companywide. So in the long run, when the problems previously addressed reoccur across different departments, the promising results gained at a local level could not be guaranteed or extended to other departments. Subsequently, the local impact would be diminished by the deficiency of the overall business activities (Walton 1975).

In the field study, the self-weight solution impact results showed that local impacts are found before and after the involvement of the external agent in the knowledge process through the workshop in different firms under various situations. Before the workshop, both Beta and Delta had experienced a gain in local impact with changes in particular units. After the involvement of the external KA, the learning group at Alpha has successfully generated positive impacts in the local unit, the production department. Beta, however, has not experienced much change in the nature of the impact which is retained at a local level. The field data confirmed the

self-weight solution impact of Beta.

In the pre-workshop interview and focus group meeting, Beta shared their learning experience in exploring new markets and invention of new technologies for production processes. Beta had reflected that their cognitive abilities to explore new markets were strong. They started two seasons ago to work with French retailers, and consequently, the firm has a good understanding of customer preferences and amends the designs to match with the requirements. In the interview, the managing director, Leonardo, described his experience while working with his sales team to enter this market:

> "The trading unit, after the economic crisis in 2008, realised that we had to switch our major market from Japan to somewhere else. After I met with Eve [one of the sales directors], we decided to team up with a group to explore new opportunities in France… Now we have captured the preferences of the customers and realised our competitive advantages which will replace their Italian suppliers."

Martin, the production director at Speedy, which is a production contractor that has Beta as the major shareholder, described the innovation of technology as the key success factor to maintain production forces in Shenzhen. With a substantial number of knitwear manufacturers that are moving their production facilities to very remote areas, Martin is proud that they have a strong foothold in Shenzhen which can be attributed to the product development team. The team is composed of the production manager, product engineer and laundering technicians. They often work together to deal with the challenges of the new requirements of designers. He has also explored new production knowledge and transferred the details to the team. Martin stressed that although the trading unit could select other knitting contractors to produce the goods, many merchandisers prefer to place order with his production plant. He said:

> "These days, I feel we are not producing apparel articles. We are making works of art. When we receive sketches of a new collection, there are many technical issues that are placed in front of us. We may have never carried out some of the treatments before. The knitting pattern formula is just like a newly invented

> mathematical problem and this is something that we encounter on a daily basis. Although the mechanism of existing knitting machines is quite conventional, we have to use them to generate new ways to form different loops and knit a product. We have to continue to learn, learn and learn… The merchandisers [in the trading unit who place the production orders to contractors] always insist that we carry out the bulk production of new products in my factory, even though other contractors might charge them a lower price. You know, we produce problem free goods and they can rest easy."

However, the individual success in the trading and the production units cannot be extended across various unit levels. As Leonardo had described, the management of those two units were not properly aligned in communication. The trading unit expected the production unit to work more aggressively and reduce production lead time while the production unit claimed that it had reached its limits. The trading unit blamed Speedy for failing to provide sufficient resources: production lead time, and the standard allowed minutes (SAM) for bulk production. A few months before the field study started, Beta had formed a working group to manage the integration of the trading unit with the production unit and consolidate a single business goal to reduce total production costs and shorten total order processing lead time from the development of a product to finalizing an order for delivery to the clients. No promising results were reached. Both units had not learned much to generate solutions that would achieve the objective of the integration. The firm bought the issue to the single day workshop to explore a solution. However, the outcomes disappointed Leonardo. Although both units had separately committed to some operation improvement plans, Speedy maintains a passive manner in reaction to the request to shorten the production lead time. Thus, even though Beta received positive impacts from both the production and trading units after the involvement of the external KA in their knowledge process, the positive impact did not extend to the inter-unit level.

A typical example found in the field study to indicate the results of positive impact at local level. Martin and his team realised that they were in a good position to produce high end fashion knitwear in the supply chain because there are not many manufacturers in the region that can offer such

skillful labour work. Having participated in the workshop, Martin resumed his enthusiasm towards the goal of raising productivity. He has started to set action plans with his core team on restructuring the production facilities to streamline the production flow. However, at the same time, he has reservations on how likely the change would provide the production unit with any explicit benefits. He explained:

> "I was happy that at the workshop, the trading unit finally understood our needs. I hope they will improve their order processing and procurement system. If they don't, whatever we have done to streamline the production flow is useless. Our improvement of course can save the first costs. But we won't benefit. They just keep on asking us to cut the standard allowed minutes and reduce the amount of our expenses."

There is evidence that supports a positive association of the solution value and the local learning group behaviour for Speedy's production unit. However, the production unit has struggled with whether it should continue to make changes to respond to the requests of the trading unit.

The field data showed that the change at Alpha is similar to that in Beta: a local impact is found in the firm after the workshop. The firm has successfully moved forward from lacking any impact through their previous actions to gaining positive benefits after the new knowledge was acquired and applied in the production department. As indicated, before the workshop was conducted, Alpha was classified as making no impact with its previous knowledge process. Two months after the workshop, the department reported a promising result with the implementation of an action plan that was established at the workshop. The standard allowed minutes (SAM) per worker in the production department has increased by more than 30%. The result has excited the firm and Ivan himself. Ivan was privately planning to expand the new production concept to other departments.

Delta is also identified to have experienced a gain in local impact after their knowledge process was carried out in the past twelve months before the workshop. Unlike Alpha and Beta, Delta's cognitive resources of gaining useful knowledge before the workshop were limited to the

production department which is located in Mainland China. The analysis of data collected from the firm indicates that the production unit has successfully transformed from making basic to complexly constructed lingerie products. The production manager, Frank, and his engineering team are proud of the development of the engineering department in upgrading the technical skills of their engineers and workers. Delta clients often appreciate the suggestions made by the company on changes to product configurations that would meet their budget. In addition, other lingerie manufacturers in the region admit that the engineering capabilities of Delta are ahead of the manufacturers in the same region. In the pre-workshop interview, Frank concluded his success as follows:

> "A smooth flow is important to productivity. The solving of production problems and removing of obstacles in the production line are the daily work of the engineers. We have made a big step forward to refine our production line in order to respond to the changes in market requirements: short delivery time, small quantities per each order, wide variety of each product collection. To allow us to move ahead of our rivals, I encourage my subordinates to learn more in terms of new management knowledge after their working hours. I often select publications for them to read. When they are finished with the reading, they would write a report for me to solicit my comments. My team is much stronger than it was, three years ago."

However, other departments at Delta, for example, the procurement and merchandising departments, indicated that they have tried many ways to overcome the difficulties in improving performance, such as the quality of materials, and the accuracy of production information to the engineering or production department, but the results are not convincing. Nelson, the sales manager, talked about his situation in coping with quality problems:

> "The fabric quality does not always meet our requirements. We have tried different approaches to reduce fabric defects on a finished good: random checks on incoming fabrics, inspections on the length and defect points of each roll of fabric, adding more check points in the production line to pick out the defective panels…We have spent a lot of money on inspection to ensure that only quality goods are shipped to the clients. But the defects cannot be entirely eliminated… I have attended many seminars held by the Hong Kong Productivity Council and other institutes. We have implemented the 5S practice and AQL 2.5. We have provided training to front line

> clerical operators. But our costs have been increasing at such a level that we will not be able to survive in the long run…You know, these days we always say that we pursue harmony in the company because we don't want to quarrel with each other."

The analysis reflects that the local impact of the knowledge process in Beta exists in different business units. The usefulness of the knowledge is scattered in separate units but there is no bridging of the units together to form a unity towards a single goal. In contrast to Beta, Delta's local impact in the production department brings about conflict between the production and supportive departments. Alpha, on the other hand, basically did not learn. After the involvement of the external KA, the learning group members from the production department acquired new knowledge which produced a positive impact at the local level. It is needed to know the reasons of the firms of the sample that have local impacts after obtain desirable knowledge. Further analysis of the field data will be carried out in the forthcoming sections.

5.3.3 Solution Values: Extensive Impacts

Extensive impacts show that the gained knowledge benefits with organisational learning processes are not only at the local level. The gains comprehensively affect the company in a broader manner with which latent systematic problems, that is, the errors that randomly occur in different locations within an organisation without a specific factor that causes the errors, will be eliminated or the negative impact caused by external changes will be minimised. Most of researchers who are carrying out organisational learning focus on this aspect to determine the likelihood that an extensive impact can be obtained in collective learning processes (e.g. Argyris & Schön 1996, Edmondson & Moingeon 1998, Huber 1991, Levitt & March 1988, March 1991, Senge 1990, Weick & Roberts 1993). Among the four participating firms, the findings indicate that there were extensive impacts generated from the knowledge process in Gamma before and after the workshop. Unlike the other three firms, the firm indicated that their business strategy had been planned as early as ten years ago, and since then, the implementation of actions for changes have never stopped.

Gamma started to consider a company transformation from producing grey fabric to making bi-stretch and technical denim fabrics a decade ago. To achieve the goal, Gamma realised that they would face many challenges with technology, production and quality issues. Hence, they had implemented several action plans. Those plans included cognitive abilities enhancement and operation management requirement. Some examples collected in the field are illustrated as follows.

Engineers were sent to Germany and Japan to learn the new technology of weaving bi-stretch fabrics and technical denims. To ensure that the quality met the requirements, Gamma had organised quality management training courses to those who were involved in production and quality control before the Six-Sigma quality management system was imposed.

Having implemented the action plans to reposition their business, Gamma admitted to attaining promising results in both production capacity increase and product diversification. The success does not stop Gamma in their pursuit for excellence and better returns. In the individual interviews and focus group discussion, the learning group members indicated that they have momentum to learn and are never satisfied with their current achievements. Gamma's learning experiences show that the extensive impacts after a knowledge process was carried out have a positive association with their learning group behaviours. Moreover, Gamma is continually expanding its cognitive capacity to create a better future with ongoing production of new knowledge in response to changes. The data collected after the training workshop demonstrated that the firm is apparently a learning organisation in which the learning group has fluidity to deal with new challenges (see Table 5.3). Compared to the other participating firms, Gamma maintains their momentum to spread positive impacts of the generated knowledge to various units within and outside the company.

The extensive impacts are found in Delta after the involvement of

the external KA. The Delta staff members admitted that their solution values from previous knowledge processes remained at a local level of impact prior to the workshop. After the workshop was conducted, Delta improved its capability to generate solution values which extended to dealing with their collective problem. The vast improvement illustrates that the nature of a learning group at the local level may be altered.

In the sample frame, solution values with extensive impacts are found in Gamma and Delta. The involvement of the external KA, to a certain degree, has influenced the knowledge process that has generated extensive impacts to the firms. A further analysis of the field data will determine the inter-association of the characteristics of the learning groups and the results of the knowledge processes.

5.3.4 Summary

The analysis shows that before the involvement of the external KA in the knowledge process, all of the companies except for Alpha experience positive impacts from their goals. However, only Gamma has experienced extensive impacts companywide. The solution values for Beta and Delta are at the local level in which issues are settled at the departmental or group level. For example, the production units in both Beta and Delta have been improving their production skills in making fashionable items and developing special techniques for processing to meet the requirements of leagile manufacturing. Their knowledge, however, cannot resolve the collective issues. After the involvement of the external KA, all of the firms were assessed to determine if positive impacts could be found. Gamma, as prior to the workshop, has experienced extensive impacts, which help to achieve their collective goals established at the training workshop. At Delta, solution values at the local level are extended to other units. However, there is not much change at Beta after the workshop. The solution values are still restricted to impacting local units. The analysis indicates that even though a learning group has acquired new knowledge in operation management, it can only make changes in their local units in trading and production

respectively. The solutions cannot achieve the firm's collective goal to integrate the two units together for overall productivity improvement. At Alpha, the productivity in the production department in terms of SAM increased 30% six weeks after the workshop. The dramatic improvement excited the firm. However, the situation reverted because the performances of both the merchandising and sampling departments continued to remain at a low level. The collective goal to improve overall productivity has not yet been achieved. All of these findings are proof and evidence that verify a double neighbourhood relation and autopoietic characteristics conceptualised in KAT.

It is assumed that (1) if organisations experience positive impacts, they learn, and (2) if organisations learn, then a proper KA entity exists. In Chapter 3, the learning behaviours of different types of KAs were described. In the analytic data, extensive impacts are found in Delta and Gamma. It is assumed that proper KAs may have been found in these two firms. The local impacts which have been identified in other firms in the sample frame before and after the involvement of the external KA may be an indicator that quasi- or pseudo-KAs exist. At Alpha, before the involvement of the external KA, no impact was found. It is possible that the likelihood of the existence of any type of KA exists. In the following sections, the findings that could verify the constructs proposed in the KAT under these two assumptions are examined.

5.4 Findings and Discussion

5.4.1 Introduction

The problems of productivity decline (Alpha), price and cost issues (Beta and Delta), and maintaining continuous improvement (Gamma), are all critical issues which have a great impact on the firms in the sample frame if they could find the solutions. The patterns of collective knowledge process activities observed provide evidence to draw inferences with regards to the properties of KAs. An organisation learns when there is a positive impact after the knowledge process is conducted. In the field study, there

were three types of impacts observed in the sample firms. They are: no, local and extensive impacts. It is assumed that the KA entity makes the learning happen. In the event that individuals do not detect a positive solution value from the knowledge process which matches or mismatches the expectations derived from their collective need, the organisation does not learn (Argyris & Schön 1978). Hence, no KA exists in the knowledge process. With the field data analysis, it is inferred that pseudo-, quasi- and proper KAs may have existed to conduct the knowledge process in which there are no, local and extensive impacts observed, respectively.

The KA is theorised as a learning group which holds autopoietic properties. S/he self-produces his or her components which are members within a boundary who have cognitive capacities and circularity to reflect on its knowledge process experience to learn continuously. The outputs produced by the entity comprise two types: (i) knowledge which would be implemented to solve collective problems or change organisations for the better, and (ii) memories of experiences in relation to learning processes and applications of new knowledge. A summary of the findings of the learning groups in maintaining a continuous learning capacity is shown in Table 5.5. The evidence from the collected data confirms that a recursive self-producing system exists in the learning groups which generate extensive impacts on the solution values of the sample firms. In the following section, the findings are discussed which verify the construct of the KAT by comparing the similarities and the differences in learning behaviours between different firms which have obtained the same level of impact and experienced different levels of impact, respectively.

Table 5.5: Evidence of KA in maintaining continuous learning capacity Part I

Before the workshop				
Evidence	**Alpha**	**Beta**	**Gamma**	**Delta**
Continuously acquiring professional and conditional knowledge	Only the managing director committed to acquiring new knowledge	2out of the 3 management team members did not intend to acquire new knowledge	- All key members on the management team had been awarded Master's degrees or above in statistics, technology and management in the last three years - Learning groups established for sustainability, innovative product development and social accountability	- Production manager awarded academic qualification in business management - A team of product engineers was established to examine the latest production technology
At the workshop				
Evidence	**Alpha**	**Beta**	**Gamma**	**Delta**
Selection of participants	Appointed by the managing director	Selected by the sales directors and production directors respectively	Suggested by the core management team and confirmed by functional managers. Some members volunteered to join	Suggested by the HR managers and confirmed by the managing director
Survey findings: Reflection of learned knowledge (see Appendix XVI)	45% of learned knowledge recalled	30% of learned knowledge recalled	All learned knowledge recalled	85% of learned knowledge recalled
At the workshop: Time spent on application of knowledge	57%	44%	39.8%	61.5%
Application of learned knowledge to generate action plans (see Appendix XVII)	30% of learned knowledge applied	30% of learned knowledge applied	All learned knowledge applied	92% of learned knowledge applied
Survey findings: Application of learned knowledge to collective problem in the next twelve months	6 action plans generated and scheduled to be implemented in the next one and half months	14 action plans generated and all but one scheduled to be implemented in the next three months	- 16 action plans generated and scheduled to be implemented in the next 2 months. - One action plan scheduled to be implemented in the future	8 action plans generated and scheduled to be implemented in the next four months

Table 5.5: Evidence of KA in maintaining continuous learning capacity Part II

Post-workshop meeting and interviews				
Evidence	**Alpha**	**Beta**	**Gamma**	**Delta**
Discussion in relation to knowledge process	- Difficulties of action plan implementat-tion - Difficulties of knowledge transferring - Difficulties of finding solutions - Sharing successful factors in the production department with other departments	- The need to employ an external KA to facilitate the process - Lack of momentum to implement the action plans - Ways to review and reorganise the learned knowledge	- Methods to transfer new knowledge - Cognitive resource management - Establishment of common goal - Scope in the transferring of new knowledge - Applications of new ways to conduct training programme.	- Break through original knowledge constraints, - Implementation of action plans
Enquiry of future knowledge management strategies	N/A	N/A	- Continuity in applying the method to create, acquire and transfer new knowledge - Selection of internal or external KA - Growth of learning groups	- Knowledge transfer to the whole firm - Methods to train different levels of employees - Tolerance of differences
Application of learned knowledge	In production department only	In production and merchandising departments	In the R&D department; sales, production planning and operation; production and maintenance; sub-contractors and yarn suppliers	In the merchandising department, purchasing, production, product engineering, human resource and quality assurance
Transferring of knowledge	Nil	Nil	- 3 seminars were conducted to introduce new knowledge to middle management. - New knowledge was shared with two key sub-contractors	Plans to conduct a sharing meeting with individual departments

5.4.2 Learning Groups with Continuous Learning Capacity

Proposition 1: The KA is an entity that comprises a group of members who maintain a continuous learning capacity to deal with collective problems or issues.

The learning group generates solution values with extensive impacts across an organisation to deal with collective problems or issues, and in the knowledge process, is likely to hold an identity as an entity known as the KA. In Chapter 3, the KA entity is conceptualised as an autopoietic living system. To maintain its existence, the KA would maintain learning capacity. The picture that emerges from the field data matches with this assertion (see Table 5.5). The firms in which extensive impacts of solution values are found, their learning group has a momentum which maintains learning capacities while those in which only local impact is found, their learning group lack a driver to propel learning capacities.

5.4.2.1 Finding 1: continuous learning capacity

Finding 1: (i)The learning groups which generate solution values with extensive impacts on collective problems or issues are entities that comprise a group of members who maintain a continuous learning capacity.

(ii)The learning groups which generate solution values with local impacts are entities that comprise a group of members who are interested in improving local issues, but do not work together to deal with collective problems or issues.

(iii)The learning groups which generate no impacts on collective problems or issues are entities that comprise a group of members who do not take part in any actions to deal with collective problems or issues.

Gamma is the only firm in which extensive impacts are found before and after the involvement of the external KA in the workshop (see Table 5.5). The maintenance of the learning capacity to deal with collective problems or

issues is also found and triangulated by the qualitative data from different sources in the observed learning group in the firm. Gamma is used to predicting critical issues which may be obstacles to their future development. Therefore, Gamma is often prepared to deal with foreseen or unforeseen problems. The success stories shared by some of the members of the learning group about the firm's strategies with knowledge processes in acquiring, applying and transferring new knowledge which created a radical change from weaving basic cotton grey goods to technical fabric confirmed that learning groups maintain a continuous learning capacity and avoid being fire fighters. Most of key management personnel are observed as active learners. They have expanded their cognitive resources from learning new professional knowledge in the textiles industry to other generic knowledge, such as information system, quality, and supply chain management, etc. In the field observation, mutual respect between members in the learning group is found. Another observed learning behaviour is their reflection of knowledge learned or created (see Appendix XVI). It is evident in the observations of the naturalistic environment in the field study. Each time after a discussion activity at the training workshop, every team were required to create a short summary or conclusion to confirm their understanding on the discussed matter and share this work with other teams.

Among the sample firms, Gamma took the least amount of time to capture the main ideas of the new theory introduced at the workshop (see Table 5.6 in section 5.4.3). They also finished all the tasks assigned in a shorter amount of time than the scheduled time. The post-workshop field data also indicate that Gamma maintains momentum in enhancing their learning capacities. The recommendation letter written by the firm shows that Gamma has the ability to absorb new knowledge with effective cognitive skills. The letter is attached as Appendix XVIII. Compared with the other firms in the sample, Gamma clearly demonstrates what the participants have learned, the main points of the new concept and how the concept differs from others that they have come across and the likelihood that this can be practically integrated into improving their operation

processes. The analysis shows that the Gamma learning group has strong cognitive capacities for recursive learning.

In contrast, the cognitive capacities of the learning group on a continuous basis are not found in Alpha (see Table 5.5). The members from the management team with the exception of Jade, the production manager, showed no commitment to making changes. There are numerous examples that demonstrate the deficiency of learning. In the pre-workshop interviews and meeting, the most common words overheard were “lack of communication”. Managers blamed each other for not paying attention to their instructions and doing the wrong things. The operation manager insisted that if the advanced information system was properly operated, then all of its problems would be solved. However, during the individual interviews, the sampling room supervisor complained that he was asked to change the operation procedures to fit the requirements of the new information system. He questioned whether he is serving the system or it serves him. According to his explanation about his experience, he felt that the new system is not much use in enhancing his daily work which includes making samples, and estimating standard allowed minutes and yardage consumption of each garment to be produced. He blamed most of the production troubles on other departments, but none of the departmental managers addressed the roots of the problem. The managing director also muttered that he has been engaged in numerous disputes between departments and has no time to set a strategic plan.

Only the production manager at Alpha, who had recently joined the firm, showed a change. When she was hired, she was delegated to restructure the production workplace. During the training workshop, it was obvious that she had a blueprint in mind. She and other production personnel, who are her subordinates, were actively involved in the learning activities. Jade carefully compared the new theory and used it to justify her blueprint where a new floor plan that involves the moving of the production facilities would help to shorten production time. She continued to clarify the concepts with the facilitator at the workshop when she had any doubts. After

the workshop, she conducted a series of changes. She created a small group in the production department to work out the standards of workmanship requirements, established morning briefing meetings for each production line to ask their supervisor to identify the critical parts for each batch, and applied the 5S practice in the store room where the production attachments and devices are kept. The usefulness of the changes, however, has been limited to benefiting only the production department. She had tried to make some changes in collaboration with her colleagues in the engineering and merchandising departments to establish a mechanism that would refine garment construction before production, but received negative feedback. She showed her concerns during the individual interview and at the group meeting. She also shared the problems that she had encountered with Ivan, the managing director. During the field study, it was observed that most of the meetings at Alpha targeted the struggles with its daily operational problems. The learning group has failed to facilitate and extend a companywide learning momentum.

A similar pattern in learning behaviours is found in Beta. Although some changes were made in response to the external business environment at Beta, they failed to make changes in accordance with their new business model. The managing director realised that the original business model does not fit under the new business environment. He tried to integrate the order processing into the production unit in order to shorten the total production lead time. In the workshop, the members from these two units worked together to generate fruitful outputs. They gained a better understanding of the daily operations to process an order in both units. The participants also worked out action plans for improvement in their own operation processes. However, the members from the two units did not jointly implement the action plans as the director had expected. In the follow up meeting after the workshop, the production director was not even invited to attend the meeting (see Appendix XV). The data collected from the informants of both units illustrate that they are still doing their own separate work. The trading unit is eager to put forth effort on setting the requirements and reinforcing control

of its contractors, including Speedy, the production unit, and ignores the self-improvement action plans. Similarly, Speedy would like to start to restructure their production facilities and shows no interest in participating in the action plans to improve communication between the two units. There is no continuity plan on how both units will deal with the collective objective: to work together to reduce the total production lead time. The collective objective, therefore, has not yet been achieved.

On the other hand, Delta showed changes in learning behaviour and outcomes after the external agent intervened in the knowledge process (see Table 5.5 Part II). The production manager and the management team in the production department significantly contributed to improving productivity. However, the impact was not extended to other departments, such as the procurement and quality control departments. The manager admitted that there were limitations on his part on making changes. Having finished the single day workshop, the participants learned how they could work together to deal with their collective objective. The managing director discovered that procurement is a critical factor to break through the constraint to improving productivity as a whole. He organised a work team, including representatives from the sales, production, engineering and production departments to implement the new action plan which would improve the procurement process. The engineering department also became involved in the transfer of the product knowledge to the junior coordinators in both production and merchandising. To keep the momentum in learning, the human resources manager has been delegated to set a long term plan that would enhance the capacities of the employees for learning and working. The director has proposed a seeding plan: train the trainers, ensure the knowledge embedded in the firm can be comprehensively transferred to employees and new knowledge can be continuously generated.

In summary, the firms in the sample who have generated positive and extensive impacts from the actions taken indicate that they have taken to dealing with their collective problems or issues to maintain continuity in learning capabilities through different ways. Both Gamma and Delta have a

fluid group of members, in accordance with the need to be formed by different members. Their learning behaviours in acquiring and adopting new knowledge are in a recursive manner that continuously regenerates new ways of doing things or provide a new approach. Their response to radical or incremental changes is to seek solutions rather than escape or avoid the challenges. On the other hand, the learning groups in the sample firms who have failed to learn have at least one of the following characteristics: (1) those who participated in the knowledge process lacked the proper attitude to work together and tackle a collective issue or problem, (2) the group did not intend to continuously improve, (3) the members in the group tried to transfer the responsibility for change to someone else, (4) the members were satisfied with their current practice and did not want to change.

5.4.2.2 Finding 2: recursively using learned knowledge

Finding 2: *Learning groups who create extensive impacts to an organisation recursively use the learned knowledge (learning skills and useful knowledge or solutions) to generate new approaches (such as new goals, learning skills, applications of knowledge, and solutions) as inputs of forthcoming knowledge processes while this is not true for the learning groups who have local or no impacts.*

In the sample, the learning behaviours of those who recursively use the learned knowledge to generate new approaches have become the inputs of their forthcoming knowledge processes, as found in Gamma and Delta. In Gamma, recursive learning behaviours are present consistently before and after the involvement of the external KA. In Delta, the behaviours are only observed after the involvement of the external KA. Although there are positive impacts in the other two firms, the data analysis shows that there is no recursive learning behaviours in Alpha or Beta (Table 5.5). Consolidated data of the findings are shown as follows.

Extensive impacts through recursive learning behaviour

Gamma's circular knowledge process is obviously influenced by the plan, do, check, act (PDCA) cycle, which is their quality improvement management model (Deming 1986). The data reveal that the firm regularly reviews its business operations and continuously seeks opportunities for improvement. The firm's learning experience indicates that it recursively uses previous experience to generate new meaning of things to cope with the new external environment. When Gamma accepted the invitation to participate in the field study, they had been working on a strategic plan to improve supply chain management in the next twelve months. The issue was raised in the corporate business strategic plan. A few months ago, the parent company of Gamma relocated its spinning unit from Hong Kong to Zhanjiang in China for business expansion and cost consideration. The managing director and the management team of Gamma recursively used their previous experiences and learned knowledge from the time when core production changed from making basic woven items to advanced fabrics in the mill. The team revisited the process of change management and identified some issues that must be addressed for a smooth integration of the operations between the two units located in different regions. Coordination of the operations between two locations, however, is a new thing to Gamma. The director predicted several issues that might be encountered, such as logistics arrangement, yarn production capacities reserved for Gamma, import and export requirements, and communication. Furthermore, the production scale of the spinning unit expanded to more than double the previous capacity. The spinning unit, therefore, expanded its sales force to obtain more orders from other mills. This new business model with the spinning unit has allowed Gamma to tackle the issue with the production capacity plan in order to manage the yarn supply chain.

To obtain a better understanding of the operations in the new spinning plant, the firm appointed a former spinning manager who had worked at the Hong Kong plant to be the yarn supply coordinator and manage and monitor the yarn supply. Meanwhile, it had arranged for the

operation manager to refine the material supply processing system in order to minimise the delay of delivery of raw materials. The weaving plant manager had also visited the spinning factory several times to discuss matters that are a concern to both units. Gamma believes that in order to effectively work with the Zhanjiang spinning unit, a mutual understanding of the operation processes between the two units and streamlining the yarn procurement process are critical factors which guarantee that the fabric is delivered to the users on time.

Gamma not only continuously compares and examines the new requirements and existing knowledge to meet the quality and on time delivery targets, but the analytic data shown in Table 5.5 also illustrate that they have always tried to new approaches so that they can use the approaches as inputs to the forthcoming knowledge processes. A typical example is found in the discussion about making the decision to participate in this research project. After the research project was introduced to Gamma, the management team came up with two ideas: (1) to use the training workshop as a platform to review its new material supply management model and examine if any alterations should be made after they learn about the new operation management theory, and (2) invite some key persons at the spinning unit to participate in the workshop so that they can learn together. After some discussion, the second idea was withdrawn because Gamma wanted to play it safe due to two considerations: (1) they did not have enough information to assess the appropriateness of the new knowledge introduced in the workshop to use it or for refining its new material supply management model; (2) the participants could introduce the new theory to the spinning unit after they have learned so no confidential business data would be exposed to any outsiders. According to its decision process to select workshop participants, the firm illustrated a general practice of adopting learned knowledge for further use. The findings also revealed that the firm is used to reviewing previous knowledge and comparing such with new knowledge to generate new meanings for the firm. Plus, in the field observation, it was evident that Gamma was eager to

clarify each step of their activities and approach the method that the facilitator was using. Indeed, Gamma explained that it is its knowledge management strategy that reinforces the knowledge learned by the participants. The approach is consistent with Nonaka and Takeuchi's (1995) four modes of knowledge conversion SECI model.

SECI is a continuous cycle of four integrated processes of knowledge: socialisation, externalisation, combination and internalisation. Externalisation is a process that articulates tacit knowledge, which always resides in the mind of an individual and is difficult to formalise and communicate with others in an explicit form to translate into formal and systematic aspects. Internalisation, on the other hand, is learning explicit knowledge by doing and sharing mental models and technical know-how in order to broaden, extend and reframe them within tacit knowledge. Combination is a process that integrates and manipulates explicit knowledge into systemic knowledge by sorting or other techniques to form a whole new form of knowledge. Socialisation is a rather limited form of knowledge creation in which the speed of transfer of knowledge is relatively low. The knowledge is transferred through experience sharing with others, observation, imitation and practice. Apprenticeship is a common way to learn tacit knowledge. All but internalisation were found or observed in Gamma staff in knowledge process management.

In the post-workshop meeting, Gamma realised that one way to acquire knowledge is to maintain learning capacity. Terrance, the managing director, summarised that the learning experience in the group not only involve the acquiring of a new concept on operation management, but also insights have been gained to develop a new approach that would generate new knowledge and solutions which involve people within the firm through the process learned at the workshop. He explained:

> "In the past, we had invited experts to give seminars or workshops on new knowledge. Occasionally, we would send some of our colleagues to different institutes to attend short courses or program. So those who gained new knowledge always dominated the changes made. Having attended the workshop, I discovered that we can

> extend learning in another way to groups where members work together to create new knowledge without external KAs. We can extend learning companywide to establish more learning groups and generate solutions in different aspects."

The findings from Gamma demonstrate that their learning group contains the characteristics of a proper KA entity conceptualised in KAT which recursively uses the learned knowledge, includes learning skills, solutions, and concluded relations between factors, as a reference to acquire, transfer and adopt new knowledge that deal with new collective issues and establish or refine the learning capacities for learning. The learning groups in other firms did not generate extensive impacts and lack such capacities. Gamma views knowledge in two dimensions: changes to the effectiveness of operation processes which contribute to overall productivity, and changes to the knowledge process to further enhance the cognitive abilities of individuals to acquire useful knowledge. The informants indicated that the action plans generated at the workshop which pinpointed on ways to improve the overall order processing are feasible and appropriate. The acquired knowledge includes not only the new concept to streamline operations, but also the procedural knowledge to run a training workshop which enriches their ability to extensively transfer knowledge in different situations.

After involvement of the external KA, Delta also used the learned knowledge as inputs of forthcoming knowledge processes. The momentum of maintaining learning capacities for continuing knowledge processes of acquiring, transferring, applying and storing knowledge is seen in the post-workshop meeting. Unlike Gamma, Delta relied on the human resources manager to reform the training programme by adopting the method that the facilitator used in the workshop.

Local impacts: lack of recursive learning behaviour

Extensive impacts are not found in Alpha or Beta. Although the managing director at Alpha is keen on acquiring new knowledge, he failed to enable the learning group to maintain cognitive capacity for

organisational learning. The solution values for several implemented plans conducted in the firm for the last twelve months at the time of the study illustrated that the firm did not make use of the experience to generate knowledge on why the improvement plans were not successfully implemented. At Beta, the learning group was naturally separated into two sub-groups; those from the trading and the production units, respectively. Thus, the solution values, with or without the involvement of the external KA, are consistently at the level of local impact (refer to Table 5.5).

The results confirmed that the firms where recursive learning is found in the learning group are associated with extensive impacts while those which only have local impact, recursive learning behaviour is not found.

5.4.2.3 Finding 3: keeping awareness of the KA identity

Finding 3 *Learning groups that generate extensive impacts to the organisation maintains awareness by reviewing its learning group membership in reference to its cognitive resources in order to maintain its identity for learning (self-referring) while this is not true for learning groups which generate local or no impacts to the organisation.*

Table 5.5 shows the multiple sources of data collected from the field and these indicated that the formation of learning groups among the firms in the sample varied. The findings from the interviews and post-workshop meeting also illustrated that the learning group in Gamma has fluidity. Their working group which dealt with a collective issue was initially formed in accordance with the principles of which: (1) members are stakeholders of the issues, (2) they will contribute to the knowledge process, (3) they have potential to transfer knowledge to deliver the outcomes that the group has conducted through their activities, if the knowledge has a positive impact on the firm. The members of the knowledge work team at Gamma, as mentioned earlier, change according to different issues. The training workshop provides a naturalistic environment for the field study to observe

the formation of the learning group. In the pre-workshop meeting, the core members of the current knowledge work team reflected the diligence in selecting members to attend the workshop. In the post-workshop meeting, Gamma indicated that they had established a strategic plan which involves several stages to extensively transfer the new operation concept to different departments, the spinning unit and its sub-contractors. The firm made use of the meeting for a discussion with the workshop facilitator on the necessary skills held by the trainers, and the advantages and disadvantages of using internal and external trainers. The observed behaviours in learning group formation align with the learning experience shared by the informants in individual interviews, the survey and post-workshop interviews in fluidity.

Other firms in the sample indicated that in most situations, the members of the learning group are initially selected based on those who have close relations with the core management team (refer to Table 5.5). At Alpha, the learning group members are always appointed by the managing director. At Beta, the core team is formed by the three directors in the trading unit while the production director is often neglected. In contrast, the learning group at Delta is normally assigned by the production manager.

The data analysis confirmed that the learning groups that generate extensive impacts also have the means to maintain awareness by reviewing their membership with reference to their cognitive resources in order to maintain their identity for learning.

5.4.2.4 Finding 4: needs to conduct knowledge processes

Finding 4: *Learning groups which have extensive impacts on an organisation examine the need to conduct knowledge processes by observing their cognitive resources to solve collective problems or issues in order to sustain their identity for learning (self-observing) while this is not true for learning groups that have local or no impacts on an organisation.*

All of the informants in the field study admitted that they assumed the workshop training would provide them with new knowledge to enhance their cognitive resources. Among them, only the learning groups at Gamma and Delta (see Table 5.5) have demonstrated that they recursively examined the need to enhance cognitive abilities. Gamma explained their goal for participating in the study which is to increase the likelihood of the learning group members in acquiring new knowledge with which they can enhance cognitive resource to improve material supply chain management. After the workshop training, the group reviewed the learning process and summarised the usefulness of the learning outputs into two parts: new knowledge that creates new meaning from previous experiences to establish a new system for managing the material supply chain, and new skills to deliver knowledge to the subordinates. Meanwhile, the group had a comprehensive discussion with the facilitator at the post-workshop meeting to evaluate the advantages and shortcomings of inviting an external agent to deliver the new knowledge so that the learning group as a whole would learn better.

Delta used another way to review their learning need. The learning group recorded the entire process of the workshop training by video camera which was used for comparison with the current training method in order to improve their techniques. Their approach is similar to the action inquiry model (Torbert 2004) which is used to identify ways to improve learning within the learning group.

The analytic results of the consolidated data from the learning groups in Alpha and Beta, however, suggest that the self-observing property for learning does not hold; instead, it weakens their ability to generate positive impacts from the knowledge process. The merchandising manager, Clara, at Alpha did not think that the merchandising staff needed to improve as they were already putting forth exceptional efforts. Instead, she put the blame on other departments and claimed that they did not understand the complications of order processing carried out by her department. She also felt that her colleagues in the sample room and the production department did not appreciate the work that was carried out by the merchandisers. She

explained this by saying:

> "The merchandisers coordinate all of the information given by the clients before any orders are issued to the sample room or production department. We are clerical staff. We don't know much about production process or garment construction. If we do, we would be working in production instead. … Indeed, the production department only needs to follow our instructions to make the bulk products. They should change their attitude to work with us. We have resolved almost all the problems: those that involve the fabrics, trimming, fitting, etc. before production starts. Sometimes the trimmings or fabrics are defective. But the suppliers are appointed by the clients. We are only following the clients' request when placing orders. We have no control [over the trimmings and fabrics that have defects]. These are not our problems. What I can do is write a request to the client for a shipment extension [if the shipment is affected by the defects]."

In the interview, Clara and her subordinates said that if the production staff followed their instructions, the production processes will be much smoother. Clara did not feel that the merchandising team should learn. Similar findings were found at Beta. The core members of the learning group at Beta did not see that there was any extra need to learn for the sake of increasing cognitive abilities. They considered that the new knowledge introduced at the workshop is indifferent to the production and motivation theories that they had learned at school. In their opinion, they just did not know what to do so that the new concept could be implemented.

Confirmation of Proposition 1

The KA is an entity that comprises a group of members who maintain a continuous learning capacity to deal with collective problems or issues.

The results obtained provide evidence that the extensive impacts generated by the learning groups in the knowledge process are positive. These learning groups should have the autopoietic characteristics to self-produce their components, self-reference their cognitive resources to change the membership of the entity and self-observe their need to learn in order to enhance their cognitive abilities so that they are able to solve collective problems. The results also confirmed that some of the learning groups generate local or no impacts in their organisations in which autopoietic

characteristics are not found. This means that the former is more likely to have the suggested autopoietic characteristics (see Figure 5.1).

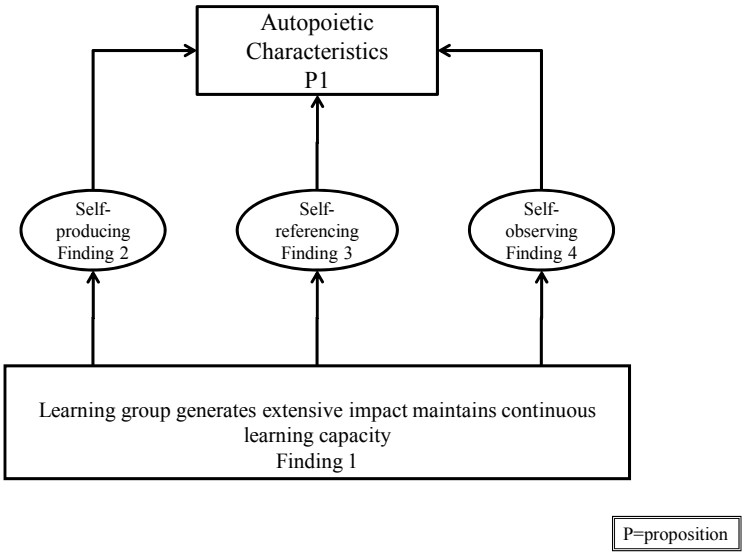


Fig. 5.1 Confirmation of Proposition 1

5.4.3 KA Boundary Properties

Proposition 2: A KA set has boundary properties to distinguish a group of members to carry out knowledge processes in an organisation to deal with collective problems or issues.

Members in a learning group who are capable, willing to put forth effort and take action to acquire knowledge are likely to form a learning set which would maintain their identity as an entity known as the KA to better the performance of an organisation. The results of the data analysis from the field study are shown in Table 5.6. They provide evidence to support this assertion. The boundary properties of a KA are found in the learning groups who have generated extensive impacts from the solution values, while those who have had a local impact or no impact to the organisation, at least one of the three boundary properties cannot be found.

Table 5.6: Boundary properties of KA found in the sample firms

Evidence to indicate the cognitive ability				
Findings	**Alpha**	**Beta**	**Gamma**	**Delta**
% of informants who hold tertiary education or professional qualifications	18%	56%	86%	36%
Duration to generate action plans at the workshop	175 minutes	174 minutes	152 minutes	184 minutes
Methods to acquire, retain, create or transfer knowledge from previous knowledge processes before the workshop	- seminars given by divisional supervisors, managing director - attend short courses	- self-learning - acquire Master's degree qualification - attend short courses	- regularly provide relevant training programme to employees - acquire Master's or higher degree - attend short courses - implement PDCA cycle for continuous improvement	- self-learning - acquire Master's degree - staff seminars given by production manager - training courses arranged by HR
Evidence to indicate the willingness to put forth effort (survey & post-workshop interview)				
Findings	**Alpha**	**Beta**	**Gamma**	**Delta**
Pre-workshop interviewees intend to carry out knowledge management for the firm	3 out of 8	5 out of 7; the director and a sales director did not intend to carry out the knowledge management process	7 out of 7	4 out of 8
Workshop participants intend to establish action plan	7 out of 22	8 out of 16	18 out of 21	8 out of 22
Post-workshop interviewees have intention to carry out knowledge management for the firm	2 out of 4	1 out of 3	4 out of 4	4 out of 5
Evidence to indicate the action taken (workshop & post-workshop interview)				
Findings	**Alpha**	**Beta**	**Gamma**	**Delta**
No. of informants who are committed to action plans established in workshop	3 out of 22	10 out of 16	14 out of 21	6 out of 22
No. of action plans established in the workshop which were implemented.	3 out of 6	7 out of 14	18 out of 18	8 out of 8

5.4.3.1 Finding 5: boundary properties of KA in learning group

Finding 5: The members of learning groups who generate positive impacts from the knowledge process, their initiative in taking action to learn, their willingness to put forth effort towards the knowledge process and their cognitive ability to acquire knowledge are evident while those who have local or no impacts, do not have at least one of the boundary properties.

In the sample firms, the findings indicated that all of the learning groups except for that of Alpha have the boundary properties of a KA before attending the workshop, which are: (1) cognitive abilities to acquire knowledge, (2) willingness to put forth effort towards the knowledge process, and (3) taking action to plan and implement the knowledge process to solve problems. Table 5.6 shows the summary of the boundary properties found in the sample firms. The Gamma learning group members, particularly the core members, have strong cognitive abilities to conduct the knowledge process. The consolidated data collected in the field demonstrated the group has the capacity to summarise and reorganise the learning experience into meaningful knowledge for further use that would generate new knowledge and transfer such knowledge to other members. A typical example is evident from its forthcoming action plans to continue the previous actions taken to better their material supplier system. Their plans have four parts: (1) to transfer the new knowledge learned at the workshop to the spinning unit, (2) to reinforce the key concepts to related departments and contractors, (3) to implement the second stage of the action plans established at the workshop, and (4) to practice the new training method that was taught by the external KA for conducting forthcoming internal training workshops. The plans demonstrated that this learning group has strong cognitive abilities in applying the learned knowledge and retrieving from the knowledge inventory for recursive learning. The observations of the group's learning activities showed that the firm is capable of examining the likelihood of adopting the created or acquired knowledge which is suitable for application to their situation. In addition, the prior knowledge and

education background of the learning group members are the highest among the sample firms.

Their strong cognitive abilities to conduct the knowledge process are also evident in the recommendation letter (Appendix XVIII) given by the firm after the field study was completed in which Gamma summarised the outcomes, benefits and participant feedback of the entire process. Besides that, it is evident that Gamma was highly motivated to put forth effort towards learning. From the interviews, it is found that the firm has come up with a strategy for member selection based on those who are willing to spend time on acquiring new knowledge and implementing action plans to deal with collective issues. One of the core members of the learning group, the managing director, stated:

> "Before any of the members are involved in an improvement plan, the core group, which includes Roger [material procurement manager], Vincent [production manager] and Peter [sales manager], would identify the stakeholders and their common interests so that we can select the right individuals to participate in the work group. In the event that common interests are not found, the work group retains the original core members to find another opportunity to reform the group with appropriate members. Willingness is a critical factor for change. I don't like it when someone verbally agrees with me, but does not actually do anything because paying lip service (inaction) would only affect the opportunities to solve problems. Luckily, after so many years, our colleagues have always committed to dealing with the challenges. Of course, we also face the situation where some colleagues insist that no solution is better than the current one to deal with a problem."

Cognitive abilities are also found in the learning group from Beta and Delta (see Table 5.6). Similar to Gamma, the members of the learning group from the trading unit at Beta have a tertiary education. Their prior knowledge is just as strong as the staff members at Gamma. However, unlike the group from Gamma who continuously maintain their cognitive resources through recursive learning, the core members of the learning group from Beta lack awareness of the importance of pursuing new knowledge for change. Among the core members, David, the merchandising director, shared his learning experience in the post-workshop meeting which

illustrates his deficiencies for learning:

> "Frankly, I have learned most of the concepts introduced at the workshop from school already. I just don't know why I did not realise this, and recall them when we tried to integrate the production and trading units… We are really busy in carrying out our daily operations. Even during our regular meetings, we can only work on urgent matters. The long term plans that we have come up with, are soon neglected. We have not seriously sat down and considered how to implement them."

Similar behaviours were observed among other core members of the learning group from Beta. The managing and the production directors did not implement the plans established at the workshop. They made excuses of a busy schedule and were not willing to put any effort into changes. Instead, it appears that they are waiting for others to do so.

In terms of Delta, the resultant local impact indicates the learning group has the cognitive ability to learn, particularly the members from the production plant. The production manager, Frank, is a typical example of a member who holds the boundary properties of a KA. He joined Delta as an accountant. He often renewed his cognitive resources to acquire new knowledge. Having examined the business performance, he began to manage the firm warehouse. After he reviewed the inventory pattern and the raw material supply, he concluded that production technology, material supply and accurate sales order information are the key factors of facilitating production to generate a profit. He transformed himself from an accountant into a factory manager by studying corporate management theories on his own, networking with manufacturers who produce similar goods in the region and attending various short courses on management.

However, the managing director, Gilbert, assumed that OEMs have "no say" in the actualisation of the ordering process. He felt that they would only passively follows the requirements of clients and do not play an active role in suggestions for changes. Subsequently, no improvement plan has been implemented outside the production department. Complete boundary properties are not found among the members of the learning group to deal with collective issues in the firm. Gilbert changed his assumption about

OEMs after the workshop. He re-defined his role in the firm as a champion who would lead them in a new direction. He had previously not taken part in any of the changes. Now he is willing to play an active role in leading the restructuring of their procurement system. Thus, the KA entity at Delta has all the boundary properties required.

In the analytic data, the behaviours of the informants from Alpha showed that some of the members in the learning group do not have the complete boundary properties of a KA to act on the suggested solutions for dealing with the collective problems. Among the members in the learning group, some have insufficient cognitive abilities to handle the new knowledge. Others are not willing to participate in the knowledge process while a few of them do not want to take part in the suggested solution for improvement. Many of the stories collected from the interviews and meetings illustrate that the members from Alpha are not able to completely form the boundary properties required of a KA entity. Some typical examples are selected, as shown in the following.

During his individual interview, Ivan, the managing director at Alpha, indicated that many of the daily operation problems occupied his time. He and Henry, the operation manager, have put forth much effort to work with their colleagues and set action plans that would improve the daily operations. However, their colleagues would not take action to make the changes happen. He gave two typical examples: (1) sample making priority, (2) recruitment policy implementation. Ivan admitted that in most cases, he is the only decision maker who would give instructions on ways to settle an argument. He explained that there were many disputes between different departments, but nobody cared to take action to change this scenario. Everyone else just wanted to pass the problems onto other departments.

The merchandising department also gave another example. Clara, the merchandising manager, indicated that the production and sampling departments do not follow instructions given by the merchandising department. At the same time, she was in denial about the competency of the

staff members in the merchandising department because they are merely clerical workers and so would not have knowledge of the products. Meanwhile, she stressed that her staff members have carried out a substantial amount of preparation work so that every single instruction given out has been properly retailored to the requirements of their clients. She claimed that the production and sampling staff are too fastidious and never appreciated the work done by her department.

Similar complaints were echoed in the sampling department. Kevin was dissatisfied with his colleagues from other departments. He said that the sales and production staff have an offensive attitude which made him feel that the suggestions given by the technicians are not respected. Kevin shared his frustration at an individual interview:

> "I always remind myself to refine the operation flow. But I have yet to find any room for improvement. Indeed, it is not an individual issue… After the workshop training, only Ivan [managing director] and Jade [production manager] took part in the action plans. They [other people in the firm] do not do much to make changes. How on earth is the training that we attended any useful? The merchandisers still give us incomplete information but pressure us to meet the due date….. I am so busy. I have no time to be taken on the improvement plan [in my department]. Other people must also do their part.... I also want a promising result similar to that of Jade. But I need other departments to do what they have committed to doing. This is not just lip service."

In the conversation, Kevin showed his unwillingness to participate in the knowledge process. He gave two excuses to explain why he did not want to take part in the improvement plan. He did not find any room for improvement and he was too busy. His excuses demonstrated that his agenda is to cover cognitive disability.

The observations provide explanations for the failure to generate positive impacts for their organisation (see Table 5.6). The findings indicated that the key members from the merchandising and sampling departments do not have sufficient cognitive abilities and resources to conduct knowledge processes. Clara and her subordinates have acquired

product knowledge from work experience. They are lack of confidence to handle new things in the way which they have not come across. As Clara and her merchandising team refused to cooperate with other colleagues, this caused them to reject their comments or suggestions. In the workshop, the conversation between the members within the same group revealed that most participants from the merchandising department do not understand the descriptions provided by production people. In the post-workshop interviews and survey, some of the merchandising staff shared that they want more product knowledge and terminology to communicate with overseas buyers and colleagues in the production department. The workshop gave them the opportunity to understand the production process. However, one single training workshop is not enough to enhance their cognitive capacities.

The same observation was found in the sampling department. Kevin was previously a pattern technician. As he is a hard working individual, he was promoted to be a supervisor in the sampling department. He is assigned to lead a group of pattern makers to find solutions for reducing the total processing time to make proto samples for client approval. In his interview, Kevin stressed several times that he is not a professional in garment engineering, particularly with fashionable items. He is in the position because Ivan trusts him. In an open manner, he stated that he could neither cope with such a complex situation where he has to handle the priorities of sample making nor could he think about what he could do to improve the process. He does not know how to mobilise his subordinates to find new ways of doing things. He is only confident in following what has been already established in the system. Any new change creates a burden for him. He frankly asked about training that could improve his management and problem solving skills. Evidently, he lacks the confidence to handle managerial work.

The findings also indicated that the previous knowledge held by the core members in the learning group from Alpha is not as strong as that of their counterparts from other firms in the sample (see Table 5.6). Most of

them have acquired procedural and professional knowledge from their previous professional experience in the apparel industry. They are hard-working people. In his interview, the managing director shared that his colleagues do not make changes not because they are lazy but lack the cognitive ability to learn new things. The boundary properties of KAs, however, are found in a few of the individual members. For example, members from the production department demonstrated that they are capable of learning to carrying out a knowledge process for changes. The promising results in the production department after the workshop show that the local unit has learned. Jade, the production manager, continues to strive for better ways to manage the production process. In an interview, she discussed her work model:

> "I always keep my eyes open when I am walking around in the production line. When I find something unusual, I call for a meeting with the people concerned. Then we work together to find a solution. Prevention is the core means to streamlining operations. I don't want to see products that are incorrectly made. Sometimes I have to talk to the sample room staff about the construction.... Recently, I am thinking whether I need to be involved in the sample construction meetings. It seems to me that it is too late to change the garment construction when the production has started."

The findings collected from the field give evidence to support the hypothesis that learning groups who generate positive impacts have the boundary properties of KAs while the groups who do not generate any impact, some of boundaries properties are missing. The findings also indicated the association of unwillingness to learn with inappropriate or insufficient cognitive resources of the learning group members. The opinions of the informants in the meetings and during the interviews were no exception; those who took actions for change were willing to make changes. In other words, members who made it a point to learn are also eager to do so. The observations made during the meetings, interviews and the workshop provided a picture that illustrates why members of a learning group do not act as the KA defined. This is because the members lack the cognitive abilities to acquire or apply knowledge. There are two aspects of cognitive abilities: (1) the learning skills for acquiring or creating new

knowledge, and (2) the cognitive resources (Fiedler & Garcia 1987) from previous relevant experiences, a diversity in experience or prior knowledge. Learning skills include the attention and awareness of the change, working memory of previous experience, abilities to plan and act for a goal, interpretation of observations and reasoning to make sense of the relationship between facts.

Confirmation of Proposition 2

A KA set has boundary properties to distinguish a group of members who carry out knowledge processes in organisations to deal with collective problems or issues.

In the learning groups who have autopoietic characteristics, the boundary properties of the KA are evident for the formation of a KA set, while in the learning groups who do not have autopoietic characteristics, some of the boundary properties of the KA may form a KA set, but some of the properties do not exist and therefore, no KA set is formed (Figure 5.2).

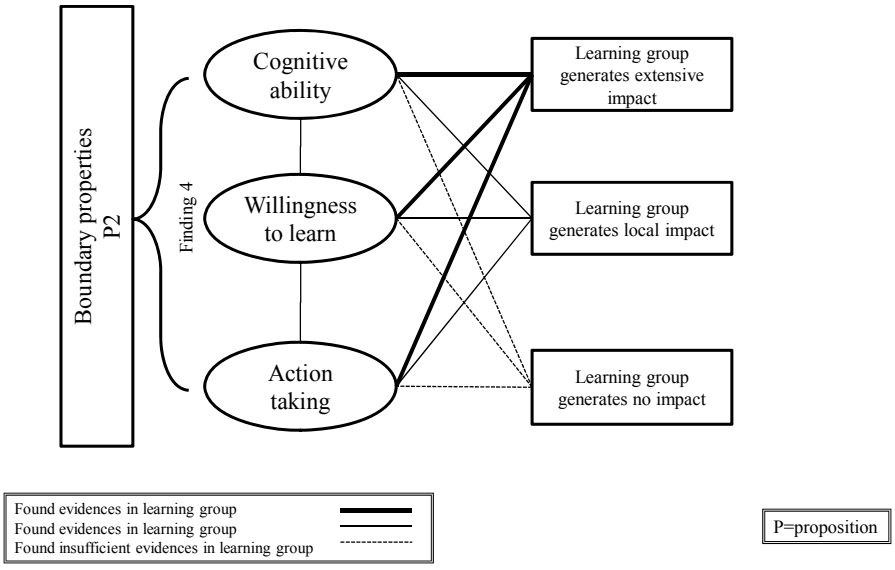


Fig. 5.2 Confirmation of Proposition 2

5.4.4 Neighbourhood Relations of KA

Proposition 3: As an entity, the KA is a set bonded together through commonalities and tolerance of differences, which separates the KA from its environment in learning to deal with collective problems or issues.

The KA is defined as an entity composed of a group of internal or external members in an organisation who deal with collective problems or issues. Collectiveness embraces more than one stakeholder who is involved with an issue in which the consequences will affect many different units in the organisation. Many works of research in organisational learning have found that individuals might have reservations in taking actions for change because there is conflict between the local and universal (Edmondson 2002). In the field study, many of the scenarios described by informants exemplify that their firms have failed to make changes because the members felt they are unable to reach common objectives or expectations with other members due to unmerited benefit allocation, ambiguous responsibilities and unfair measure of performance while firms which have successfully generated solutions to change, conflicts between members or departments still exist despite that common goals are set. A summary of the findings from the field is shown in Table 5.7.

Table 5.7: Commonalities & tolerated differences found in the firms (interviews, workshop, consultation meeting)

Commonalities found between members of the learning group, organisation and local business unit		
	Management level	**Individual level (local business unit)**
Alpha	- Improve communication	- Improve communication - Improve operation processes
Beta	- Become core knitwear suppliers in global market - Integrate trading unit with production unit to develop products - Improve communication between trading and production units	Production unit - Improve communication - Improve product knowledge of merchandisers Trading unit - Become leading supplier in high-end knitwear products
Gamma	- The firm continuously takes proactive actions to better business performance	- Are willing to and take action to find a common goal among those from different departments or business partners who are the stakeholders of collective problems - Understand shorten production time is difficult, but must find ways to achieve and improve - Believe there is room to improve productivity and costs - Acquire new knowledge to more effectively manage knowledge process - Application of learned knowledge is important to understand the context of new knowledge - Share learned knowledge with colleagues and business partners
Delta	Before the workshop - Nil After the workshop - Change in attitude to actively find solutions to resolve conflicts between business partners and departments	- Become a preferred supplier - Enable every employee to use cognitive abilities to do better - Resolve conflicts between departments
Tolerated differences found among members of the learning group		
Alpha	Nil	
Beta	Nil	
Gamma	- Sales department are concerned with customer satisfaction and provide wide range of products while production department want a limited range of products.	
Delta	- Different business aims of the managing director and production team	
Un-tolerated differences found among members of the learning group		
Alpha	- Sampling department is asked to follow the new ERP systems to collect and input the material consumption and estimate SAM even if no product details are given by sales department - Different views on responsibilities among departments - Different views on knowledge that should be acquired in different departments	
Beta	- Require production unit to support the objective of trading unit to shorten production lead time and become core supplier in the global market - Different compensation between trading and production unit,	
Gamma	Nil	
Delta	Nil	

5.4.4.1 Finding 6: existence of commonalities and tolerated differences

Finding 6: Existence of commonalities and tolerated differences among members of the internal learning group

(i) Commonalities and tolerated differences are found in double neighbourhood relations at the local and organisation levels which are established among the KA set formed by internal organisational members and generate extensive impacts.

In the focus group discussion, Gamma indicated that they wanted to show how they could reach an agreement to learn effectively, when they were determining the issues for the single day operation management training workshop. In contrast with the other firms, Gamma identified all possible common goals among the meeting participants in order to come up with a problem that affected everyone for the field study. Gamma was no exception when it came to conflicts between members or departments. When the issue of "improv(ing) the overall productivity for bettering delivery on time and reduction of total costs" was selected as the scope at the workshop, there were overwhelmingly many reasons to explain the limitations on further improvement which were raised by the production staff. Their explanations included: substantial increases of small orders which interrupted the production schedule, excessive cleaning of the dyeing tanks and resetting of the weaving machine for new fabrics, and instability of the material supply. Members from marketing department, on the other hand, were convinced that the market for technical fabric is large, but orders are small in quantity. The informants then listed out the possible areas for improvement which may bring about positive impacts and eliminate the negativity of conflicts between the departments. In the field study, the learning group from Gamma took action to search for commonalities to deal with collective problems which is a general practice that allows them to work together. The consolidation of the data collected from the field showed that their problem solving approach can be summed up as follows: first, they collectively identified issues which affected common goals or objectives.

Then, they determined the stakeholders who would be affected. After that, they formed a work group to find solutions. Having taken the actions to implement the solutions, they reviewed the outcomes and examined if there is any follow up needed. The drive behind the problem solving by the learning group members is due to the fact that they have shared expectations to fulfill the long term objective of being a market leader in advanced fabrics in the region. They believed that the understanding of other operation processes would help them eliminate negative impacts when changes must be implemented. They are also willing to share knowledge with others. The sales manager, Peter commented on his experience with learning group members on their thoughts:

> "Even if each department does a good job, this does not mean that the mill can provide good products. We have to work with all the departments as a single entity. Pity that as soon as I find that I have made a proper change, another department may have a new requirement for us. This is because they want to further improve their performance. So we work together to find a new solution. Like Roger, our materials manager, who often uses this slogan: find problems before they occur. So we don't run away when there is a challenge in front of us. We are prepared."

In the workshop, evidence of commonality and tolerance of differences was found at Gamma. For the former, the learning group wanted to maintain a production force in Hong Kong. Hence, the members of the group hold several commonalities to better the overall business. For the latter, the group respected different views of handling orders that had small quantities. The action plans generated at the workshop, therefore, involved the improvement of the operation processes in different departments in order to reduce the burden on the production department or facilitate the production operation in a more effective way. The action that were to be carried out include: (1) that the sales department work out a marketing strategy which focuses on several types of products which would have synergy effects on the clients and the firm, (2) that the material procurement department reengineer the process to reduce the yarn supply time; at the same time, maintain the quality performance of the yarns, (3) that the engineering department reexamine the machine set up so that the time taken

to change parts would be shortened, and (4) that the quality department starts a programme to enhance preventative measures to be taken both within the firm and with its contractors to minimise the occurrences of defects during production (Appendix XIX). All of these actions have an impact on the company-wide objective; that is, to be a leader in the production of advanced fabrics in the global market. The findings also indicated that commonalities and tolerated differences between the local and universal would allow the members to take action to streamline the overall operation process. Double neighbourhood relations are found between the learning group members, which hold the properties of a KA set, with individual members from different business units and within the organisation.

Double neighbourhood relations between the KA set at the local unit and organisation level are found in Delta after the external KA intervened in their knowledge process. The cognitive capacity of the key members in the KA set increased after the workshop when common goals were revealed. In the post-workshop meeting, Gilbert, the managing director of Delta, indicated that his management team has searched for common areas that are applicable to all of the learning group members. He was confident that there are many opportunities to reduce the total costs of their business operations. He stated:

> "At the workshop, the notion behind the new operation management concept came as a complete culture shock to us. Now we have a breakthrough on how we have been doing things. You know, this factory has been established for a long time since my father founded it in the 50s. We are used to the traditional ways of operating our business… A few months ago, when you approached us, you were told that our goals were to reduce expenses, and speed up the production lead time. Now we have changed our objectives. We have now digested the concept that was introduced at the workshop and it has become a philosophy that guides our business. We have started to change the operation process in the procurement department to reduce the burden on the production staff. Our sales team has established a new business strategy to expand our market. At the same time, the human resources department plans to make arrangements for some workshops on basic product knowledge for our front line merchandising staff."

After the workshop, Gilbert and his management team are using a new lens to review the direction of the company, which is to find common goals among different departments. Originally, Gilbert was not able to see that advanced technology in the making of goods was the core competency of the company with which he could use to change his business strategy. Although Frank, the production manager, still insists that developing a brand will lead the firm towards a better business position, he accepts that streamlining the material supply chain to improve the quality of materials is indeed a crucial change. In other words, even the members agree that different views in their business strategies for the future would constitute a burden to reach a common goal, the objectives that are set for improvement from the current procurement management activities can be achieved.

(ii) *Double neighbourhood relations at the local unit and organisation level are not established if commonalities and tolerated differences are not found among the internal organisational members in a KA set which would otherwise have positive impacts.*

Before the involvement of the external KA, tolerated differences were not found at Delta. Frank, the production manager, mentioned several times that the firm should change their business mode from OEM to ODM. Gilbert was adamant that the firm is absolutely an OEM and he could not change the DNA of the firm. Frank concluded that the low profitability was caused by the stubbornness of the managing director Gilbert, who would not change the business mode. He provided some typical daily examples that caused this dilemma:

> "I can make changes to my operation processes [production operation processes] and have the operators make changes too. But I cannot change the quality of the materials. Look! Because of the unexpected large amount of fabric defects, I have had to arrange for extra labour to sort out the unacceptable pieces. This affects the production schedule…. I will provide you with dozens of cases about the poor quality of the material supplies which I have been handling for years. Unfit hanger, wrong price tag, mismatching hooks …..Gilbert [managing director] can only tell me that the

material suppliers are chosen by the clients. We have no choice. Do we really have no choice? Why don't we try to change the minds of our clients? I am really frustrated. "

The difference in their views diverts Frank and Gilbert from making improvements. Frank wants to expand the design and engineering department while Gilbert just wants to save money and hold off all further possible expenses. No commonality has been reached and thus, no neighbourhood relation between the KA set and the organisation is established.

In contrast, while differences were tolerated, no commonalities were found in the KA set at the local level in Alpha and Beta during the period of the field study. In Beta, although both the trading and production units agree that the long term goal is to become the key vendor that would replace the Italian suppliers, the two units cannot compromise and work together to reduce the production lead time. Both units have separate profit and loss accounts. Although Beta holds the majority of the Speedy shares, the production unit insists that the advantages of a shortened production lead time would not bring about many benefits for them.

Hence, the unit prefers to focus their efforts on product development. The trading unit, on the other hand, has the flexibility to source other contractors to fulfill the order requirements, so the drive to push Beta to review its operational processes to facilitate the production process is not strong. The conflict of interest between these two units have resulted in an insurmountable obstacle that prevents make their integration as one KA entity that would work together to learn and change.

Similar to those from Beta, the learning group from Alpha has generated positive impacts at the local level only after the involvement of the external KA. Their situation is also similar to Beta in that there are no commonalities found among the learning group members and the departments do not tolerate differences among one another (see Table 5.7). The informants from the merchandising department at Alpha showed that they were the fire fighters who put out the fires between the sample room

and production department. During the interviews, they shared that most of time, the problems were discovered at the very last minute, which put the merchandising staff into a very embarrassing position when they had to face the clients and ask to delay shipment. On the other hand, the sample room supervisor complained that the instructions given by the merchandising department was not clear which actually caused delays in making the samples. Similar complaints were heard from informants in different departments. Two typical examples are illustrated as follows.

A merchandiser, Sarah, explained her view on translating the improvement that took place in the production department to the merchandising department:

> "I don't know what has been carried out in the production department. Every department has a different situation. We are really busy with the carrying out of our daily operations. We need to simultaneously handle numerous issues and coordinate them well before we issue a production order to the production floor. [It is] very rare that [we would] contact other people unless we have a direct working relation…. The merchandisers don't have to know everything about production. They are capable of translating the requirements of overseas clients to the production floor. "

Henry, the operation director gave a typical example to share his difficulties in transferring the new knowledge learned at the workshop to other departments:

> "After the workshop, I asked the supervisors of each department to depict their operation flows. They roughly did so. I further asked them to determine some non-value added operations [that I learned at the workshop]. They just kept on telling me that they are busy. I know that this is an excuse.… The top management accepts the new concepts of operation management that we have learned at the workshop. But the middle management staff members aren't so accepting. They only care about their own departments."

(iii) No impacts are generated when commonalities or tolerated differences are not found among the learning group formed by internal organisational members.

The Alpha learning group had incomplete KA boundary properties

before the workshop. In addition, there were many conflicts between the different departments. Plus, they were not able to reach any common goal to improve productivity. Many informants expressed their need to ask other departments to improve their communication with them. Commonalities or tolerated differences are neither found among the members within the learning group nor between departments. No neighbourhood relations are found.

In summary, the results of the field data analysis indicate that the learning groups which are formed by internal members (1) that have properties of a KA set, generate extensive impacts from the knowledge process; commonalities and tolerated differences are found; and double neighbourhood relations at the local and organisational levels are established, (2) that have properties of a KA set, generate local impacts from the knowledge process; commonalities or tolerated differences are not found; and double neighbourhood relations at the local and organisational levels are not established, and (3) that do not have properties of a KA set, generate no impacts from the knowledge process; commonalities or tolerated differences are not found; and double neighbourhood relations at the local and organisational levels are not established.

5.4.4.2 Finding 7: existence of commonalities in the external KA

Finding 7: *There is the existence of commonalities and tolerated differences among the members of a learning group that have internal and external agents*

(i) *Commonalities are found among the external agent, the members of the learning group and the organisation, which include the completion of a primary relation in the establishment of the first and second orders of neighbourhood.*

Commonality is not limited to reaching a shared goal or common objective. It could be a form of communication that uses the same language

in an industry or sharing of the ownership of a collective problem in an organisation. The observations of the interactions between Benjamin, the external KA who was the facilitator in the field study, and the participants, as well from the participant feedback, indicated that there is commonality between the participants and Benjamin. Benjamin integrated into the sample firms as a member of the learning group by setting some form of commonality with the participants: dialogue that uses the same industrial terms and resonance with the concerns of the collective problems. Benjamin proactively learned about the characteristics of the industry and technical terms before he took part in the site visits. During the visits, he not only tried to understand the overall operations in the firms, but also adopted some of the technical language which allowed him to create a closer relation with the firms. To show that he is not an outsider or alien to the industry, he also adopted some similar situations in the textile industry to elaborate on the new concept to his audience. Furthermore, he started to use statements that were inclusive; that is, "we" statements, as suggested by Covey (2004) to compel people into taking a proactive role, naturally at the pre-workshop meeting, to discuss the firm's issue. One of the informants, Vincent, the operation manager at Gamma, described about his experience while working with Benjamin at the workshop:

> "Benjamin is really an expert in our industry. We attended the Six Sigma management training given by other institutes. The coach gave us plenty of examples. But many of my colleagues were falling asleep during the class. Why? Because the coach only gave us examples from the electronic industry. Who would have any interest in other industries! We want to know how to apply the concept to our situation. Benjamin is different. He quoted a lot of examples that are related to our daily work. Moreover, he has used real cases that have also happened at our factory to demonstrate how to apply the concept, for example, the [suggestions to] change machine parts to reduce the setting time. Now, we have the confidence to implement the solutions plans which were established at the workshop."

Commonality through the use of a common language and pinpointing to similar problematic concerns convinced the team that they could rely on Benjamin and have more confidence on applying the concept

to their real life problems.

(ii) Commonalities and tolerated differences that exist in double neighbourhood relations at the local unit and organisation level among the KA set formed by internal organisational members and external agents generate extensive impacts.

After the input of an additional hypothetical factor into Gamma in which the external KA agent intervenes in the knowledge process, they were still able to maintain capability in generating extensive impacts from the knowledge process. The consolidated data indicate that a first order neighbourhood has been developed in the primary relations, which is the commonality between the external agent and the individual members of KA sets, and the second order neighbourhood, which is the commonality between the external agent and the organisation, have taken place. In the Delta learning group, commonality was found after the involvement of the external KA, and a primary neighbourhood relation is established.

(iii) Incomplete neighbourhood relations at the local unit and organisation level are found among internal organisational members even though a primary neighbourhood is established with external agents in a KA set which generates local impacts.

In comparison with Gamma and Delta, even though a primary neighbourhood relation is found at Beta and Alpha, the KA sets can only generate local impacts. The results suggest only a primary neighbourhood between the external agent and the individual members of the KA sets, and the second order, which is the commonality between the external agent and the organisation, may not have any association with the results of the knowledge process to produce extensive impacts.

Apart from the observation data in the field, the interview survey before the workshop also provided evidence that there is a positive association between extensive impacts and commonality among the learning

group members. Each interviewee was asked to prioritise the importance of improving performance in a list of operations. Then the rankings were compared. All of the informants in the sample were asked to rank six issues in descending order to indicate the priority that their firm should take when addressing the issues in the next twelve months. In Gamma, five out of the same six issues were ranked by almost eighty percent of the informants with the same or adjacent priority, while eighty percent of the informants from the other three firms ranked less than half of the issues with the same or adjacent priority (Table 5.8). Among the responses, the differences in the views between the directors and production staff on customer satisfaction in Delta are the greatest. The directors ranked customer satisfaction as the lowest priority while the production staff placed it as the highest priority. This finding confirmed that Gilbert's business attitude has been diverted to his employees. The ranking of other items, on the other hand, were relatively close. This is evident that the staff at the firm had reached commonality to deal with the collective problem after the involvement of the external KA.

At Alpha, eighty percent of the informants provided similar rankings for two out of the six items, but the ranking similarity for half of the items is less than 50%. The Beta staff did not rank the majority of the items in the same or adjacent order. This indicates that the informants have an extremely conflicting view.

Table 5.8 : Percentage of item the informants ranked with the same or adjacent priority

Importance issue of the firm	**Alpha**	**Beta**	**Gamma**	**Delta**
No. of informants who were interviewed before the workshop	7	8	8	8
Customer satisfaction	33%	63%	89%	50%
On time delivery	50%	50%	78%	75%
Key product quality performance	83%	38%	67%	100%
Employee satisfaction	33%	75%	89%	88%
Company business result	67%	63%	89%	75%
Safety at work	83%	38%	78%	63%

In conclusion, members may work together to generate solutions for collective problems or issues when there are commonalities on the condition that the differences among members are tolerated. The research findings confirm there is positive association between positive impacts yielded after a knowledge process when the commonality that the learning group members have with other members is able to override differences or conflicts. With reference to the KAT, this relation is defined as a neighbourhood. Members are linked together to form a KA entity with a double neighbourhood relation at the individual local unit and the organisation levels, respectively, including the establishment of a primary neighbourhood relation between the external agent and KA set of internal members.

5.4.4.3 Finding 8: hypothetic factors that verify the constructs of KAs

Finding 8: ***A learning group generates extensive impacts when they have autopoietic characteristics, boundary properties and double neighbourhood relations.***

The learning groups in Gamma and Delta generate extensive impacts because they have autopoietic properties, boundary properties of KAs and completion of double neighbourhood relations, including a primary neighbourhood relation with an external agent. In Gamma, the learning behaviour of the learning group before and after the workshop matches with that of the theorised proper KA as an unblocked agent. In Delta, the neighbourhood between the KA set and organisation was established after the external KA became involved in the knowledge process; a double neighbourhood relation is completed and the KA set also behaves like an unblocked KA.

A learning group generates local impacts when it is associated with either incomplete KA boundary properties and/or neighbourhood relations. Before the involvement of the external KA, the Delta learning group did not establish a secondary neighbourhood at the organisational level. The Beta learning group members from the trading and production units did not establish a primary neighbourhood relationship and there were no changes in

the conflict of interest between the two units. In the Alpha learning group, even though some have complete KA boundary properties after the involvement of the external KA, their learning behaviours are restricted to having a local impact. All of these KA sets behave like a quasi-KA as theorised in the KAT.

Gamma is the only firm in the sample during the whole period of the field study who demonstrates a neighbourhood relation between the learning group members at both the individual and organisational levels. The members in the learning group have shared common goals in learning to find better solutions to maintain a leading position in production of advanced fabrics. This bond links them together. The interactions between the informants and Benjamin in the study settings demonstrated that the commonality extends to an external KA to establish first and second order neighbourhoods in primary relations. The neighbourhood formation is a process of structural coupling with which enables Gamma to enhance their cognitive capabilities for forthcoming knowledge processes with new members that join the learning group who are outside the firm.

Gamma's action plans (see Appendix XIX) are consistent in keeping a double neighbourhood relation: the members have commonality to achieve the organisational goals which aim to add value to the products for their clients and reduce total costs. They also have a shared value in that improvement is not relied on individuals but carried out by a proper work team. Gamma's cognitive resources show that they often take action to find opportunities that meet the goals. In the training workshop, when the learning group was discussing about the likelihood of changing current operation processes, the members referred to the necessity of checking with other stakeholders about the possible influences and conditions in which the action plans can be feasibly implemented. The actions include those that may be taken in order processing, raw material procurement and arrangement, and sub-contraction management; these are interwoven as one local unit is integrated with another unit into a larger operation system to improve supply chain management.

Conflicts between members of the learning team were found. However, these are not associated with the function of the learning entity because there is commonality and the conflict caused by differences in opinion is tolerated.

Prior to the workshop, a primary neighbourhood was found in Delta between the KA set and individual members, but a secondary neighbourhood was missing. Although the learning group had generated positive impacts, their knowledge process outputs were restricted to benefits at a local level. Different views for the future development of Delta between the directors and the production manager resulted in different views in approach to manage the material supply chain. Gilbert insisted that Delta is an OEM while Frank advocated that Delta should become an ODM or OBM. The former felt that it is the responsibility of the clients to monitor the supply of the raw materials in terms of quality, price, delivery and quantity. Delta, as an OEM, does not need to negotiate with the suppliers. The firm would only play a very passive role and follow the instructions given by their clients. The suppliers of materials were also appointed by the clients. Under this assumption, the firm did not have a say on the performance of the supplier. Hence, he tolerated the poor quality of the incoming materials. He did not consider the poor quality to affect the development of the firm very much. Frank, on the other hand, assumed that as an ODM or OBM, the firm would have more influence in selection of suppliers so that quality would no longer be an issue. If so, Delta would have better business performance. Frank and Gilbert were not able to reach a consensus on the business mode of the firm. Although Frank's assumption has driven the production people to put forth a huge amount of effort to improve the engineering and research and development department in order to preparation to transform the firm from an OEM to ODM or OBM, the rewards fell short of their expectations and some informants indicated their frustration.

After the involvement of the external KA, Gilbert released his assumption and instead, created many common goals with his employees: (1) enhance the supply chain of materials, (2) improve the product knowledge

of the merchandising staff, and (3) improve human resources to meet the new requirements of the firm's future plan. The common goals brought the members together and a double neighbourhood relation was thus established. In the post-workshop meeting, the participants indicated that these new goals substantially changed how the firm deals with problems caused by improper management of suppliers.

At Beta, although a primary neighbourhood relation was established between the participants and the external agent, there were still conflicts between local interest and cooperate interest. The findings showed that there is dispute between the production and trading units which prevented them from building a neighbourhood relation at the individual level. The members from the two units formed a learning group to deal with the collective issue, but in fact, did not take action to change. They preferred more to protect the local interests. The two units were afraid that their gained benefits would be eroded by the other unit. Hence, the implementation of the action plans established at the workshop that would integrate the production and trading units together to shorten the total order processing time backfired and both resorted back to their own local issues.

The behaviour of the Alpha learning group is observed as that of pseudo- and quasi-KAs before and after the workshop, respectively. No primary or secondary neighbourhood relation was found before the workshop. The findings indicated that the members of the learning group were appointed by the managing director, Ivan. No commonality was found among the members in the group. The members shifted the blame to each other for the existing problems in the firm. Conflicts were found among the departments. These conflicts prevented local members from working together with staff from other departments. Besides that, the members from the sampling and merchandising department did not completely have all of the boundary properties. Their cognitive incapability is associated with unwillingness to learn. The result is that the firm does not learn. No changes have been carried out after the knowledge process was conducted. The firm, however, did not know that its learning group behaved like a pseudo-KA.

After the involvement of the external KA, the members of the production unit established common goals for the workplace management to reengineer the work flow and rearrange the production facilities and devices. However, the members among the different departments still could not resolve their disputes. The sales department was convinced that their instructions should be followed for the production details. A neighbourhood relation at the individual level is, therefore, not found. Eventually, only a local impact from the production department can be found. The learning group behaviour matches that of the KAT description of a quasi-KA.

As a whole, the findings suggested that there is a positive association between extensive impacts and double neighbourhood relation, and local impacts and lack of a double neighbourhood relation. The findings agree with the hypothesis that commonality and tolerated differences or conflicts jointly occur in a firm to establish a double neighbourhood that links individual members within the KA set and also the individual and organisational levels.

After examining the data collected from the field, members in a learning group who were not willing to learn could be classified into: (1) those who could not reach a neighborhood relation at either or both the individual and organisational levels, and (2) those who lack the cognitive abilities to acquire new knowledge. Table 5.9 illustrates the overall results of the data analysis on the four firms in the sample.

Table 5.9: Summary of findings of KA constructs in the field study

	Alpha		**Beta**		**Gamma**		**Delta**	
Autopoietic characteristics before and after the involvement of the external KA								
Involvement of the external KA	before	after	before	after	before	after	before	after
a. self-producing	x	x	x	x	√	√	x	√
b. self-referencing	x	x	x	x	√	√	x	√
c. self-observing	x	x	x	x	√	√	x	√
Boundary Properties								
a. cognitive abilities	x	x	x	x	√	√	√	√
b. willingness	x	√	√	√	√	√	√	√
c. taking action	x	√	√	√	√	√	√	√
Double Neighbourhood								
Primary neighbourhood								
Involvement of the external KA	before	after	before	after	before	after	before	after
1st order with external agent and organisation	n/c	√	n/c	√	n/c	√	n/c	√
2nd order with external agent and individuals	n/c	√	n/c	√	n/c	√	n/c	√
Individual level	x	x	x	x	√	√	√	√
Secondary neighbourhood								
Involvement of the external KA	before	after	before	after	before	after	before	after
Organisational level	√	√	√	√	√	√	x	√
Types of KA suggested	**Pseudo-KA**	**Quasi-KA**	**Quasi-KA**	**Quasi-KA**	**Proper KA**	**Proper KA**	**Quasi-KA**	**Proper KA**

√ evidence was found in the field study
x no evidence was found in the field study
n/c not covered

Confirmation of Proposition 3

As an entity, the KA is a set that is bonded together through commonalities and tolerance of differences, which separate the KA from its environment in learning to deal with collective problems or issues.

In the field study, the learning behaviours of learning groups in the firms conform to the different classification of KAs in the KAT (see Table 3.2). They are: unblocked, quasi- un-recognised and localised, and pseudo-delegated KAs. The findings suggested that unblocked KAs have double neighbourhood relations while quasi- and pseudo-KAs fail to hold at least one neighourhood relation. The findings also showed that having all of the boundary properties of a KA is associated with the type of KA formed in an organisation; if all of the boundary properties are found, they are unblocked or quasi-KAs, while if one out of the three required boundary properties is not found, this is a pseudo-KA.

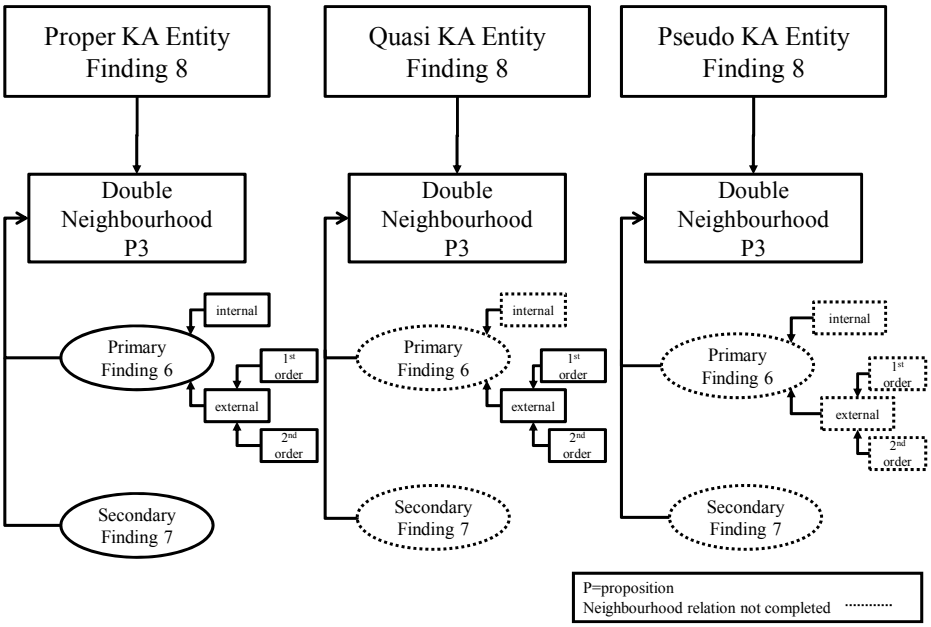


Fig. 5.3 Confirmation of Proposition 3

5.5 Summary

The KAT describes the properties of KAs as autopoietic in that an agent entity is formed and sustained by self-producing components with boundary properties of the entity itself. The entity does not stand alone to carry out the knowledge process. The existence of KAs is to deal with collective issues in an organisation. Hence, the entity is a social group that interacts with the stakeholders of collective issues. Luhmann's (1995) social systems theory provides the foundation to formulate the investigation on the properties of KAs, which is the simplest unit in an organisation and carries out knowledge processes for changes to take place. In the field study, the propositions and hypotheses summarise the observed uniformities of the data which conform to the constructs of the KAT established in this study (see Table 5.10).

As mentioned, the prerequisite condition of members to become a component of a KA entity is they hold the boundary properties that distinguish them from the outside environment (Proposition 2). The distinction of the entity is to ensure that the conflicts between the members within the entity and their local relation will not affect the functions of the KA, that is, if there are commonalities and tolerated differences (Proposition 3). When a proper KA entity exists, self-producing systems that maintain the learning capacity to continuously deal with collective problems will appear (Proposition1). The KA enables organisations to respond to changes in the business environment. The overall conformation of the constructs of KAT is illustrated in Figure 5.4.

Table 5.10: Summary of Hypotheses and Findings Part I

<table>
<tr><td colspan="2">Proposition 1:
The KA entity is a group of members who maintain a continuous learning capacity to deal with collective problems or issues.

Finding 1:
(i) The learning groups which generate solution values with extensive impacts on collective problems or issues are entities that comprise a group of members who maintain a continuous learning capacity.
(ii) The learning groups which generate solution values with local impacts are entities that comprise a group of members who are interested in improving local issues, but do not work together to deal with collective problems or issues.
(iii) The learning groups which generate no impacts on collective problems or issues are entities that comprise a group of members who do not take part in any actions to deal with collective problems or issues.</td></tr>
<tr><td>Hypothesis1:
A KA recursively uses learned knowledge to generate new meanings of things as inputs of forthcoming knowledge processes.</td><td>Finding 2:
Learning groups who create extensive impacts to an organisation recursively use the learned knowledge to generate new approaches as inputs of forthcoming knowledge processes while this is not true for the learning groups who have local or no impacts.</td></tr>
<tr><td>Hypothesis 2:
The KA maintains awareness by reviewing components through reference to its cognitive resources, and outputs become inputs of self-observing activities in order to keep an identity for learning.</td><td>Finding 3:
Learning groups that generate extensive impacts to the organisation maintains awareness by reviewing its learning group membership in reference to its cognitive resources in order to maintain its identity for learning while this is not true for learning groups which generate local or no impacts to the organisation.</td></tr>
<tr><td>Hypothesis 3:
The KA examines the need to conduct knowledge processes by observing its cognitive resources to solve collective problems or issues in order to sustain its identity for learning.</td><td>Finding 4:
Learning groups which have extensive impacts on an organisation examine the need to conduct knowledge processes by observing their cognitive resources to solve collective problems or issues in order to sustain their identity for learning while this is not true for learning groups that have local or no impacts on an organisation.</td></tr>
<tr><td colspan="2">Proposition 2:
The KA set has boundary properties to distinguish a group of members who carry out knowledge processes in an organisation that deals with collective problems or issues.</td></tr>
<tr><td>Hypothesis 4:
Members of a KA set have cognitive abilities to acquire knowledge, are willing to put forth effort on knowledge processes and take action to plan and implement knowledge processes to solve problems.</td><td>Finding 5:
The members of learning groups who generate positive impacts from the knowledge process, their initiative in taking action to learn, their willingness to put forth effort towards the knowledge process and their cognitive ability to acquire knowledge are evident while those who have local or no impacts, do not have even one of the boundary properties.</td></tr>
</table>

Table 5.10: Summary of Hypotheses and Findings Part II

Proposition 3: *The KA entity is a KA set bonded together through commonality and tolerance of differences which creates separation from the environment in learning to deal with collective problems or issues.*	
Hypothesis 5: *The members of a KA set which has been formed by internal individuals of an organisation have commonality and tolerate differences to establish double neighbourhood relations at the local unit and organisation levels.*	Finding 6: Existence of commonalities and tolerated differences among members of the internal learning group: (i) Commonalities and tolerated differences are found in double neighbourhood relations at the local and organisation levels which are established among the KA set formed by internal organisational members and generate extensive impacts. (ii) Double neighbourhood relations at the local unit and organisation level are not established if commonalities and tolerated differences are not found among the internal organisational members in a KA set which would otherwise have positive impacts. (iii) No impacts are generated when commonalities or tolerated differences are not found among the learning group formed by internal organisational members.
Hypothesis 6: *The members of a KA set which include internal people and an external agent have commonality and tolerate differences to establish double neighbourhood relations at the local unit and organisation levels.*	Finding 7: There is the existence of commonalities and tolerated differences among the members of a learning group that have internal and external agents: (i) Commonalities are found among the external agent, the members of the learning group and the organisation, which include the completion of a primary relation in the establishment of the first and second orders of neighbourhood. (ii) Commonalities and tolerated differences that exist in double neighbourhood relations at the local unit and organisation level among the KA set formed by internal organisational members and external agents generate extensive impacts. (iii) Incomplete neighbourhood relations at the local unit and organisation level are found among internal organisational members even though a primary neighbourhood is established with external agents in a KA set which generates local impacts.
Hypothesis 7: *The learning group is a KA entity which holds autopoietic characteristics, boundary properties and double neighbourhood relations.*	Finding 8: A learning group generates extensive impacts when they have autopoietic characteristics, boundary properties and double neighbourhood relations.

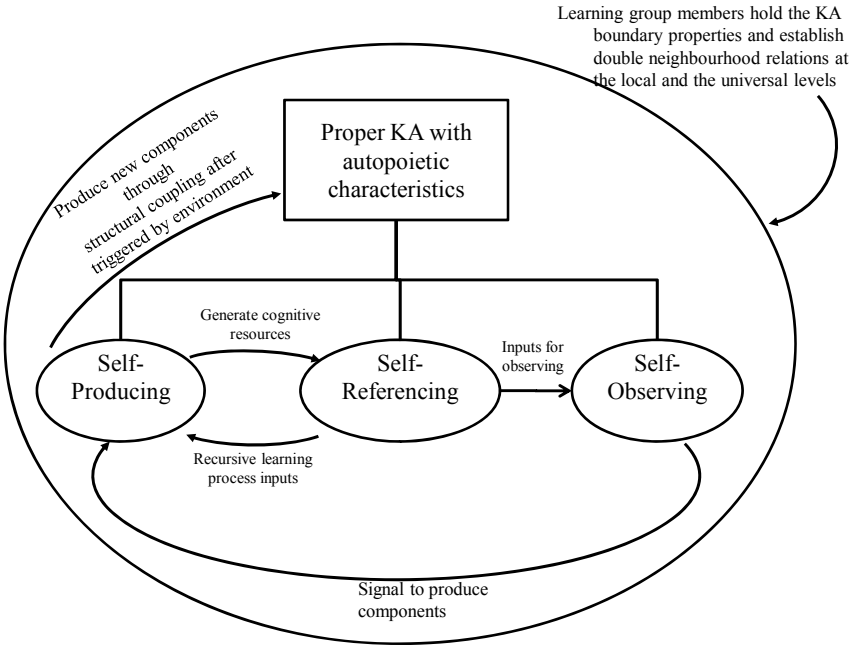


Fig. 5.4 Confrmation of the constructs of KAT for organisational learning

Chapter 6 Conclusion and Future Research

The objectives of this study are to investigate the ontology of KAs and the impacts of learning groups that could have the characteristics of KAs on the performance of organisational learning processes to deal with collective problems or issues. A new theory, KAT, which is used to identify the autopoietic nature of KAs, has been developed. Double neighbourhood relations of KA members at the local and universal levels have been discovered. In order to collect valid and reliable data, a new research method design called CNERMs has been established. The results of the study give evidence that a research gap which stems from a fundamental manner to investigate the ontology of the simplest unity, KAs, has been addressed. A proposed model with different types of KAs has been developed, and explains the nature and properties of a proper KA entity which enables organisations to generate better solution values. In this chapter, the contributions of this research for academics and corporate managers are discussed. The limitations of the research results are then highlighted. Finally, the opportunities for further research in this study area are identified.

6.1 Academic Implications

6.1.1 Ontology of Entity for Knowledge Processes

A knowledgeable workforce is admittedly as a key factor to increase the productivity. Many knowledge management researchers have been studying in the technical approaches aimed to create ways that measure, disseminate, store and leverage knowledge. The study of KAs who activate knowledge, however, is limited. Therefore, in the introduction, it was discussed that one of the key objectives of this study is to determine why organisations learn or do not learn by investigating the nature of the simplest entity, which is a learning group that deals with collective problems or issues in an organisation. Then, a new theory was developed, which indicates that the ontology of KAs could be self-living systems that sustain the ability of a group of members to learn. This theory is dubbed as the KAT,

and uses knowledge processes to deal with collective problems. In conforming to the conceptualisation of a KA, the field study results from the case studies of four leagile manufacturers in the soft goods industry have revealed that the completeness of boundary properties and a neighbourhood relationship are associated with cognitive capacity for learning in order to conduct the knowledge processes. The autopoietic characteristics found in proper KAs enable the learning group to sustain its identity and functions to solve collective problems. The theory also provides a new perspective to examine and predict the solution values of knowledge processes conducted by different types of KAs. The proposed boundary properties and double neighbourhood relations of KA sets at the individual and organisational levels give a more comprehensive explanation as to why some organisations learns while others do not, with or without intervention from an external source. Depending on whether all of the boundary properties are complete and the type of neighbourhood, organisations can be categorised into four types KAs: proper, quasi-, pseudo- and no KAs exist, and the corresponding solution values, which are determined to be extensive, local and having no impact, are found.

The field study results confirm that the learning groups that are identified as KAs are ready to engage in learning and knowledge management processes in an organisation. The theory provides a thorough description of the nature of KAs which resonates the ontology of living systems. The discovery of the autopoietic characteristics of KAs allows sustainability to be elucidated in terms of cognitive capacity for recursive learning in an organisation. Unlike previous research findings, KAs are not an altruistic unit to help an organisation survive. Their existence can be depicted as selfish behaviour to avoid disintegration of their identity. The identification of boundary properties and detection of double neighbourhood relations indicate the occurrence or disintegration of proper learning groups which generate solution values that benefit organisations. The neighbourhood relations also support the explanation as to why the use of external KAs, usually consultants or experts, would possibly have no impact

on an organisation after knowledge processes are conducted. Moreover, the theory establishes a new perspective to predict the effectiveness of knowledge processes carried out by different types of KAs as modeled in Chapter 3.

Furthermore, the qualitative findings from multiple case studies provide rich evidence that identify the types of commonalities with which neighbourhood relations could be established. In contrast to many publications in the literature on organisational theories which argue that the corporate culture is an enabler for organisation learning, the KAT suggests that members are willing to put forth efforts in working out solutions if neighbourhood relations are built between KA sets, in which all members have KA boundary properties, and other sets, which are from the local business units of the members and the organisation. The structural coupling process mentioned in the theory also explains the likelihood that internal members would make sense of their environment after carrying out self-referencing and self-observing activities within a KA entity. This approach enables the examination of the research inquiries which take into consideration various factors on the performance outcomes of different types of KAs.

An interpretative analysis of the collected qualitative data holds that the KA retention of an identity as a capable learner in organisations is parallel with the theorised characteristics of an autopoietic living system which self-produces its own components by self-referencing and self-observing. This study has laid grounds for future research to specify and test other factors in relation to commonalities and tolerated differences between a KA set, individual local business units and the organisation under which the solution values of knowledge processes can be improved.

In addition, the analytical findings from multiple cases suggest that the solution values are different across learning groups because these depend on how many of the boundary properties are present, or the presence of neighbourhood relations.

6.1.2 New Method to Create a Field in Qualitative Research

Many qualitative researchers have experienced time constraints in selecting natural setting research sites or find that there is limited availability of such, and are also limited by the logistics of the cases themselves, for example, permission to attend events on site for observing natural behaviours. Hence, the generalisability of the obtained data, their rigour and objectivity (Denzin & Lincoln 1998) may have been questionable. In this study, a new method that develops action oriented learning projects has been used to individually establish such for each participating firm that collaborated with the author in the research work. A one day operation management workshop was designed and set up to serve as the core natural venue where various interactive actions could be observed at the same time. A large amount of useful dialogue and behaviours noted from conversations in the individual interviews, and pre- and post-workshop meetings have been collected. The creating of a natural environment in the study, particularly in a workshop format for group behavioural study, is not commonly found in the extant literature. This has contributed to the qualitative research method design for collecting data that involve different types of interactive group behaviours, and capture a wider perspective based on visual cues, audio cues and emotional reactions.

The data analysis method also contributed to the development of a qualitative instrument for measuring the solution values generated by the learning groups in knowledge processes. The random stratified sampling method combined with a spatial model (Quinn & Rohrbaugh 1983) and the replication logic principle (Yin 2009) contributed to the method for selecting appropriate cases to study. It was also a key factor that influenced the quality of the data collection. This method allowed a wider variety in the recruitment of industrial partners for the sample and increased the chances that the sample would more represent real scenarios.

6.2 Implications for Practitioners

The real-life case study examples on soft goods firms illustrated that

although firms have the cognitive ability with general knowledge to solve problems, not all of them can reap the expected benefits. The field study results in this research highlight that without commonalities, and if differences between the KA set and the local unit are not tolerated, a proper KA does not exist. This explains the differences in performance outcomes in relation to the different types of learning groups. Organisational learning practitioners may evaluate the type of a current learning group by using the KA model (Fig. 3.6), as inferred by the KAT and illustrated in Chapter 3.

The proposed boundary properties and double neighbourhood relations of a KA set at the individual and organisational levels also allow practitioners to strengthen the skills of those involved in knowledge processes to become proper KA members. The theory gives more concise direction to management personnel for examining and maintaining the readiness of the work by the learning group on collective issues. The categorisation of KAs may be a starting point which can determine the types of learning group. When the learning group is ready to be a proper KA, strengthening their autopoietic characteristics, for example, as part of their cognitive capabilities, is an appropriate strategy to sustain the learning power in an organisation. In the situation that the learning group is identified as a quasi-KA, the structural coupling of members into a boundary zone by determining commonalities with a certain amount of tolerance of conflicts to establish a double neighbourhood relation is an effective way to activate the KA set. The approach is similar to suggestions given by Marshall (2003), in which there is neighbourhoodisation for the development of consensus of share-values to meet a common goal with a high concentration of members that are located in the boundary zone. Similarly, Kreiner et al. (2006) coined the term “identity boundary dynamics” to describe the identity change at the margins or interface of boundary dynamics in an intra-related or inter-related situation.

The KA model also increases management awareness of the likelihood that there are pseudo-KAs so that they can remove the barriers which may have negative effects against willingness to learn. Examples of

these barriers are jealousy, lack of recognition, unfairness, or lack of motivation. The case studies have also illustrated the establishment of neighbourhood relations between an external KA and the firms. The findings from the case studies show that the external agent used two strategies to integrate into the learning groups of the firms: (i) adopt the industry jargon to communicate with the participating firms, and (ii) share the concern of the problems the firms have in order to generate solutions. Organisational learning practitioners may take into account the learning needs and abilities of external parties, and their attitudes towards the collective issues that an organisation needs to resolve.

6.3 Limitations of This Study

The research has been undertaken on a part-time basis by the author through the use of a qualitative methodology. The limitations will be first acknowledged. First, there is always the issue of objectivity in the analysis of qualitative data. The author, therefore, collected the data and information from multiple sources and triangulated them before any conclusions were made to avoid any bias caused by the informants. To increase the validity of the collected information, a third party or collaborating researcher is recommended so that qualitative data can be interpreted from another aspect to enhance the power of rigour.

Second, time is another constraint of the study. Immediate and intermediate impacts generated after the involvement of the external KA were observed in the workshop, post-workshop meeting and interviews. They were also estimated by the participating learning groups. The long term impacts, however, would only be obtained after the action plans are implemented which requires a lengthier amount of time. Hence, the conclusion was drawn based on an intermediate evaluation. To examine a more comprehensive autopoietic characteristics in learning entities, particularly self-referencing activities, a two-year longitudinal study should be conducted. In addition, if objective measurements of the impacts, such as the changes in productivity, amount of defects, delivery on time rates, etc.

after the action plans were implemented, are conducted by the learning groups, this would give more concrete results to compare the knowledge process outputs among the different types of KAs.

Third, the field study is restricted to the soft goods manufacturing sector under a leagile business environment. To ensure that the data are sufficiently generalised, the selected cases should cover a full spectrum of manufacturing modes. The scope of the analysis allowed the researcher to focus on the learning activities that are related to improvement in the operation processes and comparisons between different cases in a single industry. This means that data could be collected on other types of manufacturing modes and business environment. This can provide insights on performance impacts in organisations to explain the inconsistent results found in the literature and real-life cases in terms of the implementation methods and participants of learning programmes, and intervention of KAs from outside the organisations. Further research could examine other industrial sectors, particularly the services industry, which could improve the understanding of autopoietic characteristics in which the KA self-produces its own components.

Furthermore, the sampling frame of this study comprises manufacturers in Hong Kong which own production facilities in the Asian region. Although the businesses are widely involved in the global market in that the firms work with trading partners who have different cultural backgrounds, it is worthwhile to examine the research inquiries in other cultural settings to improve the understanding of the neighbourhood establishment in different cultural contexts.

In terms of the research scope, this study is limited to verifying the constructs of the KAT by examining the learning groups that deal with collective problems. Factorial data on commonalities or tolerated differences for neighbourhoodisation and those on willingness and cognitive abilities for complete boundary properties have not been collected. This lack of data might limit the understanding on the factors that affect the establishment of

neighbourhood relations to form a proper KA. More empirical studies are suggested to fill this research gap.

Finally, this study is qualitative in nature and the information collected from the survey and interviews are primarily subjective views. Consequently, objective measures on the impacts should be used to determine the relation between impacts and types of learning group.

6.4 Concluding Remarks

It is common to find research that examines the ways to improve organisational learning from the perspective that an organisation is a unit. This has received considerable attention in both academic research and real-life practices. This study has transformed the concept of an organisation as an entity with multiple functions to that as the simplest living system, in order to provide another explanation of the learning behaviours in organisations. Consistent with the theoretical reasoning, the findings show that proper KAs hold autopoietic characteristics, establish double neighbourhood relations with local, universal and external partners, and embrace boundary properties to sustain their identity to produce solutions that deal with collective issues while other types of KAs do not, due to a lack of such.

The findings in this research are useful to researchers and managers who are striving to understand the factors that affect the formation of KAs and the performance of knowledge processes. It is anticipated that this study will trigger a series of follow-up investigations on neighbourhood establishment and reinforce autopoietic activities to better organisational learning.

6.5 Directions for Future Research

The KAT asserts that the boundaries of a KA entity are closed so that it is separate from its environment for learning. As pioneering research, the constructs of KAT are examined, which is used to explain why organisations

learn or do not learn. The results provide the basis for future research to explore the interrelations between the constructs. The existence of a KA entity is dependent on three constructs: (1) the completeness of boundary properties, (2) the completeness of double neighbourhood relations, and (3) the continuation of autopoietic behaviours. In theory, learning groups could hold all of the conditions to be a proper KA or depending on the situation, the learning groups could become quasi-, pseudo- or deleted KAs. In the multiple case studies, the learning groups can be sporadic. In other words, the stability of KAs is not known. Hence, the factors that affect the stability of KAs warrant further investigation.

Moreover, in this study, only one learning group from each firm of the sample frame was examined. The continuation of autopoietic behaviours in multiple KAs is not known. That is, the likelihood of positive and extensive impacts that could be gained if more than one learning group exist in an organisation and work on different collective issues. This complex situation can definitely exist in a real life scenario. Furthermore, the size of a KA may also have to be taken into consideration if possibly an optimum number of members in a learning group may affect the establishment of a double neighbourhood relation, such as the formation of commonalities and tolerable differences among members, the local unit and the organisation.

To broaden the scope of this study, it is suggested that future studies expand beyond the manufacturing industry to the services industry and other countries to gain a better understanding on the learning behaviours in an intangible product business environment and enrich the usage of the KAT in different industrial and cultural contexts.

Lastly, the constructs of KAT have been verified; they occur in proper KAs which generate extensive impacts for organisations. Future studies can investigate the relationship of the outcomes between the three autopoietic activities, namely, self-producing of KA members and cognitive resources, self-referencing in terms of the level and nature of the cognitive resources to notify the KA to produce components of a KA, and self-

observing the need for structural coupling. In addition, longitudinal studies with quantitative measures on the impacts could be used to further understand the group learning dynamics and determine the relation between the impacts and types of learning group respectively.

Appendices

Appendix I Interview protocol before the workshop

Company: _____
Date: _____Time: _____
Interviewee:_____ Position: _____
Gender: _____

Interview Questions:

Time taken to ask work background questions: _____

a. What is your current role in the company?
b. How long have you been working for this company?
c. Did you work with other companies before you joined this company? If yes, what were the company type and the nature of the previous job (full time job, summer jobs excluded)?

Time taken to ask about problem solving experience: _____

i. You are working as _____. Tell me about your experience when you had to address that the work performance of your department was affected by other colleagues/departments. What did you do?
ii. Under what circumstance would you solve the issue on your own? Did you seek the help of other people?
iii. Why did you decide to do that? How did you feel about the outcomes?

Time taken for part on organization learning experience: _____

a. Any current matters (internally or externally) which have taken place in your company that affect company productivity? Tell me how your company settled the matter. Is this a typical way that the company solves a problem? Do you think that it is effective? What are the reasons for your views?
b. If the same issue in production came up again, do you think that your company would address the issue in the same way? How do you think that the approach will be the same?

Work relations & Communication

a. How do you consider your work relations with
    i. your colleagues outside your work location?
    ii. your suppliers?
    iii. your customers?
b. What are some of the experiences that make you feel that way about the relationships?
    i. Value, e.g. trust, respect, money, power, short-term or long term orientation
    ii. Experience during work with co-workers, obstacles, conflicts between colleagues, departments, trust between colleagues or departments
c. On the whole, how would you rate the communication between your colleagues?

Views of company culture

1. To your understanding, what are the attitudes of your company in dealing with the problems of
    i. shortening production lead time
    ii. quality performance, such as order information accuracy, product workmanship, quality of incoming materials, conformance of samples made
    iii. Training employees
2. What did your company do about these issues?
3. How effective were the actions taken, in your opinion? What forms your opinions? Prompt the interviewee:
    i. The value, structure, system (award system, fairness), people, level of trust (information sharing, corporation, level of reliance on colleagues, ability to keep promises), communication, risk bearing, decision making process, legitimate procedures

Exercise:

Weighting people relations

1. The individual below is one of your colleagues who will participate in the workshop on _____. Please indicate your relation with them:

Name	This is a staff member who closely works with me	We work together often	Will contact when there is an issue to discuss	Acquaintance at work	No contact at all
(will type all the participants' name)					

2. According to your company's current situation, rank the importance of the following issues in descending order:
   i. Customer satisfaction
   ii. On time delivery Key product quality performance
   iii. Employee satisfaction
   iv. Company business results
   v. Work safety

Suggestions

Think of one suggestion that will improve your company. What is it? How would you support your suggestion?

Education Background:

a. Tell me about your education experience. What is your highest education attained before you started your full-time career?
b. Did you obtain any additional education qualifications, either part-time, full-time or through short courses, after you started your full-time career? if yes, prompt
   i. What sort of course(s) have you taken?
   ii. What is the nature of the course, part-time, full-time, short course and number of days, in-house training?
c. To what extent do those learning experiences help you to deal with the daily work?

Thank you very much for your cooperation and contribution. For our research study, we need to interview one of your colleagues who will not participate in the workshop in 6-8 weeks. Would you refer someone to us?

Appendix II Focus group meeting preparation list

Purposes

1. To observe the discussion flow, whether there are opinionated leaders, leaders of the pack, i.e. if there are many individual boundaries.
   - To count the no. of individuals who participated in the discussion,
   - To count the length of each individual presentation,
   - To gauge the diversity of each individual conversation.
2. To understand the learning processing style of the respondents in their own organisation, i.e. single loop learning, attempts to settle a problem while double loop learning, attempts to eliminate a problem.
3. To observe how they address a problem: problem ownership through self-observation; and commitment to seek solutions through self referencing.
4. To observe how the staff communicates: by information sharing, verbally or by trying to understand others.
5. To prepare the workshop.

Expected immediate outcomes

1. Select participants, venue and the date for the workshop,
2. Select issues for workshop,
3. Address the doubts of the respondents, if any, and establish trust between respondents and researcher and facilitator.

Preparation

1. Understand the background of the company,
2. Determine if the company has participated in any other workshops for operation management improvement and the outcomes,
3. Understand the potential problems encountered by an organisation and anticipate to find a solution at the workshop,
4. Ask participating organisations to provide an organisation chart or staff list,
5. Understand the backgrounds of the participants: position, length of work at the organisation.

Target Participants
7-10 middle and top management staff members, stakeholders of the issues

Instruments

i. Recorder,

ii. Batteries,

iii. Camera,

iv. Extendable microphone,

v. Writing paper & pens,

vi. Refreshments,

vii. Name badges,

viii. Seating plan.

Flow
Introduction

1. Provide background of the study to respondents,
2. Introduce the flow of the focus group discussion,
3. Ask for permission to audio record,
4. Introduce the facilitator of the focus group discussion,
5. Invite respondents to introduce themselves: name, nature of job.

Body

1. Share ideas on issues, those that are related to business processes, expectations of finding a solution.
2. Select issues to be discussed at the workshop.
3. Identity potential participants who could contribute to the issues being discussed.
4. Clarify any doubts that the respondents may have about the workshop.

Closing

1. Recapitulate issues to be discussed at the workshop.
2. Recapitulate potential participants for the workshop.
3. Recapitulate any follow-up matters, e.g. the venue, time and day.
4. Express appreciation for participation.

Timing

Duration in minutes	Activities
00-10	Warm up & Introduction
	Start discussion
10-15	There are some issues that we have collected before this meeting. Before we start the discussion on topic selection for the workshop, are there any other issues that you would like to add?
15-30	What are the issues that you would like to resolve at the workshop?
30-45	What are the reason(s) of your preference of the issue?
45-55	What is the priority of the issues that you expect to resolve at the workshop?
55-60	Who else should be invited to participate in the workshop?
60-65	What suggestions/recommendations would you like to make for the workshop arrangement?
65-70	Closing

Appendix III Workshop activities form

Workshop record form				
Participant				
Role in the organisation				
Grouping before the workshop starts				
Warm up exercise duration				
Sequence of individual introduction				
New grouping after introduction				
Activity one presentation				
Activity two presentation				
Activity three presentation				
Activity four presentation				
Activity five presentation				
Wind up section				
Sequence				

Appendix IV Survey questionnaire before the workshop

The Hong Kong Polytechnic University Institute of Textiles and Clothing

Survey on organisational learning before the workshop: "_____" on _____

The purposes of this survey are to help us find out about your experiences and opinions in learning new knowledge with your colleagues. The survey contains two parts: Part I asks about your current experience; Part II asks about your opinions after the workshop is conducted. Your thoughtful and honest responses to the questions are very important and greatly appreciated for further studies on organisation theory and improvement of operation management performances. Please return the completed questionnaire before you leave. Thank you.

1. What has been your experience in the past for learning new knowledge with your colleagues in this company?

_____

_____

2. What has been your experience in solving (the problems which are going to be discussed at the workshop) at your work place?

_____

_____

_____

3. Describe in general with a sentence, the work relation between you and your co-workers.

_____

_____

4. What are the factors that have motivated your participation in this workshop?

_____

_____

Personal information

1. How many years have you been working in the textiles and clothing industry?

   _____ years

2. How many years have you been serving this company?

   _____ years

3. Did your career start in the textiles and clothing industry?
   - ❑ Yes
   - ❑ No

   What industries did you serve? _____

   How long have you served in other industries? _____years/months

4. What is your gender?
   - ❑ Male
   - ❑ Female

5. Your education qualifications are: _____

6. What is the nature of your work?

   _____

Thank you very much

Appendix V Survey questionnaire after the workshop

The Hong Kong Polytechnic University Institute of Textiles and Clothing

Survey on the organisational learning at the end of the workshop: "_____" on _____

The purposes of this survey are to help us know about your experience and opinions in learning a new knowledge with your colleagues. The survey contains two parts: Part I is concerned about your current experience; Part II is about your opinions after the workshop is conducted. Your thoughtful and honest responses to the questions are very important and greatly appreciated for our further study on organisation theory and improvement of operation management performance. Please return the completed questionnaire before you leave. Thank you.

1. Which part(s) of the workshop enabled you think differently to solve the problem?

_____

_____

2. To what extent is the outcomes generated in this workshop useful?

_____

_____

3. Which part(s) of the workshop impacts you to participate into the establishment of the action plan for the issue discussed in the workshop?

_____

4. How likely were the expectations of this workshop met?

_____

_____

5. How did you like the experience to participate into today's workshop with your colleagues?

_____

6. Please give us comments about this workshop.

_____

_____

Personal information

7. How many years have you been working in textiles and clothing industry?

_____ Years

8. How many years have you been serving this company?

_____ Years

9. Is your career started in textiles and clothing industry?

❑ Yes
❑ No

What industries did you serve? _____

How long did you serve the other industries? _____Years/months

10. What is your gender?

❑ Male
❑ Female

11. Your education qualification is _____

12. What is your working nature?

_____

_____

_____

Thank you very much

Appendix VI Interview protocols for participants after the workshop

Interview Questions

Company culture

After the workshop, what kind of changes have you witnessed in your company for dealing with the problems of

- On-time delivery
- Quality performance
- Human resources
- What are the factors that give evidence to the above?

Organisation learning experience

- Recall the learning process of the workshop, what were the impacts on you?
- Tell me about your observation on how likely you/ your colleagues/department/company changed ways to settle an operational issue after the workshop. What is the effectiveness of the workshop? What are the reasons that support your views?
- How likely will the impact(s) of the workshop be maintained? What are the reasons that support your views?

Problem Solving Experience

- How much more likely would you seek out other colleagues/departments to solve a processing problem which may affect your productivity/performance?
- How likely would you increase the number of opinions offered to solve a processing problem which may affect the productivity/performance of other departments/colleagues.
- Do you like the action plan generated at the workshop and why?

Work Relations & Communication

- What have been the changes in the work relations between your colleagues?
- What have been the changes in the work relations between the departments in your company?
- To what extent has communication in your company been effective? Prompt if needed,
  - Willingness to talk to colleagues
  - Willingness to listen to colleagues
  - Willingness to share information
  - Use of jargon or slang
  - Location
  - Feedback
  - Understand your concerns
- What are the reasons to support your views?
- Any difference between HK and offshore?

Thank you very much for your cooperation and contribution.

Appendix VII Interview protocols for non-participants after the workshop

Name of interviewee: _____

The interviewee was referred by _____

Date of interview: _____ Time: From_____ To _____

Background information:

1. What is your role in the company?
2. Tell me about your education background and work experience.
3. Describe your work relationship with the individual who referred you.

Interview Questions:

4. Some of your colleagues participated in a workshop offered by the Hong Kong Polytechnic University. How much do you know about it?

5. Do you know that your company is implementing an action plan on the issues discussed at the workshop?

6. How much did you participate in the action plan?
    i. Tell me about your experience of participation in the action plan?

7. How much have the attitudes of your company/the individual who referred you, changed in dealing with the problems?
    i. Seek other colleagues/departments to become involved during the process of solving a problem,
    ii. Frequency of contact
    iii. Willingness to listen to other people's views and concerns before a decision is made
    iv. Willingness to give feedback
    v. Willingness to share information with colleagues within the department/between the departments

8. What are the reasons that support your views?

Appendix VIII Data analysis plan

Contents	Mapping	Chart	Affinity Diagram	Pattern	Procedures or Sequence	Scripts
√ tool apply to organize the information						
Interview						
background						
- working		√				
- education		√				
performance affected by other dept						√
way to address an issue						√
communication relation						
- supplier						√
- colleagues						√
- buyers						√
company culture						
- shorten production lead time		√				√
- Quality		√				√
- Training staff		√				√
Survey						
- colleague relationship			√			√
- rank issues		√				√
Suggestions						√
Focus Group Meeting						
- seating plan				√		
- questions					√	√
- discussion flow		√		√		
- discussion contents						√
Workshop						
- seating plan		√				
- flow		√		√	√	
- contents				√		√

Contents	Mapping	Chart	Affinity Diagram	Pattern	Procedures or Sequence	Scripts
Survey						
- problem solving	√		√			√
- solution	√		√			√
- impact you	√		√			√
- meet expectation			√			√
- learning experience			√			√
personal data						
- working length		√				
- serving company		√				
- starting career		√				
- education		√				
- working nature		√				
Follow up interview *interviewed before*						
- follow up work						√
- opinions about the action plan						√
- impact						√
- impact maintain						
communication change						
company culture						
- shorten production lead time		√				√
- Quality		√				√
- Training staff		√				√
referees *background*						
- role			√			
- job nature			√			
- relation with referee			√			
know about the workshop						√
participated in action plan		√				
feeling about referee attitude after workshop	√	√				

Contents	Mapping	Chart	Affinity Diagram	Pattern	Procedures or Sequence	Scripts
Consultation Session						
- questions		√			√	√
- facilitator address the questions	√		√	√		√

Appendix IX List of coding

Coding definition	Code	Explanation
Impacts	IP	Self-weight the amount of desirable knowledge generated after a knowledge process was conducted with the consideration of: (1) desirable knowledge or capability generated after a problem is solved, (2) absorptive capability, (3) associated benefits or solution values of their experience in solving collective problems.
No impact	NI	Organisation has not received positive benefits after a knowledge process is conducted.
Local impact	LI	Potential positive value at the local level that individuals, groups of people or departments have learned to deal with local issues.
Extensive impact	EI	Knowledge generated comprehensively benefits the organisation to eliminate latent systematic problems, errors or minimise negative impact caused by external changes
Reflection of learning	RL	Knowledge learned in the workshop
Knowledge process		
Application of learned knowledge	AL	Applied the learned knowledge to establish action plans
Transference of learned knowledge	TL	Transferred or planned to transfer learned knowledge to other members inside or outside the KA
Enquiry of knowledge management	EKM	Firms raised enquiry and discussion about the knowledge management strategies could be implemented after they acquired the new operation management theory at the workshop.

Discussion of knowledge process	DKP	Informants discussed the knowledge process of acquiring, applying and transferring of the new knowledge provided in the workshop.
Willingness to carry out knowledge process	WKP	Informants are willing to put forth effort towards the knowledge process
Not willingness to carry out knowledge process	NWKP	Informants are not willing to put forth effort towards the knowledge process
Neighbourhood		
Commonality	CM	Something that has more than one element from different entities and shares the same attributes of something.
Tolerated difference	TD	The difference view between group members on something but is bearable by them.
Non-tolerated difference	NTD	The difference view between group members on something that is not bearable by some of them.
4 Speech of acts		
Framing	PSF	Explicitly stating the purpose and surfacing the assumptions of matters.
Advocating	PSA	Asserting an opinion, perception, feeling or proposal for action.
Illustrating	PSI	Describing the issue.
Enquiry	PSE	Questioning others to do something from them.

Appendix X Project presentation to invited firms

Knowledge Agent Theory (KAT) for
Knowledge Activation in the Leagile Manufacturing
Environment of the Soft Goods Industry

Background

- Principles of Effective Organisational Learning
  - Process involves groups of people to alter the business performance into more effective outcomes
  - Integrate & transform informational & knowledge resources in work systems to develop new ideas & solutions for problems
- Theory of Knowledge Agents
  - Characteristics of KAs
  - Intervention factors carried out by KAs to better organisational learning
- Study scope
  - Industry with short life cycle products (uncertain demand)
  - Manufacturing

Objectives of Research Study

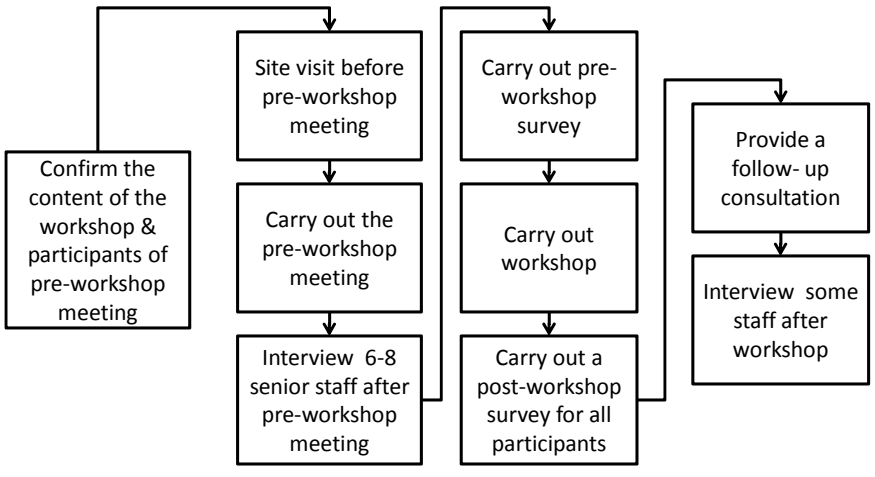
- To understand the learning process in real situations
- To compare changes with original problem solving processes in dealing with business flow through the use of a non-traditional training method

Benefits to research partners

- Gain new knowledge & skills in operation flow management to improve business process performance
- Upgrade management skills
- Enable participants to absorb new concepts & skills, & apply to their real life situation in workplace
- Generate action plan at the end of training

Research Partner Involvement

- Top management & key personnel invited to interviews & pre-workshop meetings
- 14-21 participants take part in a one-day (8 hr) workshop
- Share learning experience with researcher(s) after the workshop
- If the workshop takes place outside of Hong Kong, research partner will share the travel, catering & accommodation costs, if necessary, with the researcher(s) & the consultant.



Flow of Research Activities

Ideal participants for pre-working meeting

6-8 participants from management team:

- Top management
- Merchandising
- Production
- Factory(ies)
- Quality assurance
- Procurement

Ideal participants for workshop

15-21 participants from:

- Pre-workshop meeting participants
- Workplace supervision level personnel
- Production coordinators
- Quality assurance
- Merchandising team supervisors
- Purchaser

Confidentiality of Data

- All collected data are strictly confidential & only for the use of the research study
- The audio and written records are will only be accessed by the researchers of this project.
- None of the information will be distributed or disclosed to any other party.

Copyright

- Observational & audio data collected at the interviews & workshop are the property of The Hong Kong Polytechnic University.
- The action plan generated at the workshop is the property of the Company.

Facilitator CV

- Worked in the manufacturing field for almost 30 years
- Expert in culture change for organisation productivity & quality improvement
- Developed management models
  - Streamline Management Model, Intelligent Process, etc.
- Provided management consultancies & training to organisations in clothing, electronic, toys, and food processing industries
- Professional qualifications
  - Member of The Hong Kong Institution of Textile and Apparel (MHKITA)
  - Senior member of American Society for Quality
  - Certified Management Consultant (CMC)
  - Judge for the International Quality Competition: American Society of Quality's International Team Excellence Award
- Academic qualifications
  - Master of Economics,
  - MSc in Applied Statistics,
  - BSc in Mathematics,

Appendix XI Memorandum to participating firms

This memorandum has been made and effective on _____ between _____ (hereinafter called "the Company") which is located at _____ and Chan Yan Yu (thereinafter called "the Researcher"), a Research Student (No.: 0490) in the Institute of Textiles and Clothing at The Hong Kong Polytechnic University

Background

The Researcher is an academic staff member who is working in the Institute of Textiles and Clothing at The Hong Kong Polytechnic University. She is carrying out a study in relation to business flow management in the fashion and textile industry under a rapidly changing business environment. This study is part of her PhD programme study. The Company accepts the invitation to be a research partner of the study.

Purposes

The purposes of the research project are to understand how organisations are using an effective method to improve their operation management, and observe the changes in their original problem solving processes that deal with business flow. Meanwhile, the participating organisations will gain new management knowledge and skills to improve the performance of their business flow from this study.

Study Approach

The study will be carried out through a workshop. A proactive business flow management model will be introduced in a full-day workshop by a professional facilitator. A pre-workshop meeting will be arranged to determine the problem that is related to business flow which the organisation would like to address. Key personnel will be interviewed before and after the workshop to collect information on their experiences in organisation learning processes.

The aims of the workshop are to help organisations upgrade their management skills and generate an action plan for business flow improvement, and to allow the Researcher, the facilitator, and assistants if any, to observe the process of developing new management skills and related impact on participants. After the workshop, a two-hour follow-up consultation of the business flow improvement and collection of feedback about the workshop will be conducted within one or two months. Thereafter, the Researcher does not have any further obligation to be involved in the improvement plan of the Company.

Confidentiality of Data

All of the collected data are strictly confidential and only for the use of the research study under the project: "Knowledge Agent Theory (KAT) for Knowledge Activation in the Leagile Manufacturing Environment of the Soft Goods Industry" or a similar project title, if changes are warranted. The audio and written records are only allowed to be accessed by the researchers of this project. It is prohibited to distribute, or disclose any of the information to any other parties.

Copyrights

The copyright of the data from the observations collected at the workshop will be owned by The Hong Kong Polytechnic University for theoretic development of business flow management. The action plan generated at the workshop will be owned by the Company.

Target Participants

The participants of the workshop include top management team and key personnel of the Company. In total, 16-21 individuals with different backgrounds will be solicited. The target participants will be selected during or after the pre-workshop meeting under a mutual agreement.

Cost

The cost of the workshop will be borne by this research project. The expenses for refreshments and meals will be borne by the Company. The transportation and accommodation costs will be the responsibility of the Company, if the workshop is conducted outside of Hong Kong.

Chan Yan Yu Name:	Project Holder Position:
The Hong Kong Polytechnic University	Company:
Date:	Date:

Appendix XII Summary of invitations

Summary of Invitations		
Invitation Results	No. of firms	No. of firms that requested a project presentation
Accepted the invitation	4	3
Withdrew as the firm faced financial crisis	1	1
Withdrew as the firm had doubts	1	
Withdrew as the firms asked for postponement	2	2
Direct rejection	7	
Rejected as the firms were conducting similar management workshops	2	1
Total	**17**	**7**

Appendix XIII Workshop tentative rundown

Time	Contents
9:30 – 9:40	Welcome, Opening, Objective
9:40 – 10:20	Warm Up
10:20 – 10:40	Game & debriefing
10:40 – 11:30	Lecturing
11:30 – 11:40	Break
11:40 – 12:00	Exercise
12:00 – 13:00	Practice
13:00 – 14:00	Lunch
14:00 – 14:15	Recapitulation
14:15 – 14:25	Exercise
14:25 – 15:15	Lecturing
15:15 – 15:25	Break
15:25 – 15:35	Lecturing
15:35 – 15:50	Lecturing
15:50 – 16:15	Discussion
16:15 – 16:35	Lecturing
16:35 – 16:40	Lecturing
16:40 – 16:50	Practice
16:50 – 17:00	Break
17:00 – 17:35	Lecturing
17:35 – 18:00	Improvement items + Action Plan
18:00 – 18:10	Lecturing
18:10 – 18:20	Exercise
18:20 – 18:45	Closing
18:45 – 19:00	Survey

Appendix XIV Background of the participating firms

Alpha Fashion Manufacturing Ltd.

Alpha Fashion Manufacturing Ltd. (Alpha) is an OEM that makes lightweight clothing for fast fashion and youth casual wear retailers in Europe and the US. The firm has widespread production facilities in Mainland China and Cambodia. Its headquarters is in Shenzhen, a special economic zone in the southern part of Mainland China. Alpha has a very strong sales team. Even though there was a global economic crisis in 2008, the firm was not affected much in terms of its sales volume.

At their headquarters, they own the production facilities and employ about three hundred operators. The firm has set a strategic plan in that the Shenzhen plant will be developed as a centre for product engineering. The production management model would be used to train operators of subsidiaries and sub-contractors to give them the necessary skills. However, the plan was not successfully implemented. Currently, Alpha is relying on its quality assurance team to determine the performance quality of their subsidiaries and sub-contractors. At the time that the firm was invited to participate in the research study, they had been facing the problem of continuous declining productivity of more than twenty percent for the last two years.

Alpha often introduces new management ideas to change the operation processes. The managing director, Ivan, is keen on learning new types of management knowledge. A year ago, he implemented a workplace restructuring practice called “5S” in the office. He expected that the restructuring would demonstrate to other workplaces on ways to minimise waste. However, the results were not promising. The campaign was terminated after it had been implemented for a few months. The chairman of the firm, Allen, also had many ideas on transforming the firm in order to improve business performance. Lately, he has decided to replace the current production manager with a former production manager, Jade, who left the

firm for almost six years. Upon rejoining the firm, Jade is responsible for products that are very different from those made years ago. The quantity demand for each order has been reduced while the specifications and styles have become more complicated. Her previous experience is not sufficient enough to handle the changes. She is analysing the current situation and trying to find new ways of doing things.

The top management at Alpha realises that the firm needs to change to cope with the new leagile business environment, particularly for its current client who is renowned for offering fast fashion items in the global fashion market. In the last two years, they have implemented numerous action plans for the sampling room, merchandising department, production, quality assurance and procurement. The lifetime of most of the action plans were only a couple months.

Beta Knitwear Ltd.

Beta Knitwear Ltd. (Beta) is a knitwear exporter that serves the high end knitwear fashion market in Japan and Europe. Forty years ago, its founder, Martin, ran a trading company to help Japanese clients to source apparel items. In the global supply market of high fashion knitwear products, there is a scarcity in the number of manufacturers who can make knitwear items that meet buyer requirements. Therefore, buyers and suppliers normally maintain a good relationship and business is relatively stable. Under this circumstance, Martin had worked out a business model which he believes is the best means to optimise profits. The model is that Beta holds the share majority of some of the knitwear OEMs in Shenzhen, Guangzhou, Shanghai and Vietnam, to secure production capacity in order to trade with their overseas clients.

After the global financial crisis in 2008, the order numbers reduced by more than one third and the unit price was lowered by 15%. The firm decided to explore new markets in Europe to replace the primary customers in the Japanese market. This was a radical change for Beta. However, the firm received a positive response and secured new customers. Beta now

receives orders from France, Spain and Germany. With such promising results, Beta has started to realise its long term business plan: to become a core producer in high end knitwear which will take the place of the Italian suppliers. To enhance business competency, Beta plans to integrate the trading unit with the production unit in Shenzhen.

The reasons that drove Martin to restructure his business model are: (1) after he started to do business with European importers, he realised that without strong production force backups, Beta's supply chain would become inefficient and not competitive, and (2) his Shenzhen business partner, Speedy Knitters, gave him the confidence that with their innovative capabilities, the firm could offer items that would attract buyers. Indeed, Martin has been preparing since the last decade to become a core supplier in the global high end knitwear market. The firm has developed a design team that gives the impression to its clients that Beta is an ODM which is the same as most Italian suppliers. Speedy helps Beta to continuously develop new laundering technologies and knitting techniques to design new products which would strengthen Beta's competitiveness. The good market responses of the products sold to the European market proved that Speedy has high learning capabilities to provide new ways of laundering knitwear and new knitting patterns.

The idea of integrating the trading and production units into one single entity became an important business strategy that aimed to maximise the production capacity and reduce the total lead time. This new business strategy has propelled Beta toward another radical change. This time, however, it involves issues that have unavoidably brought many challenges to Beta between the trading and production units: willingness to exchange information, profit sharing, costs distribution, etc. Therefore, Beta established a working group that is trying to consolidate a single business goal to reduce production costs and shorten total order processing lead time between the two units.

Gamma Fabric Mill Ltd.

Gamma Fabric Mill Ltd. (Gamma) is a fabric mill with production facilities in Hong Kong. The parent company also owns another business unit in cotton yarn spinning in China. The spinning unit is the sole cotton yarn supplier to Gamma. The latter was in the same premises with Gamma before the production facilities moved to China a year ago. During the time that Gamma accepted the invitation to participate in the research study, the firm was working on bettering the yarn supply management and continuously improving product performance.

Ten years ago, Gamma was still a grey fabric manufacturer. They had established long term business strategies and action plans to reposition their business. Gamma decided to manufacture bi-stretch and technical denim fabrics which were a radical change for them. The results look promising because the sales amount has increased more than 10% annually in the last five years. Now Gamma is a market leader in manufacturing bi-stretch, technical denim and advanced cotton fabrics. The monthly production capacity in 2009 reached two million yards. Similar to Beta, Gamma is an effective learner that has entered a new market. Indeed, the firm has undergone many changes from its original market. A research and development department has been established to focus on developing new products and markets. At the same time, a consultant in denim production has been recruited to give advice on setting up new production facilities. The firm has also sent engineers to different places, locally and overseas, to gain knowledge for producing new products. Similar to their rivals, they realise that there is the challenge of high labour costs in the production of goods in Hong Kong. Consequently, the firm has been trying to strategically eliminate the total costs in three areas. First, they have been trying to save on the costs of acquiring materials. The majority of the materials for production are yarns which are supplied by the spinning unit, which is also owned by the same corporate. The spinning unit, however, also supplies yarns to other fabric manufacturers. Unlike the situation at Beta, Gamma still needs to compete with other mills in the production market to acquire

production capacity, but pay the market rate. In fact, Gamma does not think that they have any advantages in material procurement. Hence, the firm has established an intermediate plan to refine the yarn supply system.

Second, they are shortening the production process time by transferring the dyeing facilities from a remote location to that of the weaving plant so that they are under the same premises. These two areas involve radical changes in yarn supply management and the production facilities, respectively. Third, they are trying to maintain a low level of total cost. Gamma knows that they will face continuous incremental changes in managing the operation processes. The firm has identified three areas for reducing costs: core operations, supportive operations and quality improvement. For instance, to eliminate the defective goods that are made during production or occur while in storage, Gamma implemented the Six-Sigma quality management system in their production systems. In order to ensure that the systems were properly operating, all of the employees involved in production and quality control were sent to a Six-Sigma quality management training course.

When the research study was introduced to the firm, Gamma came up with an issue in a very short amount of time that deals with the changes in the supply chain of materials and production arrangement to shorten the overall production lead time, which pinpoint to the company's overall objective for the field study. They foresaw that the relocation of the yarn production facilities may generate some deficiencies in the production processes later. They wanted to take the opportunity to review their supply chain management in order to reduce disruption.

Delta Lingerie Apparel Ltd.

Delta Lingerie Apparel Ltd. (Delta) is a typical OEM that produces lingerie apparel for both large and small lingerie retailers in the US. Except for the sales and finance departments, all of the operations are located in the production plant in Dongguan, a county in Guangdong, China. Like most apparel manufacturing firms, Delta also has several sub-contractors who are

dispersed in different counties within Guangdong. Delta has been changing its production operations and skills to response to the changes in the leagile business environment which include: a short delivery time, small quantities per order, and a wide variety of each product collection. The supervisor of the product engineering division is proud of the technical skills and technologies developed under her supervision with which the firm can manage the leagility of market requirements. In fact, Delta has successfully transformed their production facilities from making basic to fancy and functional goods.

However, the new market environment has caused the firm to bear higher production and raw material costs. Under this situation, Delta often works on reducing the overall costs in order to maintain competency. The managing director, Gilbert, believes that after the quota system phased out in 2005, cost is the key factor to remain competitive. Thus, he has not come across any other operations which may affect the overall performance. Their business performance, unfortunately, has fallen below expectations and most of employees are quite pessimistic on finding solutions to further reduce costs.

The production manager of Delta, Frank, is a dynamic young man in his thirties. He is an active learner. In a period of six years, he has led the production team and transformed the production plant to become the leader of technical skills for making lingerie apparels in the region. Frank wants to make a radical change that will transform the business from offering manpower and production capacity to the establishment of a brand so that they will be able to design their own products. Gilbert, however, is more conservative. He was previously a principal at a primary school. After retirement, he returned to Delta as his father had founded the firm. In his mind, running a factory is much easier than operating a school. His burden is that the employees are not well educated. Besides that, the garment industry is a sunset industry in Guangdong after the quota system was phased out. So Gilbert believes that there is not much room left for him to improve things.

Appendix XV Informants list

Informants from Alpha					
Position	**Pre-workshop interview**	**Focus group meeting**	**Workshop**	**Post-workshop interview**	**Consultation meeting**
Director (Ivan)	Yes	Yes	Yes		Yes
Operation Director (Henry)	Yes	Yes	Yes	Yes	Yes
Senior Merchandising Manager			Yes		
Merchandising Manager (Clara)	Yes	Yes	Yes		
Merchandiser			Yes		
Merchandiser				Yes	
Merchandiser			Yes		
Merchandiser				Yes	
Merchandiser (Sarah)				Yes	
Senior Merchandiser			Yes	Yes	
Production Coordinator				Yes	
Production manager (Jade)	Yes	Yes	Yes		Yes
Factory Supervisor			Yes		
Production Coordinator			Yes		
Production Coordinator			Yes		
Factory Supervisor			Yes		
Production and QA Coordinator			Yes		
Production and QA Manager	Yes	Yes	Yes		
Production Assistant Manager	Yes	Yes	Yes		
Sample Room Manager (Kevin)	Yes	Yes	Yes	Yes	Yes
Sample Room Supervisor			Yes	Yes	
Sample Room Coordinator			Yes		
Sample Room Technician			Yes		
Sample Room Coordinator			Yes		
Fabric Supervisor.			Yes		
Quality Controller			Yes		

Informants from Beta					
Position	**Pre-workshop interview**	**Focus group meeting**	**Workshop**	**Post-workshop interview**	**Consultation meeting**
Managing Director (Leonardo)	Yes		Yes	Yes	Yes
Sales Director	Yes	Yes	Yes		Yes
Sales Director (Eve)	Yes		Yes		Yes
Division Manager			Yes		
Sub-division Manager			Yes		
Sub-division Manager			Yes	Yes	
Merchandising Supervisor			Yes		
Senior Merchandiser		Yes	Yes		
Senior Merchandiser			Yes		
Merchandiser		Yes	Yes		
Merchandiser		Yes	Yes		
Material Sourcing Supervisor			Yes		
Production Director (Martin)	Yes	Yes	Yes	Yes	
Production Manager	Yes	Yes	Yes	Yes	
Deputy Factory Manager	Yes	Yes	Yes		
Production Coordinator		Yes	Yes		
Production Coordinator		Yes			
Production Engineer	Yes	Yes			
Production Coordinator Supervisor	Yes	Yes		Yes	
Operation Coordinator				Yes	
Division Manager				Yes	

Informants from Gamma					
Position	**Pre-workshop interview**	**Focus group meeting**	**Workshop**	**Post-workshop interview**	**Consultation meeting**
Director				Yes	
Managing Director (Terrance)			Yes	Yes	Yes
Sales Manager (Peter)	Yes	Yes	Yes		Yes
R&D Executive			Yes		
R&D Executive			Yes		
R&D Executive				Yes	
Sales Executive			Yes		
Merchandiser - Fabric			Yes		
Sales and Marketing Officer				Yes	
Operations Manager (Vincent)	Yes	Yes	Yes	Yes	Yes
Mill Manager in Dyeing Dept. (Wilford)	Yes	Yes	Yes		
Deputy Mill Manager (Roger)	Yes	Yes	Yes		Yes
Production Co-ordinator	Yes	Yes	Yes		
Planner			Yes		
Production Planner			Yes	Yes	
Assistant to Mill Manager / Engineer	Yes	Yes	Yes		
Fabric QA Manager	Yes	Yes	Yes		
Quality Assurance Supervisor			Yes		
Project Co-ordinator Maintenance/ Inspecting Dept.			Yes		
Mill Supervisor			Yes		
Inspecting Room Officer			Yes		
Quality Controller			Yes		
QA				Yes	
Management Trainee			Yes		
Senior Manager	Yes	Yes	Yes		

Informants from Delta					
Position	**Pre-workshop interview**	**Focus Group Meeting**	**Workshop**	**post-workshop interview**	**Consultation meeting**
Managing Director (Gilbert)	Yes	Yes	Yes	Yes	Yes
Sales Director	Yes	Yes	Yes		Yes
HR Manager (Yvoone)		Yes	Yes		Yes
Sales Manager			Yes	Yes	
Asst. Sales Manager			Yes		
Sales Manager (Nelson)	Yes		Yes		Yes
Sales Assistant Manager			Yes		
Purchasing Manager (Xera)	Yes	Yes	Yes		
Factory General Manager (Frank)	Yes	Yes	Yes	Yes	Yes
HK Supervisor			Yes		
General Manager Assistant			Yes		
Engineering Supervisor	Yes		Yes		
Materials Control Manager	Yes	Yes	Yes		
Warehouse Supervisor			Yes		
Production Supervisor		Yes	Yes		
Production Supervisor			Yes		
Production Supervisor			Yes		
Production Supervisor			Yes		
Production Supervisor			Yes		
QA Manager	Yes	Yes	Yes		
QA Supervisor			Yes		
Packing Supervisor			Yes		
Engineer				Yes	
Engineer				Yes	
Purchaser				Yes	

Appendix XVI Reflection of learned knowledge from the workshop

Reflection of learned knowledge from the workshop				
Knowledge introduced in the workshop	**Alpha**	**Beta**	**Gamma**	**Delta**
Operation flow				
1. Good process criteria			√	√
2. Value-added & non value-added	√	√	√	√
3. Intelligent flow		√	√	√
4. Constraints & waste	√		√	√
5. Flow chart	√	√	√	√
Methods to streamline operations				
6. Solve problematic principles	√		√	√
7. Ways to reduce waste	√		√	√
8. 5 whys		√	√	√
9. 5S practice	√		√	
10. Eight and half steps for improvement			√	√
Theory explanation				
11. Quality costs			√	√
12. TPS & constraints			√	
13. Imaginations			√	√

√ **Reflection of learned knowledge found in the Workshops**

Appendix XVII Application of learned knowledge from the workshop

Application of learned knowledge from the workshop				
Knowledge introduced in the workshop	**Alpha**	**Beta**	**Gamma**	**Delta**
Operation flow				
1. Good process criteria			√	√
2. Value-added & non value-added	√	√	√	√
3. Intelligent flow	√	√	√	√
4. Constraints & waste			√	√
5. Flow chart	√	√	√	√
Methods to streamline operations				
6. Solve problematic principles			√	√
7. Ways to reduce waste			√	√
8. 5 whys		√	√	√
9. 5S practice	√		√	
10. Eight and half steps for Improvement			√	√
Theory explanation				
11. Quality costs			√	√
12. TPS & constraints			√	
13. Imaginations			√	√

√ **Application of learned knowledge found in the Workshops**

Appendix XVIII Recommendation letter offered by Gamma

11st January 2010

To Whom it may Concern

Late last year, twenty employees from various functions of our company had participated in a one day workshop organized by Joyce Chan of Hong Kong Polytechnic University. We found this workshop exceptionally informative and useful to inspire us to further improve our operations. We are very pleased to share the following information and experience to some companies which may wish to know some more details about this workshop from the perspective of a participating company.

Title:
Knowledge Agent Theory (KAT) for Knowledge Activation in the Leagile manufacturing Environment of the Soft Goods Industry

Contents:
The workshop provided both management concepts and practical skills to participants to identify and solve problems in process management. The concepts included Streamline Management Model, Intelligent Process, the Toyota Production System and its constraints. The facilitator also gave a lot of real life examples in textiles and clothing industry and in other industries.

Training method:
The training was well prepared and organized. Before the workshop, the trainer has made a plant visit, pre-workshop meeting and interviewed our senior staff.

At the workshop, the non-traditional training method allowed participants to learn, absorb and apply the management concepts at the same time to find out the non-value added activities in any business operation processes, such as order processing, material supply and vendor management process.

The trainer encouraged our colleagues actively participated in the training and enjoyed the learning process. They commented that the workshop was interesting and useful. The training has opened our colleagues' mind set through tailor made game and training material.

Benefits:
The workshop has introduced new knowledge and skills in our operations flow management for improving the business process. Our colleagues can apply those new tools in identifying and eliminating non-value added activities. The workshop has influenced our staff to change their attitude in shortening the delivery lead time, raw material supply and improving vendor management.

The one-day workshop encouraged group cooperation and participation. It has successfully built bridges among departments based on trust and open communication. The discussion among our staff were based on mutual respect while resolving problems one-on-one.

The workshop helped our colleagues realized our blind points in our business operation flow design. Through different activities, our staffs grasped the knowledge for application without burdens. At the end of the workshop, our colleagues have successfully generated 20 action items in improving our operation processes.

The training was excellent and I strongly recommend this workshop to any other companies.

Appendix XIX Action plans developed in the workshop

Alpha: improve productivity
- Restructure production facilities, - Set up training plan for merchandising team, - Renew the compensation scheme, - Review the operation flow in sampling, merchandising, logistics, purchasing and production departments, - Re-implement 5S practice in production department and the office.
Beta: shorten production lead time
Developed by the production unit: - Set specification and quality requirements for suppliers and sub-contractors, - Set up training programme for purchase and marketing colleagues, - Establish machine maintenance schedule, - Create a working group to restructure the production facilities and layout. Developed by the trading unit: - Review the operation flow for sampling making, - Establish a plan to improve calculation method for yarn consumption, - Create a motivation system, - Work out a schedule for merchandisers to visit factories in China.
Gamma: smooth supply chain operation
- Establish a product list for sales department, - Implement a 3-month sales prediction report plan, - Establish a work plan with the sole supplier of yarns to set production capacity plan, - Create a policy for inventory management, - Review maintenance schedule of production facilities, - Review operation process of lab dip to reduce set up time, - Refine the information system to share information with suppliers and internal departments, - Refine order enquiry system in order processing, - Develop a Lotus standard flow for system reminder on outstanding orders to sales department.
Delta: reduce total production costs
- Coordinate a monthly production meeting with colleagues in sales and production department, - Set vendor selection criteria, - Establish material specifications and quality requirements, - Create employee training programme, - Refine operation flows on production floor, - Create employee appraisal system to evaluate the effectiveness of training programme.

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