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Knowledge Integrated Business Process Management for Third Party Logistics Companies

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Declaration

I certify that the work was compiled without any unauthorized help; no materials or references other than those cited were used; those sections that are quoted or referenced from other pieces of work are clearly marked.

Bremen, den 06 August 2013

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Hongyan Zhang

Abstract

The growing importance of logistics as well as the increasing dynamic complexity of markets, technologies, and customer needs has brought great challenges to logistics. In order to focus on their core competency in such a competitive environment, more and more companies have outsourced a part or the entirety of the logistics process to third party logistics (3PL) service providers. 3PL has played a crucial role in managing logistics processes within supply chain management. Logistics processes require and supply various types of knowledge for planning, developing, operating, controlling and improving business processes. Therefore, in the current knowledge era, knowledge integrated business process management (KIBPM) is of significant importance for 3PL.

This work applies KIBPM in 3PL from both a theoretical and practical perspective. The methodology for this study is a combination of literature and primary source research. From the theoretical perspective, it reviews the related literature on knowledge, KM, KIBPM and 3PL. It next analyzes application potentials as well as basic theories of KIBPM in 3PL, and proposes a framework for application. Furthermore, it studies the issues, knowledge sources and content, as well as KM approaches from the strategic and operational perspectives. In particular, it discusses the dynamics, logistics networks, business process networks and tacit knowledge sharing in 3PL.

From the practical perspective, a case study of a leading 3PL provider demonstrates the drivers, practices and approaches of KIBPM application. The case study is based on in-depth interviews and extensive access to the secondary data of the firm. It analyzes the core business processes, the process knowledge and key activities of KM in the formulation of business strategy and the operation of business processes in contract logistics. In addition, it applies the proposed framework in this case. Furthermore, it discusses the findings from the literature and case study that relate to the research questions, compares the differences and similarities of KM in 3PL between theory and practice, and puts forward some research and managerial implications.

This study has come to the conclusion that it is more effective and efficient to integrate KM in business processes. Knowledge of market, customer requirements, partners, and competitors and collaborative KM in the logistics networks are essential when choosing

competitive strategies, process designs and development strategies for business. 3PL needs dynamic capabilities to sustain competitive advantage through KM. In operation, knowledge related business procedures and domains, as well as the results in project management of warehousing, intermodal transport and cooperation between geographic networks, have considerable value for business process execution, evaluation and improvement. 3PL motivates tacit knowledge sharing and effective knowledge acquisition, production, warehousing, distribution and application with a trusting organizational culture, process oriented structure, appropriate technology, and incentive measures. However, while KM is a tool for improving the competency and performance for the organization, learning capability is more important to keeping sustainable competitive advantage in the long term for 3PL.

The application of KIBPM in 3PL supports business process management at both the strategic and operational levels. It especially contributes to business development, collaborative projects, intermodal transport, and logistics service improvement.

Key words: business process, knowledge management, third party logistics, dynamic, networks

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List of Abbreviations

1PL	first party logistics
2PL	second party logistics
3PL	third party logistics
4PL	fourth party logistics
AI	artificial intelligence
APQC	American Productivity and Quality Council
BPM	business process management
BPI	business process improvement
BPR	business process reengineering
CM	Contract Manufacturer
CMS	content management system
CRM	customer relationship management
CTI	customer transmission integration
DBMS	database management system
DOR	documentation requirement system
EDC	European Distribution Center
e.g.	Exempli gratia, for example
ERP	enterprise resource planning
et al.	et alii, and others
etc.	et cetera, and so on
ETOP	environment, technology, organization and people
GCT	global calculation tool
GTCF	generic taxonomy components framework
HRM	human resources management
ICS	Intellectual Capital Statement
ICT	information and communication technology
i.e.	id est (that is)
IT	information technology
JIT	just in time
JIS	just in sequence
KIBPM	knowledge integrated business process management

KM	knowledge management
KMS	knowledge management system
KPI	key performance index
KSN	knowledge supply network
LSP	logistics service provider
LTL	less-than-truckload
MNC	Multinational corporation
OA	office automation
OCS	operation control system
PCF	Process Classification Framework
PKM	process-oriented KM
p.	Page
pp.	Pages
QSHE	Quality, safety, health and environment
RBV	resource based view
RFID	radio-frequency identification
SCC	Supply Chain Council
SCM	supply chain management
SCOR	Supply Chain Operations Reference
SECI	socialization, externalization, combination, and internalization
SME	small and medium enterprise
TQM	Total Quality Management
SOA	service oriented architecture
VAS	value-added service
vs.	versus

1 Introduction

The objective of this introduction is to outline the research motivation, overview, methodology and significance of my work.

1.1 Motivation

Since the 1990s, supply chain management (SCM) and logistics have become more and more important in the competitive environment. In the continuously changing conditions of dynamic customer preferences and changing technological development, the network of supply chains is frequently restructured to respond to such environmental changes. As a result of the emerging demand for advanced logistics services [Hertz & Alfredsson (2003)], third party logistics (3PL) is an emerging trend in the global market [Liu & Sun (2011)] and is developing very fast. Intensified globalization and consequent competitive pressures have reemphasized the importance of 3PL in managing logistics processes as well as customer and supplier relationships within the SCM.

Through innovative ways of improving logistics effectiveness, 3PL providers offer strategic and operational value to many shippers all over the world [Terry (2012)]. It is claimed that, on average, companies gain approximately 9% savings and a 15% increase in capacity and quality through outsourcing their logistics activities to 3PL service providers [Sahay & Mohan (2006)]. Other estimates suggest that global 3PL services is a $390-billion industry, with double-digit annual growth expected, particularly as firms continue to engage in global expansion [Quinn (2007)].

In order to survive in the competitive environment, most enterprises recognize the importance of knowledge assets for attaining enterprise performance goals and competency. Knowledge based resources are seen to contribute most to the performance and sustainable competitive advantage in a dynamic, changing environment [Lee & Hong (2002), Haasis (2008)]. In the current economic crisis the discovery and utilization of organizational knowledge increasingly becomes the critical factor of success for all companies [Hexelschneider (2009)]. Knowledge management (KM) in this context is often seen as a universal remedy, so that the number of KM implementations has steadily grown in recent years [Kern & Boppert (2010)].

In order to provide these logistics services with professional solutions, logisticians of 3PL services should master the required knowledge in business processes. Knowledge flow is an important value chain in logistics, from supplier to customer. The sources of all kinds of knowledge are varied, e.g. documents, internet, intranet, knowledge base, and people. Integrated logistical service products are much more complex and knowledge intensive than traditional single services [Haasis (2008)]. Logistics processes and systems need to cope with the increasing diversity of logistics problems in networks [Neumann & Tomé (2006b)]. There are good reasons for applying KM in logistics, e.g. new requirements of knowledge exchange between countries, sectors, and logistics networks, reliable and trustworthy services, prevention or minimization of the outflow of knowledge in high turnover, structuring of knowledge instead of redundant data storage and unstructured data deluge, efficiency and reduction of time spent on finding information [Haasis (2008)]. The implementation of KM techniques and systems within logistics service providers, which hold the potential for the development of sustainable competitive advantages [Haasis (2001)]. KM application in logistics and 3PL is expected to reduce costs, improve customer care and service [Wilk & Inteligencji (n.d.)], enhance the value chain and improve the efficiency of logistics processes. In short, it aims at providing the right knowledge of the right quality and with the right costs at the right place and time [Neumann & Tomé (2005), Rajesh et al. (2011)]

However, there are many problems in dealing with knowledge. The project Pro-Wis investigated 47 companies, and listed some issues (see Table 1-1), e.g. quick integration of new employees in the company, use of existing knowledge for new projects and services, transfer of knowledge in-project and between projects, use of knowledge for process and product optimization. The major problems in implementing KM in the daily logistics business include financial limitations, time restrictions, as well as insufficient structuring and presentation of knowledge [Rajesh et al. (2011)]. KM has not been considered or implemented in 3PL companies or the logistics departments of larger firms on a large scale [Neumann & Tomé (2005)]. Moreover, knowledge separated from the business process context cannot contribute to performance goals [Han et al. (2008)]. It is a great challenge to properly handle this strategic resource by applying KM solutions to the planning of logistics systems and processes as well as the operation of logistics services.

Table 1-1 Problems in dealing with knowledge

Quick integration of new employees in the company	4.12
Use existing knowledge for new project and services	4.08
Transfer of knowledge in-project and between projects	3.96
Use of knowledge for process and product optimization	3.90
Information use of and about customers and suppliers	3.7
Acquisition and communication of knowledge in the mind	3.68
Structuring and networking of data depositions	3.68
Knowledge security of employees' turnover	3.67
Improvement of knowledge transfer between departments	3.50
Creation of transparency on the existing internal competency	3.43
Prevention of unwanted outflow of knowledge	3.40
Internal and external representation of intangible corporate assets	3.08
Management of knowledge in collaborative networks	2.92

(5 completely applies, 1 does not apply)

Source: [Voigt et al. (2006)]

How to effectively manage knowledge is a critical question in both academia and industry. In recent years, the possibility of applying KM to logistics and to logistics planning has been put forward in literature [Rajesh et al. (2011)]. Application of knowledge is to a large extent driven by its context, which defines the intent of usage [Raghu & Vinze (2007)]. A major part of organizational activity (exceeding 90% in some cases) can be described in terms of processes [Amaravadi & Lee (2005)]. Business processes involve knowledge creation, distribution, usage and innovation [Yu (2011)]. The use of knowledge will be decisive for the fluent meshing of business processes and the innovative consolidation or better strengthening of the own position in the international competition [Haasis (2007)]. In the business process of 3PL, knowledge flow is another value chain along with material and capital flow. Effective management of process knowledge will provide employees with task-related knowledge in business processes, enhance the adaptability to external environment, reduce time and cost, and better allocate resources [Wu et al. (2007)].

Knowledge Integrated Business Process Management (KIBPM) has application potential for improving process optimization and service innovation in 3PL. Due to enterprise growth and business development, KM has become increasingly necessary in order to learn from the past, from old specialists, from ongoing business, and to accumulate this knowledge in organizational memory. Furthermore, business in 3PL is process oriented, e.g. a project team for warehousing management is organized by people from different

departments to fulfill one task. Specific instructive knowledge is produced, required, and applied in business processes. In addition, a common problem of KM implementation is that people have insufficient time to involve themselves in extra KM activities. KIBPM is able to avoid this problem as it links the exact context and knowledge, as well as combines business processes, people, and knowledge together. Figure 1-1 shows the context of applying KIBPM in 3PL.

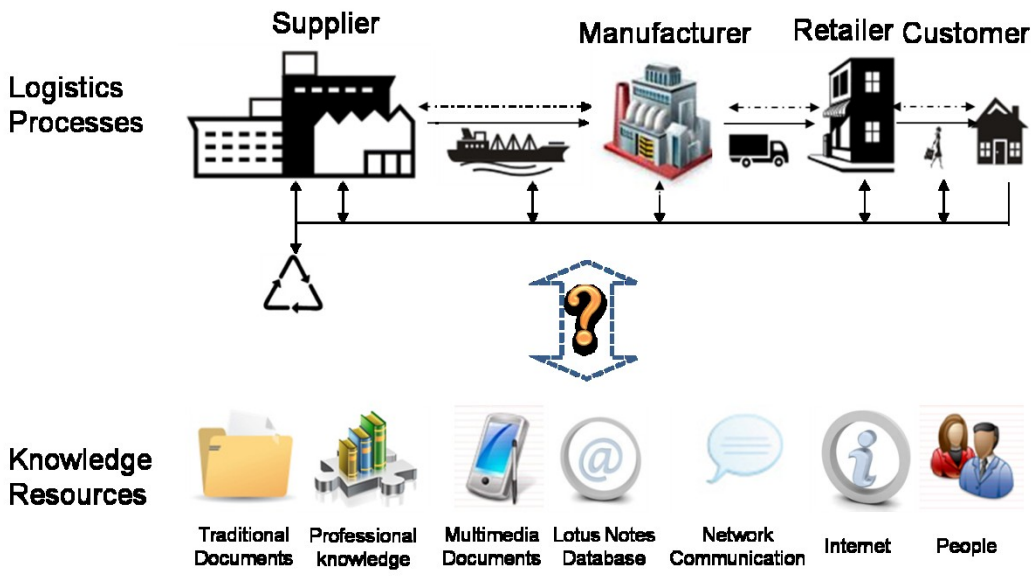

Figure 1-1 Motivation of applying KIBPM in 3PL

1.2 Research objective

In the process of commodity circulation, 3PL plays an intermediary role of integrating the flow of logistics, capital, and information [Wu et al. (2007)] and knowledge. The quality of the logistics services and the success of the logistics activities strongly depend on the knowledge, skills and abilities of people who design or operate the logistics systems and processes [Neumann (2006)]. The management of knowledge must be dynamic and meet the changing requirements of the market, the organizational objective, and the needs of customers, suppliers and employees. In addition, 3PL service providers must collaborate with both external partners and internal employees. Collaboration is essential for knowledge sharing and information exchange in the business process planning and operation. KM in logistics aims to help employees share, generate, transfer, apply, and innovate knowledge in business process, which will essentially increase organizations' competitiveness and profits.

The objective of this work is to apply KIBPM in 3PL enterprises from both the theoretical and practical perspectives. From the theoretical perspective, it aims to study the application issues and approaches and to propose a framework from the modeling and business perspectives, based on literature review and theoretical analysis. In particular, it highlights the dynamics and networks of KM context and tacit knowledge sharing in 3PL. From the empirical perspective, it will use a case study of a leading 3PL provider in Germany to demonstrate KM practices as well as to validate the KM framework. This work is expected to help researchers and practitioners understand state-of-the-art PKM and identify future directions.

In order to achieve the research objective, i.e. effective application of KM in 3PL with regard to business process dynamics and networks, the answers to the following questions will be explored.

- *Why is it important to apply KM in 3PL?*

This question is the motivation for this work. It has been answered in section 1.1, and will be further discussed in chapter 3, 4, 5 and 6 in detail from modeling, business, and practical perspectives.

- *Why should KM integrate into business processes?*

Integration of KM into business processes should improve KM effectiveness as well as efficiency. Knowledge and process integration is the starting point of this work. Chapter 3 will analyze the application potential and proposal (section 3.1 and 3.2).

- *What are the core business processes in 3PL?*

Core business processes are the actual fields of knowledge application, acquisition, and production and therefore the base for applying KM in 3PL. Chapter 5 will analyze the core business processes, process networks, and knowledge intensive core business processes (see section 5.1).

- *What are the knowledge resources in core business processes in 3PL?*

Knowledge is the object of KM and a strategic resource for 3PL in today's knowledge era.

Knowledge resources in the core business processes of 3PL include knowledge at both the strategic (e.g. business strategy choice, intermodal transport plan) and operational levels (e.g. project management, intermodal transport execution). Chapter 4 and 5 will discuss knowledge sources and process knowledge in detail.

- *How to manage, especially share and transfer knowledge in core business processes of 3PL?*

To answer this question requires exploring the approaches of KIBPM and the motivation for knowledge sharing. It will be studied from both modeling (section 4.5) and business perspectives (section 5.3 and 5.4).

- *What are the effects of applying KIBPM in 3PL?*

This is a part of the application potentials of KIBPM (section 3.2) as well as the findings from case study (7.1).

1.3 Research overview

This work will be organized in 7 chapters (see Figure 1-2). Chapter 1 provides the motivation, research objective, questions, structure, methodology and significance. Chapter 2 reviews related literature, which gives a historical overview and definitions of knowledge, KM, KIBPM and 3PL. Chapter 3 provides theoretical analysis of the application of KIBPM in 3PL. Chapter 4 discusses strategic issues of KIBPM in 3PL from a dynamic capabilities perspective. Chapter 5 studies the implementation of KIBPM in 3PL from a business perspective. Chapter 6 gives a case study of KIBPM application in a logistics enterprise. Chapter 7 presents the findings from literature and the case study, implications for research and management practice, concludes the answers to the research questions, and provides recommendations for further study.

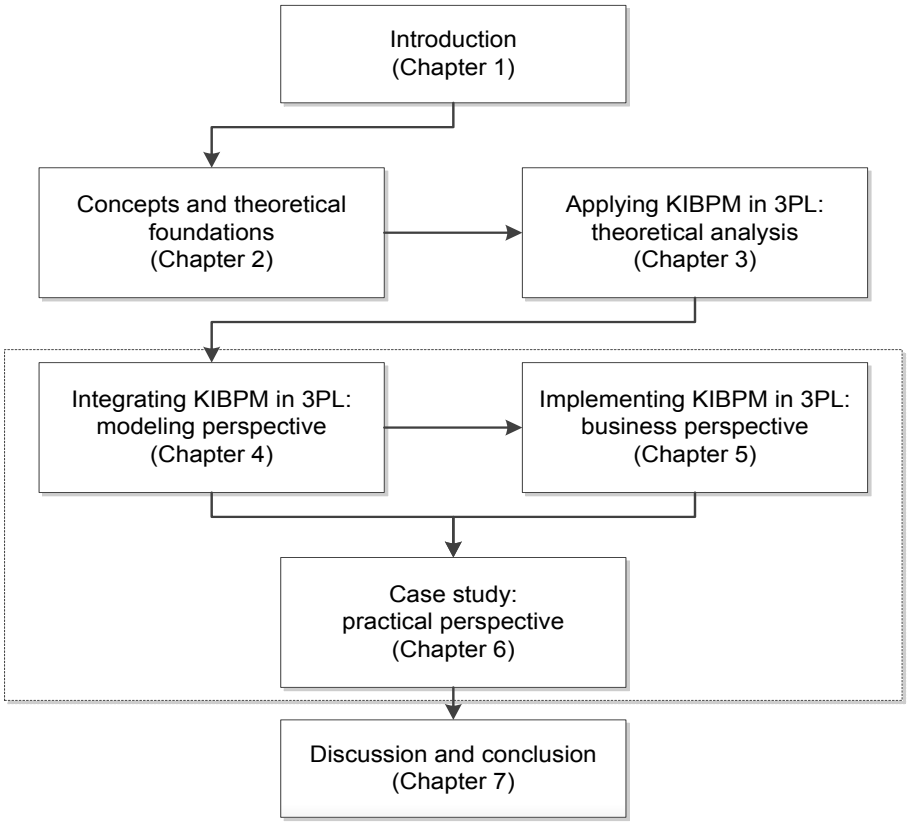

Figure 1-2 Overview of the dissertation

The core work is from chapter 4 to chapter 6. First, theoretical analysis of the application of KIBPM in 3PL, including application potentials, application proposal, and application basis: logistics capabilities, dynamic capabilities, and learning capabilities. This is the base that explains "why" to apply KIBPM in 3PL. Second, the framework of KIBPM in 3PL links the theoretical analysis in general and implementation, as well as practical research (case study). Third, the modeling perspective of integrating KIBPM in 3PL. This states the strategic issues, analyzes strategic knowledge and KM, discusses the dynamics and network of 3PL enterprises, links KM and dynamic capabilities, and presents some approaches. Fourth, the business perspective of applying KIBPM in 3PL. This analyzes the knowledge intensive core business processes and process networks, discusses three different types of process knowledge, and then studies three aspects of KM: KM foundation (knowledge sharing and transfer), KM implementation (enablers, activities and approaches) and KM improvement (transparency and organizational learning). Fifth, the empirical perspective of applying KIBPM in 3PL, consisting of a case study of KIBPM application in a leading 3PL enterprise which presents the KM drivers and practice, and an analysis of framework application.

1.4 Methodology

The methodology for this study is a combination of primary and secondary source research. Secondary data collection involves the collection and review of relevant literature. There is rich documentation focusing on this topic:

- Published studies, surveys, reports, case studies and so on;
- Conference abstracts, poster presentations and materials;
- Newspaper articles, professional magazines and other media coverage;
- Information accessed through the internet and databases online;
- Interviews and discussions with institutes, e.g. Fraunhofer IPK
- Personal knowledge from work experience and discussions with teachers.

Based on the literature review, this work applies the business process frameworks and models in 3PL to identify the core processes for KM. Moreover, this work uses logistic concepts to define the key activities of KM.

Primary in-depth research: the research is based on an in-depth case study via interviews and extensive access to the secondary data on the firm. The practice of KM application in 3PL enterprises is explored and empirically discovered. Case study research is an adequate approach for this work because it allows authentically recording and reflecting on a problem in the space of the business environment with all relevant facts, opinions and expectations [Kern & Boppert (2010)]. It focuses on understanding the dynamic present and tries to constitute generality by analyzing single cases and logical linking of data, interpretation of situations and stimulus-response-relationships [Eisenhardt (1989)].

The empirical data collection was conducted in 2012, with several visits to the companies' headquarters and interviews with top management. 1) Enterprise information: this data collection focuses on the basic information, e.g. company history, business, projects. They are obtained from both secondary resources (such as corporation homepage, public reports, and newsletters) and the primary resource of interviews. 2) Qualitative study: in-depth interviews have been conducted during several meetings. The interviews consisted of open and detailed questions, and lasted for about 1 to 3 hours. The interview questionnaires are attached. All interviews were taped and later transcribed.

1.5 Research significance

- *3PL perspective*

KIBPM has been proposed in literature, but has not been applied in any specific industry or department. Though many logistics enterprises have implemented KM, there is little application of PKM in 3PL enterprises. This work will apply KIBPM in 3PL, which is of great significance both in theory and practice. It fills the gap of applying KIBPM in an industry which requires it on the one hand, and meets the practical needs of effective KM in 3PL enterprises on the other hand.

- *Process orientation*

The application of KM in 3PL is process oriented, which makes KM more effective and efficient. Business processes provide the reality and context for knowledge demand, knowledge production and knowledge application. Process orientation ensures that KM targets the right knowledge (what knowledge is required) to the right people (who needs the knowledge) at the right time (when the tasks must be finished) in the right place (where the specific processes and sub-processes are). Meanwhile, as KM activities take place alongside the progress of business processes, it avoids wasted time spent organizing, storing, and distributing the relevant knowledge.

- *Dynamics and networks*

This work will especially consider the dynamics and networks for KM in 3PL. Most current research studies KM from a technology, product design, or resource perspective. To manage knowledge more effectively and feasibly, it is necessary to consider the dynamic characteristics of the external (competitive environment, market, technology, customer needs, competitors, partners) and internal (new business development, old business process reengineering, process optimization) business process. Moreover, the business processes are person centered, with members in different processes, levels, and networks, which emphasizes collaboration.

- *KIBPM at the strategic level*

This work applies KM not only at the operational level but also at the strategic level. At

the operational level, the goal of implementing KIBPM in 3PL is to do things right, i.e. to support business process execution, control, optimization and improvement. More importantly, KM at the strategic level can support the choice of business competitive strategy, as well as the business process plan, design, and development, which will lead actions towards the objective along the best route, thus ensuring do the right things.

- *Systematic KM application: foundation, implementation, improvement*

Under the strategic guideline of KM in 3PL business processes, the application of KIBPM at the operational level is a systematic journey, e.g. KM foundation (knowledge sharing and transfer), KM implementation (activities, enablers, and approaches), and KM improvement (transparency and learning). In particular, tacit knowledge plays a central part in a firm's sustainable competitiveness, because it is hard to copy [Nelson & Winter (1982)]. This work will study the motivation of tacit knowledge sharing and transfer based on game theory and human resources management (HRM) theory.

- *Case study*

Based on theoretical analysis, this work also provides an empirical perspective with a case study. This case study with a leading German 3PL service provider gives an example of current KM practice in industry, shows some similarities with and differences from theories, and reflects some managerial and research implications.

2 Concepts and theoretical foundations[1]

This chapter will introduce the basic concepts and theories of knowledge, KM, KIBPM, and 3PL. This is the theoretical foundation for research in the next chapters.

2.1 Knowledge

2.1.1 Definition of knowledge

The concept of knowledge has been discussed by different disciplines, e.g. philosophy, computer science, economics and management. Typical key words of the definitions are: belief, experience, data and information, organization, capability, value, process.

Plato defined knowledge according to epistemology ("*justified true belief*"). Russell, too, stated that knowledge is "b*elief which is in agreement with the facts*". Wiig [Wiig (1993)] explained that "Knowledge consists of facts, truths and beliefs, perspectives and concepts, judgments and expectations, methodologies and know- how." Nonaka stated that knowledge is a dynamic process of personal belief towards truth [Nonaka & Konno (2005), Nonaka et al. (2000)].

Empson [Empson (2000)] described knowledge as a product built from data and information, which can be seen as information that comes laden with experience, judgment, intuition and values. Tuomi [Tuomi (1999)], however, stated inversely that knowledge comes first: knowledge exists before information can be formulated and before data can be measured to form information.

Davenport, Jarvenpaa, and Beers [Davenport et al. (1996)] presented knowledge as a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. Moreover, Davenport & Prusak [Davenport et al. (1998)] defined knowledge within an organizational context. In organizations, knowledge often becomes embedded not only in documents or repositories, but also in organizational routines, processes, practices, and norms [Davenport & Prusak (2000)]. Furthermore, Polanyi (1966) [Polanyi (2009)]

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[1] The content of section 2.1, 2.2, and 2.3 is part of [Zhang & Haasis (2011)]

suggested that knowledge is an activity, a process of knowing rather than a use of procedures.

2.1.2 Classification of knowledge

Knowledge is usually classified into two types: formal (explicit) knowledge and informal (tacit) knowledge. The former can be articulated in language, transmitted among individuals, and documented. The latter, on the other hand, is personal knowledge, rooted in individual experience and laced with personal beliefs, perspectives and values [Nonaka (1994), Polanyi & Rotstein (1991), Polanyi (2009), Tiwana (2000)]. Nonaka [Nonaka (1994)] described tacit and explicit knowledge as complementary, not separate, entities. He presented their interaction in the four-stage conversion process: socialization, externalization, combination, and internalization (SECI). Similarly, Polanyi [Polanyi (2009)] argued that explicit and tacit knowledge were not separate forms of knowledge, but rather iterative forms of intellectual and practical forms of knowing.

Explicit and tacit knowledge can be envisioned as the components of an iceberg (see Figure 2-1). Above the water is the explicit knowledge that is easy to transfer or has already been created in the form of data and information (e.g. documentation, check list, shared knowledge in wiki). Under the water is the tacit knowledge that is difficult to transfer (e.g. after action review, idea management, expert yellow pages). More specifically, tacit knowledge has two different types. One type is the tacit knowledge that can be shared or transferred, e.g. an optional route for transport from location A to location B. The other type is the tacit knowledge that cannot be transferred, as when a person does not realize that he or she possesses the knowledge, or when the knowledge is too difficult to describe. For example, regarding selection of mode of transport, sometimes it is hard to describe the knowledge as there are many influencing factors.

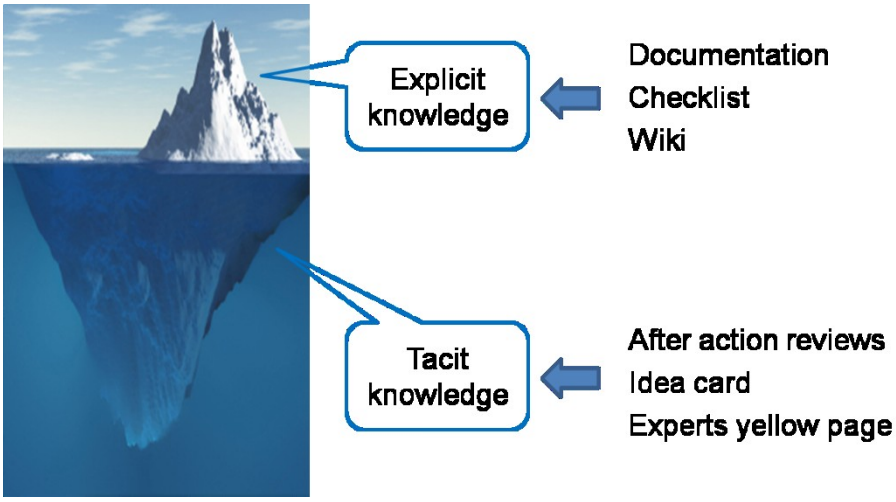

Figure 2-1 Iceberg model of knowledge
Source: adapted from [Sirmon (2013)]

According to the domains, knowledge can be classified into further types: knowledge of markets and competitors, knowledge about norms, standards, & rules, knowledge about products, knowledge about customers, knowledge about one's own organization, knowledge about a partner, knowledge about patents, and knowledge about profession & methods [Mertins & Seidel (2009)]. Knowledge of markets and competitors includes the knowledge of current and potential markets, e.g. market trends, market share or market entry barriers as well as knowledge of the competitors' market position, strategies, and strengths and weaknesses, such as customer base, delivery capability, cost structure and turnover. Knowledge about customers encompasses knowledge of both internal conditions (e.g. strategy, structure, economic status, reliability and payment behavior) and external conditions (e.g. market environment, competitive situation, relationship) of past, present and potential customers. Knowledge of partners (suppliers, associations, strategic alliances) includes knowledge of goals, strategies, contacts of the partners, as well as assessments of reliability, flexibility, punctuality or financial strength. Knowledge about profession and methods includes basic knowledge and skills for managing daily tasks, professional experience, industry-specific knowledge, and specific technologies.

Moreover, according to the storage unit, knowledge can be divided into personal knowledge and organizational knowledge. Organizational knowledge has four levels: individual, group, organizational, and inter-organizational knowledge [Nonaka (1994), Hedlund & Nonaka (1993)]. In the organization, each level of knowledge includes both explicit and tacit knowledge (see Table 2-1). Individual and group knowledge are the knowledge base for organization [Haasis (2008)].

Table 2-1 Examples of knowledge category

	Individual	**Group**	**Organization**	**Inter-organizational**
Explicit knowledge	Knowing calculus	Quality circle's documented analysis of its performance	Organization chart	Supplier's patents and documented practices
Tacit knowledge	Cross-cultural negotiation skills	Team coordination in complex work	Corporate culture	Customer's attitudes to products and expectations

Source: [Hedlund & Nonaka (1993)]

Furthermore, from the perspective of developing economy, Foray and Lundvall [Foray & Lundvall (1997)] classified knowledge into 4 types in the annual report "Economy based on knowledge": know-what (knowledge about truth), know-why (scientific theory of principal and regular pattern), know-how (skills and capabilities for doing something), know-who (who knows and who has what kind of knowledge). Additionally, [Savage (1996)] added two types: know-where (right place) and know-when (right time).

Additionally, Karl Popper [Popper et al. (1972)] defined three Types of Knowledge: 1) knowledge encoded structures in physical systems (e.g. genetic encoding in DNA), 2) subjective knowledge: beliefs which have survived our tests, evaluations and experiences; 3) objective knowledge: knowledge claims that have survived testing and evaluation by agents (individual, group, community, organization, society etc.).

2.1.3 Characteristics of knowledge

In organizations, knowledge often becomes embedded in documents, repositories, routines, processes, practices and norms, so its transfer between people can be slow and uncertain. Platts & Yeung [Platts & Yeung (2000)] asserted that the subjective and intuitive nature of tacit knowledge makes it difficult to process in a logical manner. Much of what makes people use knowledge is the need for social, cultural, and communicational meaning that allows knowledge to be harnessed and shared [Platts & Yeung (2000)].

The organizational context is essential for knowledge acquisition, sharing, transfer and reuse. A common context for knowledge sharing helps connect people who need the

knowledge (knowledge demand) with those who have it to share (knowledge supply), so that they can reach the same understanding [Davenport et al. (1998)]. Nonaka, Toyama, & Konno [Nonaka et al. (2000)] defined the knowledge place as *ba*. "*Ba is the context shared by those who interact with each other, and through such interactions, those who participate in ba and the context itself evolve through self transcendence to create knowledge. Participants of ba cannot be mere onlookers. Instead, they are committed to ba through action and interaction* (p.19)."

Allee [Allee (2000)] proposed that knowledge has the feature of wave-particle duality. Knowledge has the attribute of both entity and process. Knowledge can be product as well as process, which is similar to light, which can be recognized as a particle or undulation. Knowledge is an organizational process rather than a static collection of data that can be stored in a database [Nonaka (1994)].

Polanyi (1966) [Polanyi (2009)] emphasized the dynamic properties of knowledge and suggested that it is an activity which would be better described as a process of knowing rather than a use of procedures. Moreover, McInerney [McInerney (2002)] stated that knowledge is dynamic, not only in individuals, but also at the organizational level where there must be movement for knowledge to be transferred or shared. "Knowledge" is not merely an object that can be "placed," nor should it be confused with representations of knowledge in documents, databases, etc., but it can be seen as a collection of processes that allow learning to occur and knowing to be internalized.

In a word, knowledge is the mix of data, information, experience, and context in the value creation process of organizational activities. It has the following characteristics: embeddedness (individual or organizational), combination of object and process, diversity, ambiguity, and a dynamic nature [Wang (2008)].

2.1.4 Knowledge sources

Generally, knowledge comes from two sources: external and internal to the organization. External knowledge includes knowledge about market, supplier, competitor, industry development, customer requirements, partner, etc. Internal knowledge includes knowledge about organization, business process, work experience, lessons learnt, project management, teamwork, etc. in individual, group or organizational memory.

Organizational knowledge exists in three main categories [Sandkuhl et al. (2005)]: 1) competencies of employees (e.g. personal skill profiles), 2) externalized knowledge (explicit knowledge stored electronically in documents, databases or information systems, e.g. office documents, or formal requirement specifications from the customer), 3) corporate knowledge (tacit knowledge represented in work processes, organizational structures, standard operating procedures, or best practices) [Billig & Nentwig (2003), Lang & Pigneur (1999)].

Where does knowledge exist in the company? The result from a Delphi survey (Figure 2-2) showed that much more (42%) tacit knowledge exists in employees' brains than other explicit knowledge sources: paper documents (26%), E-documents (20%), and electronics (12%). However, the total explicit knowledge sources are relatively more than the tacit knowledge sources. Companies should pay attention to both knowledge.

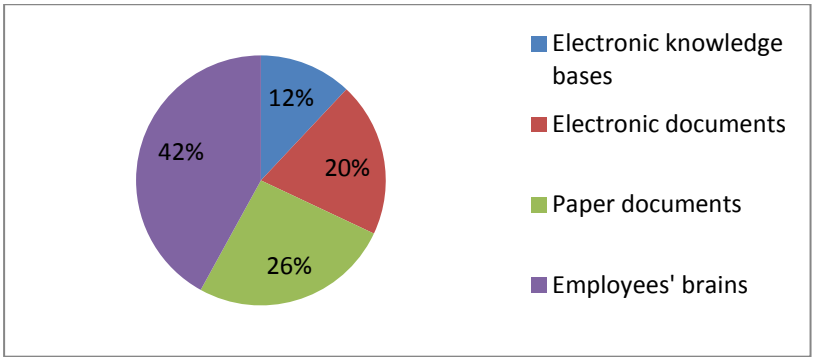

Figure 2-2 Knowledge distribution in organizations
Source: Delphi Group survey

Different knowledge is acquired from different sources. Explicit knowledge can be acquired through articulation and codification, while tacit knowledge is acquired through experience [Simonin (1999)].

2.1.5 Process knowledge

Process knowledge is an essential part of organizational knowledge which is embedded in business processes and can generate value in the business process and bring great benefits to the organization. It is defined as contextual, experiential, value laden and insightful information about a process, including how it is configured, how it is coordinated, how it is executed, what outputs are desirable and what impacts it has on the organization [Amaravadi & Lee (2005)].

Generally, process knowledge can be classified as explicit or tacit knowledge [Remus (2002), Zhang & Wang (2010)]. Explicit process knowledge includes experience summaries, process templates or instructions, job descriptions, position responsibilities, best practices, expert yellow pages, etc. Tacit process knowledge includes experience, skills, special technologies, and thinking patterns. In more detail, tacit knowledge can be further divided into two parts: tacit knowledge that can be converted to explicit knowledge, and tacit knowledge that cannot be converted to explicit knowledge.

Remus. and Schub [Maier & Remus (2002)] distinguished three categories of process knowledge per area of competency at the strategic level: core knowledge, advanced knowledge, and innovative knowledge. Core knowledge is the minimum or the basic industry knowledge. Advanced knowledge is the specific knowledge that enables an organization to survive in competition with other organizations. Innovative knowledge enables an organization to differentiate itself from its competitors and to lead its industry [Maier & Remus (2002)]. With respect to business processes, three types of knowledge can be distinguished: knowledge about the process vs. knowledge within the process vs. knowledge derived from the process [Remus (2002), Zhang & Wang (2010)].

Jung et al. (2007) define process knowledge as "three types of knowledge that supports process-related activities efficiently throughout the lifecycle of business processes (P23)." They are: process template knowledge (process template, analysis and simulation information derived from the design phase, and history of evolution), process instance knowledge (information along with process performance measurement based on evaluation criteria, information about environment, resources, results, etc) and process related knowledge (created and used within a business process) [Jung et al. (2007)].

Han et al. (2008) classified enterprise knowledge into two types: process knowledge and task support knowledge. Process knowledge is acquired and refined during and after the process execution, and provides guidelines and tools for the task execution [Han et al. (2008)]. There are three types: 1) generic process knowledge (attributes such as structure, relevance to business strategy, evaluation criteria, and simulation results), 2) project instance knowledge (attributes such as process execution history, actual performance data, resources used, incurred cost, etc), 3) task support knowledge (document, business rules & check items, expert consulting, on-line forum) [Han et al. (2008)].

2.2 Knowledge management (KM)

2.2.1 Definition of KM

KM describes everything from the application of new technology to the harnessing of intellectual capital within an organization [Sallis (2002)]. Early perspectives on KM focused on standardization or utilization of a particular process. Wiig [Wiig (1993)] described KM as the ability to acquire, create, organize, share, and transfer knowledge. Hedlund [Hedlund (2007)] suggested that KM addresses the generation, representation, storage, transfer, transformation and application of organizational knowledge.

A later perspective views organizations as bodies of knowledge. Bhatt (2001) [Bhatt (2001)] defined KM as the processes and procedures that govern the creation, dissemination and utilization of knowledge by merging organizational structures and people with technology. Malhotra (2001) [Malhotra (1998)] suggested that KM embodies organizational processes that seek a synergistic combination of data and information processing capacity within information technologies, and the creative and innovative capacity of human beings.

Another description of KM is $KM= (P+K)^S$. Here, "*P*" refers to people, "+" means technology, "*K*" refers to knowledge, and "*S*" means sharing, which are essential components of KM. Nowadays there are more perspectives from which to discuss the components of KM, e.g. process, people, technology, organization, society, government.

2.2.2 Development of KM

The theory of KM has experienced four stages: experiences, theory origination, theory formation, and theory development [Wang (2008)]. Theory development include three phases:1): current knowledge sharing, knowledge base; 2) knowledge creation and organizational learning, knowledge life cycle; 3) combination of KM and company strategy, business processes, organization and individual knowledge. There are two primary streams that drive the origination of KM theory: one is philosophical thought, and the other is the practical demand for KM in the working environment. The driving forces of KM theory formation and development are: exploration of KM in academia and industry, reflection on the driving forces of KM in knowledge era, and efforts to improve

efficiency in management [Wang (2008)].

The exploration of knowledge and KM has a long history. Western philosophers (e.g. Socrates, Plato, Russell) have discussed knowledge and KM for thousands of years. In eastern, the "apprentice-journeyman-master" method and the craft guild of the 13th century are examples of the KM concept. The conceptual foundations of KM were built by several management researchers in the early 1960s [Drucker (1969), Polanyi (1962)], while more formal discussion of the concepts began to emerge in the 1980s, especially as the resource based view (RBV) of firms was put forward. During the 1990s the dominant theme of KM research was a focus on reengineering and a process-based view of the firm [Hammer & Champy (2003)]. KM research has been developing very fast under of technology trigger. It reached the peak of inflated expectations in 1995, went into a trough of disillusionment in 2000, climbed to a slope of enlightenment in 2005, achieved a plateau of productivity in 2010, and now is driving to maturity [Bullinger et al. (2009)]. Table 2-2 explains the prominent topics from the 1960s until now. It suggests that the trend within KM development is collaboration, interaction between tacit and explicit dimensions, business process orientation and inter-organization relations.

Table 2-2 Development of KM research

Time period	Driving forces	Research themes
1950s–1980s	Increased large organizations Scientific management Transaction processing systems and manufacturing automation	RBV of the firm [Penrose (1995)] Knowledge classification [Polanyi (1962)] Organizational strategy [Drucker (1969)] Organizational learning models [Argyris (1976)]
1980–1990	Globalization Knowledge based organizations Total Quality Management	Competitive strategy framework [Porter (1980)] Organizational design and strategic fit [Mintzberg (1980)] Strategic capability of the firm [Prahalad (1983)]
1990 onwards	Business process re-engineering Increased attention to knowledge and intellectual capital management Information economy Tighter inter-organizational relations in operations and strategy	Collaboration and communities of practice [Goodman & Darr (1998), Orlikowski (1993)] Spiral model of knowledge creation [Katsoulakos & Zevgolis (2004)] Interaction between tacit and explicit dimensions [Nonaka (1994)] Industry practice and prescriptions for effective KM [Davenport et al. (1998)] The Fifth Discipline [Senge (1993)]

Source: adapted from [Raghu & Vinze (2007), Wang (2008)]

The practice of knowledge activities has experienced different stages ever since agricultural economy (Table 2-3). The management object has developed from literature to data, information and finally knowledge, while the instruments have advanced from manual labour, through computers and internet, to learning and innovation. Since the 1990s, numerous companies have started knowledge sharing, transfer and innovation activities to improve competency with high technology. These practices are influenced by the development of KM theory, and also put forward new themes for KM research.

Table 2-3 Development of KM practice

Year	Society Background	Management	Instruments
1900-1950	Agricultural economy	Literature	Manual labor
1950-1980	Industrial economy	Technology	Computer
1980-1990	Information economy	Information	Technical, internet
1990-	Knowledge economy	Knowledge	Intellectual capital, Organizational learning, Innovation management

Source: adapted from [Wang & Gu (2005)]

2.2.3 Research schools of KM

The theoretical foundation of KM has emerged from a wide variety of disciplines such as organizational theory, artificial intelligence (AI) theory, and various scientific fields [Haasis & Kriwald (2001), Shang et al. (2009)]. Figure 2-3 illustrates the interdisciplinary perspectives of KM. The psychology shows basics of learning behavior, the acquisition of knowledge and the motivation of people. Education concerns with related issues to the preparation and transmission of knowledge. Sociology contributes to the social framework for KM in business. Computer science uses IT programs and tools to deal with the flow of data and knowledge concepts and implementation. Along with the development of KM theory and practice, several KM schools have arisen, e.g. technology, behaviorism (learning), eclectics, strategy, knowledge capital, process, supply and demand, etc.

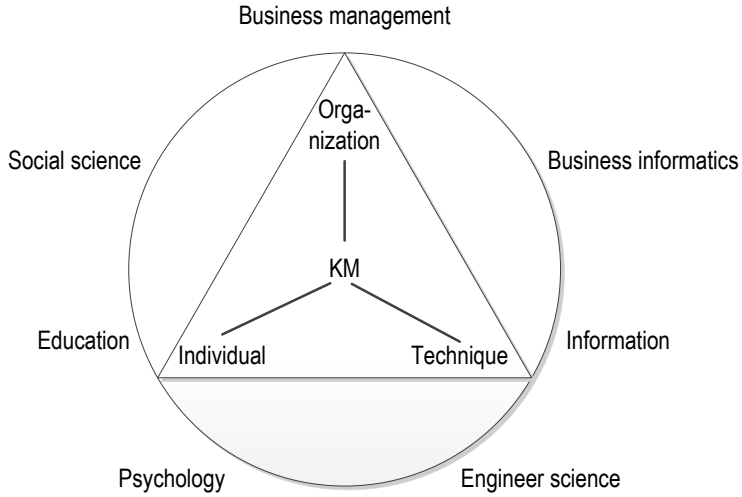

Figure 2-3 Interdisciplinarity of KM

Source: [Haasis & Kriwald (2001)]

The technology school studies the application of information technology in KM, which includes the design and construction of information systems, artificial intelligence and groupware. Behaviorism (learning school) studied KM as well as learning by individuals, groups and organizations from the perspective of psychology and sociology. Eclectics (social-technical), combining the technology school and behavior school, studies KM from both the information technology and people perspectives. This is presently the main stream of KM theory. The knowledge capital school considers the economic value of knowledge. The strategy school is rooted in the resource-base view, and integrates KM in strategic management, seeing KM as the final strategy to enhance organizational competitive advantage [De Tienne & Jackson (2001)]

From the perspectives of management and organization, KM research can be divided into two streams [Grover & Davenport (2001)]. One stream concerns knowledge flows between organizational units and between organizations, and investigates various related issues, e.g. strategy, culture, structure, IT and KM processes (e.g. the three-pillar model of KM [Wiig (1997)]), including the individual, group and organizational levels. Another stream concerns the theorization of performance differences, with debates between transaction cost economics and resources-based theory. The former theorists state that knowledge is critical to enable a company to create competitive advantages in order to manage economic activities in a differentiated way. In contrast, the latter theorists argue that the success of a company not only relies on the economics of contracts, but also on the possession of rare,

valuable, and inimitable resources [Barney (1991)].

The process school believes that knowledge can only realized added value in the process flow. This school gives rise to several fields: information resource management, information media, and management consulting. This school believes that knowledge flow and the business process are both integrated and separable. The business process is the source and application field of knowledge, while the knowledge process is the abstract side of business process. Taylor's scientific management, for example, is a typical KM process: observation of actions, tools and standards is a knowledge acquisition and production process; training is a knowledge distribution process; motivating employees to integrate knowledge and work is a knowledge application process, which will finally improve work efficiency.

2.2.4 KM strategies

KM supports achieving organizations' goals in many aspects, e.g. adaption to a competitive environment, goal attainment, pattern maintenance and organizational integration [Wijinhoven (2003)]. KM is critical to innovation and improvement of product and process, decision-making, and organizational adaptation [Earl (2001)].

Earl (2001) summarizes three main categories and seven KM strategies based on primary and secondary data. Systems, cartographic, and engineering strategies are based on information or management technologies that largely support and condition knowledge workers in their everyday tasks. Commercial strategy (labeled "economic") is creating revenue streams via the exploitation of knowledge and intellectual capital. Organizational, spatial, and strategic schools are more behavioral, stimulating and directing management to be proactive in the creation, sharing and use of knowledge [Earl (2001)].

Other typical theories on KM strategy utilize the perspective of intellectual capital as well as dynamic capabilities. Knowledge in the strategic perspective is a valuable asset and form of capital for the organization. The Intellectual Capital Statement (ICS, "Wissensbilanz" in German) is a strategic KM instrument (Figure 2-3) [Mertins & Orth (2006)]. Intellectual capital describes the intangible resources of an organization, and is divided into three categories: human capital, structural capital, and relational capital. Business processes cover a multitude of functions, which describe the interaction of people, knowledge and

information, as well as operating resources in cohesive steps. They are chains of activities within network-like contexts and organizations. They provide the output that is useful to the customers [Alwert et al. (2004)].

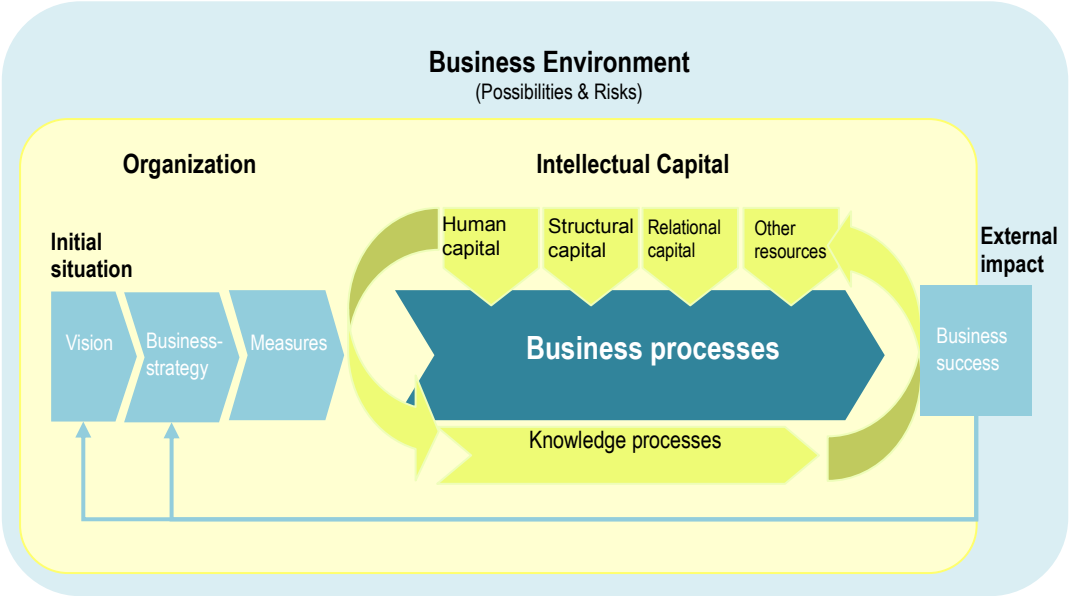

Figure 2-4 ICS structural model

Source: [Alwert et al. (2004)]

Dynamic capabilities are part of organizational capabilities or logistics capabilities at the strategic level. Dynamic capabilities enable organizations to exploit existing knowledge and explore new knowledge to form a competitive advantage [Eisenhardt & Martin (2000)]. They are critical to knowledge creation, knowledge acquisition, knowledge integration and knowledge reconfiguration, because these KM processes are underpinned by the organizational dynamic capabilities [Verona & Ravasi (2003)]. Dynamic capabilities and KM share the recognition that knowledge change and adaptation is related to the concept of learning [Eisenhardt & Martin (2000), Zollo & Winter (2002)].

2.2.5 KM implementation

KM in logistics aims to help employees share, generate, transfer, apply, and innovate knowledge in business process, which will essentially increase an organization's competitiveness and advantages. Effective KM application can reduce times, achieve intelligent logistics, improve adaptability to the dynamic environment, support supply chain management, better distribute resources, and reduce logistics cost.

KM implementation includes KM process, activities, and KM approaches. Typical KM activities are consist of combining available knowledge, distributing knowledge, generating knowledge, and developing new knowledge [WIIG (1991), Nonaka et al. (1992)]. In order to analyze the business process and assure the involvement of process owners, Mertins, Heisig, & Vorbeck [Mertins et al. (2001)] identified four core activities of KM in their survey (Figure 2-4).

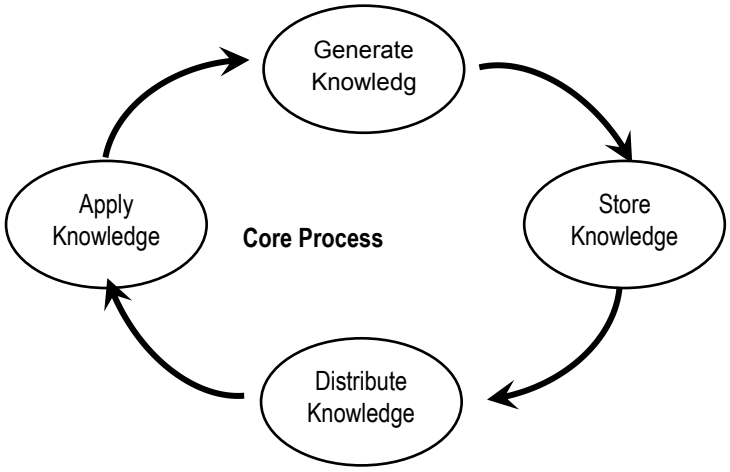

Figure 2-5 Core process of KM
Source: [Mertins et al. (2001)]

KM systems (KMS) can be classified as integrative instruments (e.g. best practices, lessons learned, and content management), interactive instruments (e.g. yellow pages, expert networks, skills directories, and communities), integrative systems (e.g. knowledge repositories, meta-search systems, knowledge discovery and mapping) and interactive systems (e.g. collaboration, knowledge transfer and e-learning push-oriented systems, community builders) [Maier & Remus (2002)].

Advances in information and communication technologies (ICT) allow knowledge-based systems to utilize the tacit and explicit knowledge within an organization and afford greater possibilities for individuals and organizations to create and to share that knowledge [Alavi & Leidner (2001), Schwen et al. (1998)].There have been various information system projects and approaches to KM application that placed emphasis on this process, e.g. discussion groups, presentations and shared workspaces [Amaravadi & Lee (2005)]. Information assets include explicit knowledge such as databases, documents, and tools, as seen in Table 2-4, and tacit knowledge which includes organizational members and their expertise, practical work experience and contributions.

Table 2-4 Examples of KMS

Knowledge creation	Knowledge codification	Knowledge transfer	Knowledge application
Groupware Intranet E-mail Expertise location Discussion group	Knowledge repositories Database system Search engine Knowledge map Portal	Groupware Intranet Expertise location Videoconferencing Discussion group Knowledge map	Intranet Work flow system Expert system

Source: adapted from [Alavi & Leidner (2001), Schwen et al. (1998)]

However, KM is not just about technology, and cannot be realized simply through information systems [Raghu & Vinze (2007)]. KM approaches include both technological and non-technological designs [Mertins et al. (2001)]. Personnel and technical requirements and options have to be balanced for an efficient design and operation [Haasis (2008)]. Davenport, Jarvenpaa, & Beers [Davenport et al. (1996)] stated: "*the most dramatic improvements in KM capability in the next ten years will be human and managerial (p.53).*"

2.3 Knowledge integrated business process management (KIBPM)

2.3.1 Business process and business process management (BPM)

Businesses are a collection of processes rather than functions. Processes cut across functional boundaries and emphasize methods of doing something, focusing on the goal and the necessary steps and activities. The majority of organizational activity (exceeding 90% in some cases) can be described in terms of processes [Amaravadi & Lee (2005)]. An order cycle process, for example, integrates several steps and activities: order transmittal (marketing function), order processing (information system function), order picking (warehousing function) and order delivery (transport function) [Murphy & Poist (1996)]

ISO9000 defines a process as a group interaction and related activities that convert input to output. Business processes are a collection of interdependent (interrelated) activities, tasks or behaviors performed by humans or machines that produce a specific service or product for a specific customer or market in order to achieve specific business goals. Business processes often cut across multiple functional organizations and hierarchies within and outside the organization, and therefore require that all activities within the process be coordinated to achieve the business goals effectively [Raghu & Vinze (2007),

Gai & Dang (2010)]. Business processes are in many cases not separated, but interrelated, interactive and collaborative. Their relationship can take the form of serial, parallel or mixed processes.

The classification of organizational processes generally has two methods: dichotomy and trichotomy. The dichotomy method differentiates business processes into operational processes and support processes [Davenport (1990)], while the trichotomy method distinguishes business processes into strategic processes, operational processes, and enabling processes [Peppard & Rowland (1995)]. Porter differentiates process activities into primary activities (e.g. logistics, marketing and sales), which directly contribute to customer value, and supporting activities (e.g. firm infrastructure, HRM), which support the fulfillment of primary activities [Porter (1985)].

Voigt, Staiger, Finke, and Orth differentiate business processes into primary business processes and secondary business processes, as seen in Figure 2-6. Compared with Porter's model, this added some detailed processes. The primary business processes include an innovation process, product planning and development processes; the secondary business processes include a strategy planning process, quality management process, and business controlling process.

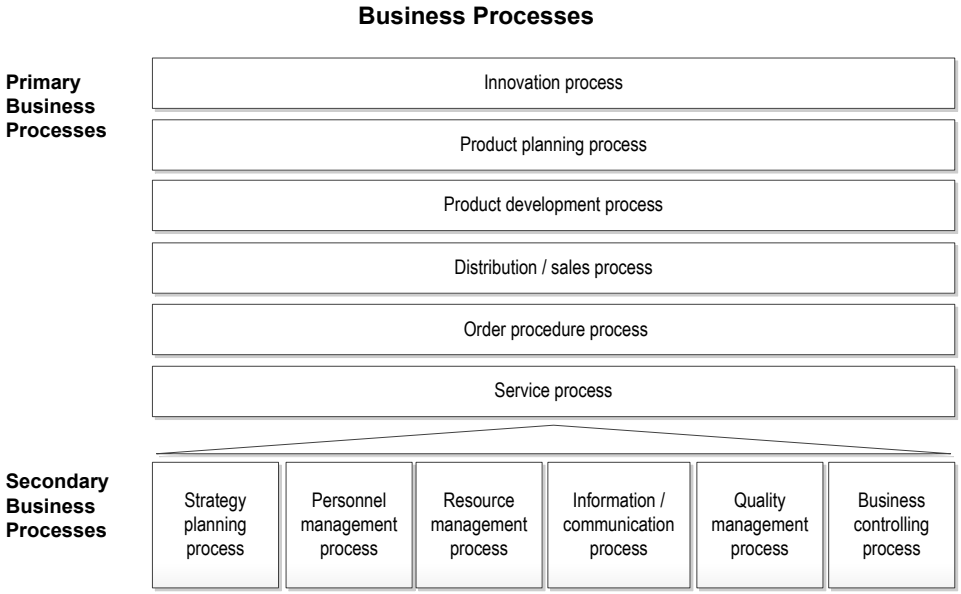

Figure 2-6 Business process classification

Source: [Schmelzer & Sesselmann (2008)], [Voigt et al. (2006)]

The American Productivity and Quality Council (APQC) has established the Process Classification Framework^{SM} (PCF). It classifies organizational processes into management and support processes, and operating processes into 12 enterprise-level categories (APQC, 2012). Operating processes include: 1) developing vision and strategy, 2) designing and managing products and services, 3) marketing and selling products and services, 4) delivering products and services, 5) managing customer service, 6) developing and managing human capital. Management and support processes include: 7) managing information technology, 8) managing financial resources, 9) acquiring, constructing, and managing assets, 10) managing enterprise risk, compliance, and resiliency, 11) managing external relationships, 12) developing and managing business capabilities.

The 'St. Gallen Management Model' define a process as a system of activities that are accomplished in a activity chain, and facilitated by employing information systems [Rüegg-Stürm (2005)]. This model classifies processes in three broad categories (see Figure 2-7): management processes, business processes, and support processes.

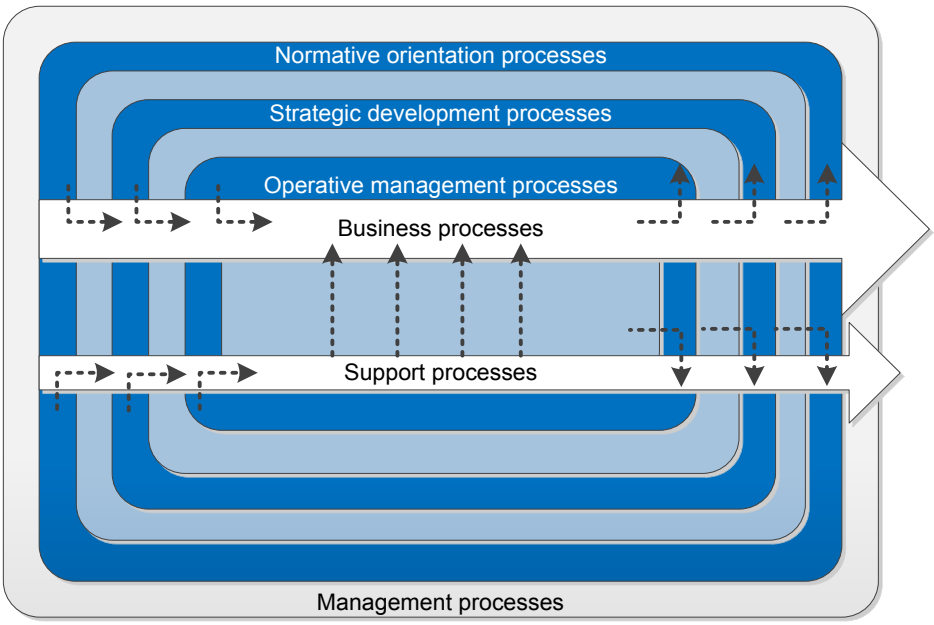

Figure 2-7 Categories of value added processes

Source: [Rüegg-Stürm (2005)]

Business processes, including customer processes, supply chain management processes, innovation processes, concern the practical fulfillment of core market-related activities of a firm which are directly concerned with creating customer benefit. Management processes includes all of the activities accompanying the planning, designing, guiding, coordinating,

controlling, and developing of the individual business and support processes. Support processes provide the infrastructure and the provision of internal services necessary for business processes to be carried out effectively and efficiently.

Amaravadi et al. [Amaravadi & Lee (2005)] classified organizational processes as operational processes (including manufacturing/service and financial/accounting processes.), support processes (including administrative and legal processes) and managerial processes. Inputs and outputs can take the form of materials, personnel, information, etc., which vary with the type of process and functional area [Garvin (1998)].

Table 2-5 Process types and dimensions

Process type	Examples	Relevant dimensions
Operational Process		
Manufacturing/service	Manufacturing Nylon assembling motherboards	Structural, personnel/coordination, performance and tools, results, quality
Financial/accounting	Preparing financial statements, auditing	Structural, performance and tools, results, impacts and implications
Management Process		
Managerial	Strategic planning, negotiating a supplier contract	Discourse, results, impacts, and implications
Support Process		
Administrative	Hiring employees, buying equipment	Structural, personnel/coordination, performance and tools, discourse, results
Legal	Issuing stock, preparing labor contracts	Structural, personnel/co-ordination, performance and tools, discourse, results, impacts, and implications

Source: adapted from [Amaravadi & Lee (2005)]

Business process management (BPM) was proposed in the 1990s. BPM deals with the management, continuous improvement and optimization of business processes. The concept can be understood from different perspectives, such as the methodological, operational, and technological. BPM is a systematic method of identifying, designing, executing, documenting, measuring, monitoring and controlling both automated and non-automated business processes to achieve consistent, targeted results aligned with an organization's strategic goals. It aims to improve quality of product or service, as well as to analyze, improve, control and maintain processes. It enables inter-functional

collaboration within and outside the organization, improves work efficiency, reduces time and cost, and enhances output and performance. Moreover, BPM needs a set of operational technologies to support its application, which combines process, information and people. BPM should be dynamic so that it can adapt to changes in the market, organizational structure and resources [Zhang & Wang (2010)].

The development of BPM can be summarized by the following three stages in Table 2-6. The objective and techniques of each stage have become increasingly advanced.

Table 2-6 BPM development

Stage	Development	Technique
Taylor and Ford period (1920s)	Scientific management, segmentation of manual structure in multi-stage process, Improvement of operational efficiency	business process optimization, "method and process analysis" professional segmentation: business process is divided into most simple and basic working procedures.
Information era (1990s)	From process automation to process reengineering, process improvements, and competitive advantage	Business process reengineering (BPR), Business process improvement (BPI), Total Quality Management (TQM) Six Sigma
21st century	Process innovation collaborative processes between organizations and departments	E-commerce, service oriented architecture (SOA), IT e.g. Web service and biz talk

Source: compiled from [Zhang & Wang (2010)]

Logistics service is a process-oriented business constituting numerous processes linked together to perform different logistics operations [Chow et al. (2007)]. Logistics is the process of planning, making and controlling efficient and fluent turnover and storing of not only raw materials, in progress tasks and final products, but also services and adequate information from the source of raw materials extraction to clients according to their expectations [Golembska (2001)]. Moreover, the logistics process is human centered [Myers et al. (2004)]. In both inbound (i.e. stock receiving) and outbound (stock delivery) logistics, most decisions are made and acted upon by people with different kinds of experience, knowledge, values and cognitive abilities.

2.3.2 Definition and characteristics of KIBPM

KIBPM is an integration of KM and BPM. It combines the two important resources of the organization: knowledge and process. It analyzes the production, sharing and application

of knowledge from the start of the process activity [Yu (2011)]. It captures knowledge produced in the work process, makes it available when needed [Beraha (2006)] and contributes to service efficiency and value creation. The goal is to transfer the right knowledge at the right time to the right people.

KIBPM can support the operation of business processes by combining KM instruments with the daily work process. The business process is the theoretical basis, and the principle, of KM strategy. The business process is the channel through which knowledge flows, [Armistead (1999)], as well as the application field of knowledge, and all core KM activities are interrelated with specific business processes [Mertins et al. (2001)]. Knowledge comes from the process [Choi et al. (2004)], and KM is a part of the business process [Karagiannis & Telesko (2000)]. Process and knowledge can be integrated by systematically managing the process knowledge.

KM is business and process oriented [Mertins et al. (2001)]. In traditional KM, knowledge was managed a bit statically in generating and storing, but poorly distributed and applied in the organization. In KIBPM, however, knowledge can be managed actively with a dynamic business process. The advantage of process-oriented KM is that it can help users avoid information overload and concentrate on important information which is essential for company value chains [Millie Kwan & Balasubramanian (2003)]. It can also improve the usability of knowledge within the company and the efficiency of KMS implementation [Remus & Lehner (2000)].

2.3.3 KIBPM at the strategic level

KIBPM at the strategic level mainly describes the relationship between KM and the business process. The business process is the strategic guide for KM. Business processes combine KM, organization, people and technology. There are three KM strategies: 1) KM strategy based on RBV, which emphasizes the accumulation of knowledge resources and improvement of organizational capabilities, e.g. learning organization, knowledge innovation, knowledge sharing and transfer; 2) KM strategy based on the market-based view, which emphasizes management of knowledge capital and realization of knowledge value, e.g. intellectual capital; 3) PKM strategy, which emphasizes the integration of KM and business processes [Jiang et al. (2005)].

A KIBPM strategy is an integration of business process and knowledge process, which can avoid the problems of core rigidity under RBV [Maier & Remus (2002)]. Maier & Remus [Maier & Remus (2002)] proposed a model that integrates RBV and the market-based view, which combines macroscopic, medial, and microcosmic views. KIBPM can help the employee obtain useful knowledge through the integration of KM and business process context. It provides solutions for sharing and distributing knowledge among the increasingly widely distributed process participants in organizations.

Knowledge is the strategic resource of companies. The business process is not only the customers' communication channel, but also the knowledge flow channel, and the effect of knowledge on organizational performance is realized in the business process. The combination of process, people and technology will improve organizational performance [Armistead (1999)]. KIBPM can provide relevant knowledge to employees in operation processes. Knowledge is generated by processes and applied in processes [Maier & Remus (2001)]. It integrates KM and the value chain, as well as adding background and guidelines for KM strategy. There are four factors involved in integrating KM and process management: strategy, content, system and KM content. This strategic perspective combines "technology oriented" and "people oriented" KM [Maier & Remus (2003), Remus & Schub (2003)].

KM is an important factor in designing the strategic business process [Campos & Sánchez (2003)]. The first step required to integrate KM into organizational strategy is that how KM supports organizational business processes. Strategic, tactical, and operational KM will support strategic policy development core external business as well as research and development and internal management and support services [Xia & Jin (2003), Smart et al. (2003)]. Jung et al. [Jung et al. (2007)] proposed architecture for PKM based on a comprehensive framework that reflects lifecycle requirements of both KM and BPM.

2.3.4 KIBPM at the operational level

KIBPM at the operational level mainly studies the influence of business process on KM and the integration of business process and KM. The knowledge base is used to seek and use knowledge according to process requirements. Knowledge must have context, and the business process is the context for knowledge acquisition and use, as well as the channel for realizing knowledge value.

- *Explicit knowledge in the business process*

This theme studies the business process modeling, the relationship between process and knowledge base. The core of KIBPM is "to provide the right knowledge to the right person at the right time". Business processes and KM activities should be combined, as knowledge seeking and acquisition is a part of the business process [Kwuan (1999), Karagiannis & Telesko (2000), Jablonski et al. (2001), Abecker (2004), Records (2005)].

Kwuan [Kwuan (1999)] integrates work flow and knowledge base, and makes knowledge acquisition and seeking a part of the business process. Karagiannis [Karagiannis & Telesko (2000)] studied the EU-Project Promote, which provides a PKM approach as an online tool to support knowledge creation and reuse. The objective is to accumulate, search and distribute product related knowledge and employee experience. Records [Records (2005)] found that the theories of KM and BPM emerged almost at the same time, and have developed in parallel. He proposed two models of knowledge driven processes and an integrated framework of BPM and KM. Later, he also built a service oriented KIBPM model, which constructed a knowledge map vocabulary.

- *Integration of business process and knowledge*

KMS must connect the knowledge demand with quality and knowledge supply. The involvement of the knowledge owner and knowledge user is an important factor in ensuring the success of KMS application [Hoffmann et al. (1999)].

Integration of knowledge and business processes is the foundation of KM. KM can realize value creation and combine with other types of management through business processes. Knowledge flow is the connection between knowledge demand and knowledge supply [Strohmaier (2003)]. Knowledge is produced during business processes [Choi et al. (2004)]. KM includes two activities: one is knowledge application in process, and the other one is knowledge innovation in process [Hawryszkiewycz & Maung (2004), Woitsch et al. (2004), Cui & Shi (2006)]. Abecker et al. [Abecker et al. (2002)] suggested that KIBPM helps employees acquire useful information through integration of KM and process context. They described a KM framework with a four level structure: knowledge application, knowledge broker/agent, knowledge description, knowledge object.

2.3.5 KIBPM models and methods

During the past decade there have been various discussions on PKM, and some models and methods have been proposed in the literature. They mainly derive from knowledge systems, information systems and intranets in business process management and re-engineering. Modeling organizational knowledge processes according to a process-oriented approach is based on well-structured business processes. These models can also be executed like business processes. Therefore such a model-based view of KM enhances the possibilities of analyzing knowledge activities, visualizing knowledge flow and tracing knowledge processes with appropriate methods and technologies [Gai & Dang (2010)]. Figure 2-8 describes the conversion process from tacit knowledge to explicit knowledge, i.e. the SECI model that has been mentioned in section 2.1.

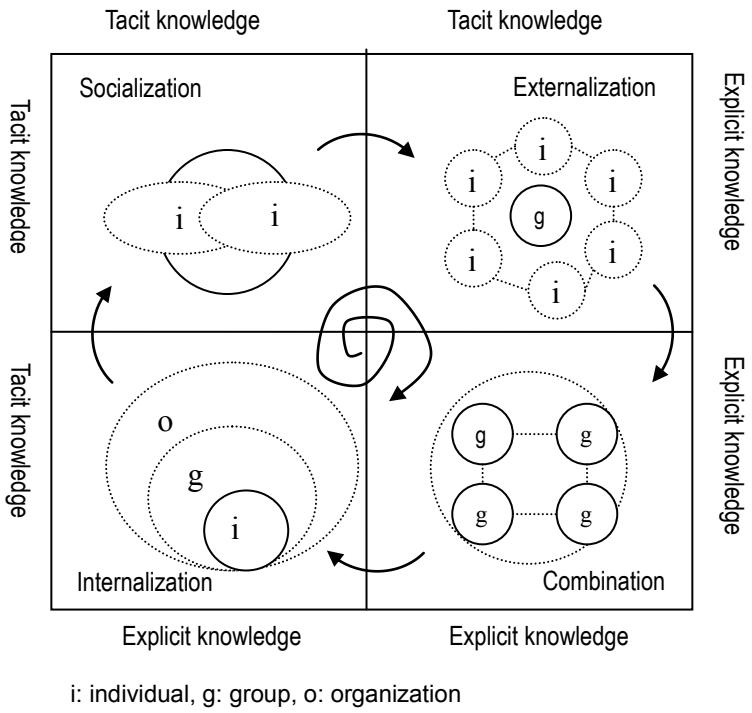

Figure 2-8 Knowledge conversion process based on SECI Modal
Source: adapted from [Nonaka et al. (2000), [Zhang (2006)]

The GPO-WM (Geschäftsprozessorientierten Wissensmanagement) model (see Figure 2-9) was developed by Fraunhofer IPK. The GPO-WM®-Method[2] combines the template-based

[2] GPO-WM is a registered trademark of Dr. Peter Heisig

GPO-WM®-Process Analysis with the GPO-WM®-Solution Base to support process teams in the integration of KM activities into daily business processes. The GPO-WM®-Framework has three layers: 1) Business process: the context and area of KM; 2) Knowledge and KM: knowledge comes from and serves the business process, while the core activities of KM are to "generate", "store", "distribute" and "apply"; 3) Enabler: organization, control, HRM, culture, leadership, and IT.

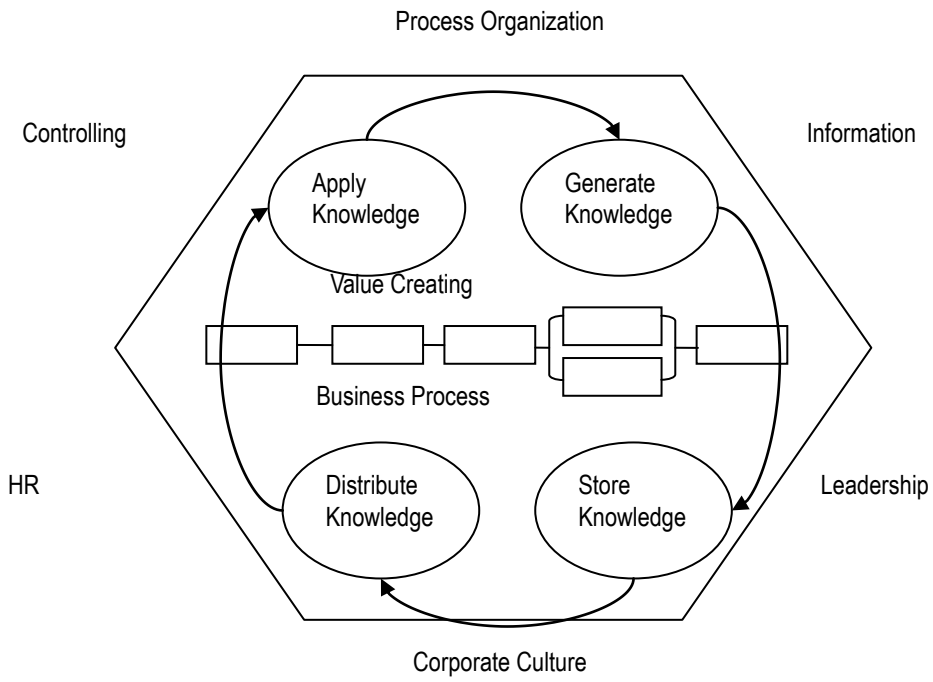

Figure 2-9 KM process and business fields

Source: [Mertins et al. (2003)]

There are some approaches that integrate KM activities into business processes. Maier and Remus [Maier & Remus (2001)] defined a PKM strategy framework and studied the implementation of PKM strategies. The InfoAtlas project developed an information system map for daily work by providing descriptions of all the information systems of an organization together with the necessary infrastructure [Telesko & Karagiannis (2000)]. A prototype system was presented in [Jablonski et al. (2001)], the knowledge base of which handled pointer references to external knowledge carriers. The knowledge carriers are arbitrary documents which might be stored in any system. A framework was proposed in [Jung et al. (2007)], which supported the lifecycle requirements of both knowledge processes and business processes by integrating existing KM systems and business process management systems.

Based on the "European guidelines for successful practice in knowledge management", Haasis et al. (2008) proposed a reference model for KM in logistics of SME (see Figure 2-10). This model illustrates subdivisions of various processes involved in KM applications: initialization, goal analysis, conception, implementation, and controlling. The KM processes have been applied in the logistics decisive fields, e.g. customer relationship and tender with case studies and KM methods. This interactive matrix model can be adapted by other logistics SMEs, according to their business processes in the KM phases.

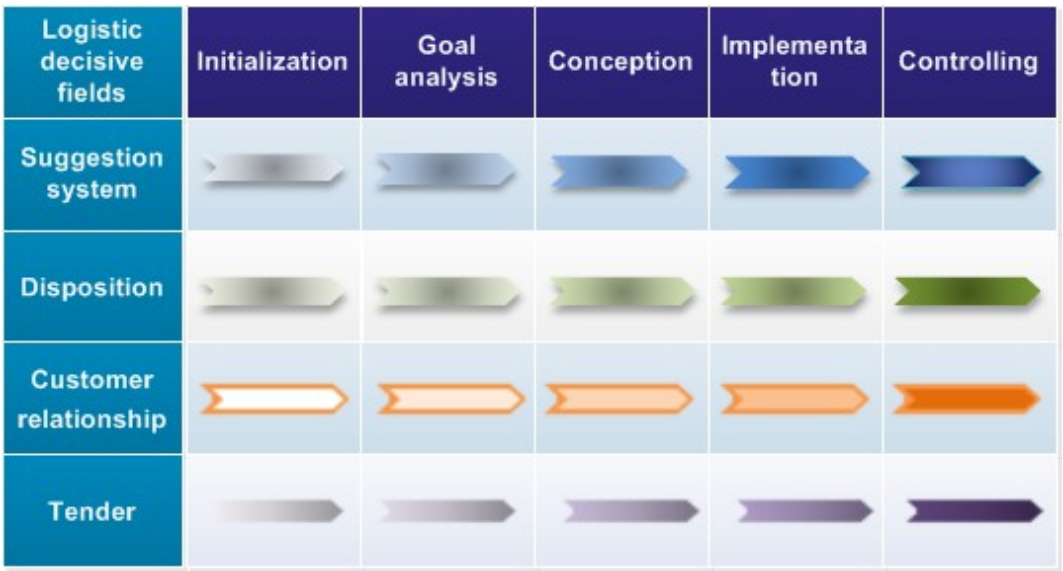

Figure 2-10 Reference model for KM in logistics

Source: [Haasis et al. (2008)]

Other approaches/frameworks include the Common KADS methodology, the business KM approach, the knowledge value chain approach, the building block approach, the model-based KM approach, and the reference-model for KM [Mertins et al. (2003)]. Table 2-7 describes and compares some examples of the various KM models and methods. However, they mainly focus on explicit and documented knowledge, due to their link to information system design. In many sectors, including logistics, the use of information technology has been central for enabling companies to reduce costs and gain efficiencies, and thus to increase their competitiveness. However, only information technology can reduce flexibility in the long term, and thus create core rigidities [Leonard-Barton (1992)].

Table 2-7 Examples of KIBPM models and methods

Model	Description	Advantages	Disadvantages
GPO-WM® Framework	Theoretical framework	Synthesis method that integrates research methods of different subjects	Lacks detailed standards of analyzing and designing business process from KM
Common KADS method	Organizational model of value process	Analyzing technology of knowledge work, promoting knowledge sharing and reusing	Lacks definite method to integrate KM into BP, does not support design of process related tacit knowledge
Business KM method	Linking KM and business target with business process based on multimedia document	Managing explicit knowledge in electronic documents	Limited in identifying unknown knowledge and improving existing knowledge
KM method based on model	Considering existing process from a new perspective, especially for building models in knowledge-intensive process	Classifying knowledge	Lacks definite method to integrate KM into BP, and to analyze standard of process knowledge
PROMOTE method system	Builds model for knowledge process, and integrates it with BP, and defines knowledge structure	Designing knowledge distribution map	Lacks analysis standard for knowledge and process design, lacks definition of BP and knowledge, no explanation of knowledge influence on process
Construction of module	Modules for KM: knowledge identification, obtaining, developing, sharing, utilizing, keeping and assessing	Uses pictograph to record tacit knowledge	Does not include leadership, culture, technology systematicness, does not mention integration of construction module into BP
Wiig's module construction concept	Proposes module instance of knowledge creation and spread	Synthesis method that integrates research methods of different subjects	Does not state the key elements in business of modeling and knowledge process

Source: extended from [Zhang et al. (2008)]

2.4 Third party logistics (3PL)

Third party logistics is referred to as 3PL, TPL or integrated logistics, also known as the logistics outsourcing ([Knemeyer et al. (2003), MALTZ & Ellram (1997), Razzaque & Sheng (1998)]) , logistics alliances ([Bowersox et al. (1990), Bagchi & Virum (1996), Andersson (1995)]), logistics partnerships ([La Londe & Cooper (1989), Andersson (1997a)]), contract distribution ([Wilson & Fathers (1989)]) and contract logistics ([Kearney (1995)]).

2.4.1 Emergence and development

The relationship between the buyer and seller of logistics functions ranges that of single transaction to integrated service agreements (Figure 2-11). The traditional relationship between buyer and seller in the transport market focused on single transactions. Agreements were normally short term and informal and carried no commitment except

the specific transaction. The price was the main leverage [Bowersox et al. (1990)]. Modern cooperation (i.e. strategic alliances) has more formal agreements and the mutual obligations have increased.

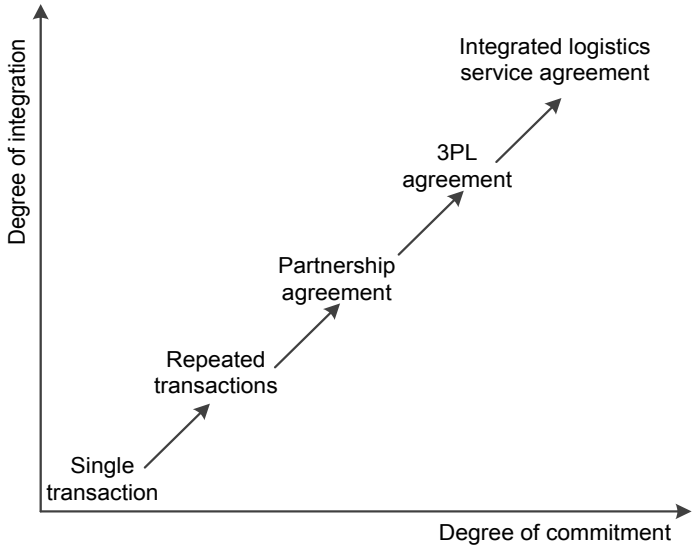

Figure 2-11 Relationships between shipper and 3PL provider

Source: [Rogers & Wardlow (1989)]

There have been three waves of 3PL industry development [Berglund et al. (1999)].The first wave took place during the 1980s when the traditional transport firms developed into TPL. During the second wave, since the early 1990s, firms such as TNT, DHL, FedEx, etc., entered the market. In the last and present wave, the emerging players are consultants and financial and/or IT management firms such as Anderson Consulting, and GE capital.

Two underlying driving forces for the development of 3PL business were international competition and the outsourcing of noncore business [Hertz & Alfredsson (2003)]. The reasons for logistics outsourcing are: financial/cost, technology, resource management, management skills and personnel [Sebastian (2008)]. More specifically, the reasons and advantages include cost reduction, service improvement, buyer focus on core competencies, asset reduction, headcount reduction, the complexities of global trade, increased flexibility, and technological improvement [Maloni & Carter (2006)].

Compared with other logistics services and related market segments, the 3PL business is highly value-added [Hertz & Alfredsson (2003)]. Figure 2-12 shows the segmentation of logistics service providers according to their business focus.

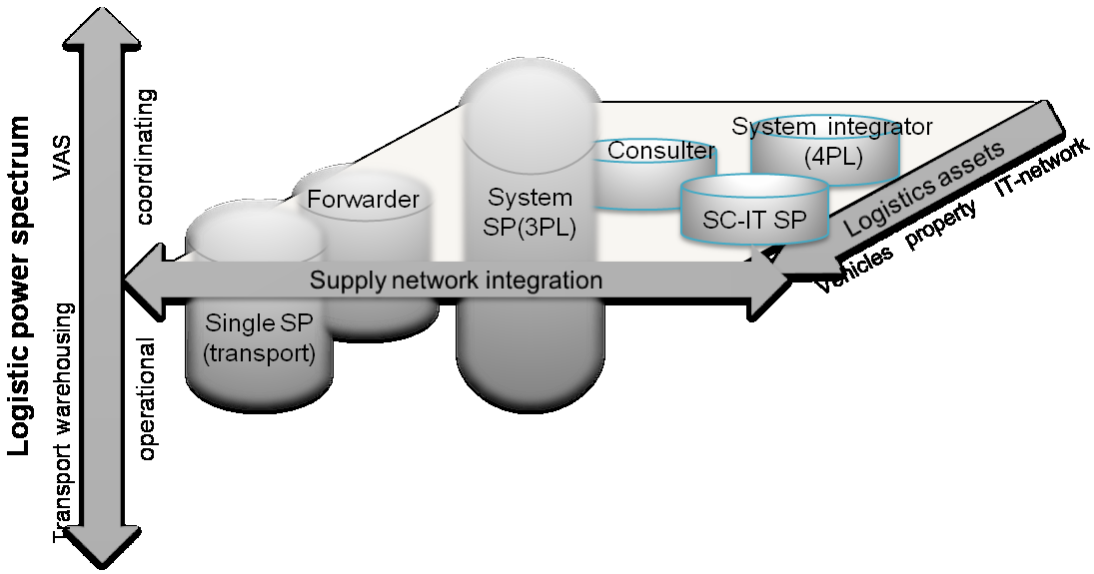

Figure 2-12 Segments of logistics service providers
Source: [Zadek et al. (2004)]

2.4.2 Definition of 3PL

The concept of 3PL originates from outsourcing in management. Outsourcing is widely regarded as a useful approach to lowering costs and gaining competitive advantage [Razzaque & Sheng (1998)]. In order to focus on core business and competencies, companies dynamically allocate their own and other companies' functions & services, which serves internal production and operation by using external resources. They contract out some logistics activities that were previously operated by themselves to other professional LSPs. Meanwhile, they keep in close contact with these LSPs via information systems in order to control the logistics process. Outsourcing logistics activities is a growing trend in a wide variety of industrial sectors [Intelligence (2004)].

There are both broad and narrow definitions of 3PL in the literature. Lieb (1992) stated that 3PL involves "*the use of external companies to perform logistics functions that have traditionally been performed within an organization. The functions performed by the third party can encompass the entire logistics process or selected activities within that process* (p.29)". Examples can be a company which employs external transporters with its own transport facilities, or a company which uses an external warehouse instead of its own [Skjoett-Larsen (2000)]. Africk and Calkins defined 3PL as '*a relationship between a shipper and third party which, compared with basic services, has more customized offerings, encompasses a broader number of service functions and is characterized by a*

longer-term, more mutually beneficial relationship' ([Africk & CALKINS (1994)]). Based on interviews with northern European 3PL service providers, Bagchi and Virum (Bag1996_93) stated that the logistics alliance indicates a close and long-term relationship between a customer and a provider encompassing the delivery of various logistics needs. The partners collaborate in understanding and defining the customer's logistics needs, including designing and developing logistics solutions and measuring performance.

The narrower definitions of 3PL link the 3PL concept to some distinctive functional and/or inter-organizational features of the logistics outsourcing relationship. Berglund et al. [Berglund et al. (1999)] pointed out that 3PLs "*are activities carried out by a logistics service provider on behalf of a shipper and consisting of at least management and execution of transportation and warehousing. In addition, other activities can be included, for example inventory management, information related activities, such as tracking and tracing, value added activities, such as secondary assembly and installation of products, or even supply chain management. Also, the contract is required to contain some management, analytical or design activities, and the length of the co-operation between shipper and provider to be at least one year, to distinguish third party logistics from traditional "arm's length" sourcing of transportation and/or warehousing* (p.59)". Murphy and Poist [Murphy & Poist (1998)] stress the duration and win–win nature of the relationship along with the customization and broader range of logistics services in the arrangement: 3PL involves "*a relationship between a shipper and third party, which, compared with basic services, has more customized offerings, encompasses a broader number of service functions and is characterized by a longer term, more mutually beneficial relationship* (p. 26)". Bask [Bask (2001)] defined 3PL as "*relationships between interfaces in the supply chains and third-party logistics providers, where logistics services are offered, from basic to customized ones, in a shorter or longer term relationship, with the aim of effectiveness and efficiency* (p. 474)" While most research addresses the two-way linkage between the logistics service provider and either the buyer or supplier (of the goods) [Marasco (2008)], he stated that 3PL is a set of three dyadic relationships linking seller, buyer and logistics service provider in a supply chain.

2.4.3 Logistics services provided by 3PL

The logistics services provided by 3PL include basic service and value-added service (VAS). Basic service is usually a standard task (e.g. warehousing, transport, loading and

unloading, packaging, distributing, etc.), while VAS is always innovative, individual and special. These services, for example final assembly, packaging, quality control, and information services [Skjoett-Larsen (2000)], are extended from basic services of warehousing and transport, in order to realize integrated logistics and supply chain management. The 3PL market can be divided into "consumer contract logistics and distribution", and "industrial contract logistics" [Klaus et al. (2011)]. The following Figure 2-13 gives an overview of different logistics services provided by 3PLs in the value network. These service offerings have developed over time both in terms of knowledge and technology [Hertz & Alfredsson (2003)].

Typical services outsourced to 3PL providers are transport, warehousing, inventory, value- added services, information services and design, and reengineering of the chain. The first three are the most common 3PL services and also the most common services outsourced by industrial firms [Hertz & Alfredsson (2003), Andersson (1997b)]. Some other services provided by 3PL include logistics consultancy and e-logistics management, for example transportation, warehousing, freight consolidation and distribution, product marking, labeling and packaging, inventory management, cross docking, product returns, order management, and logistics information systems [Xiao et al. (2009)].

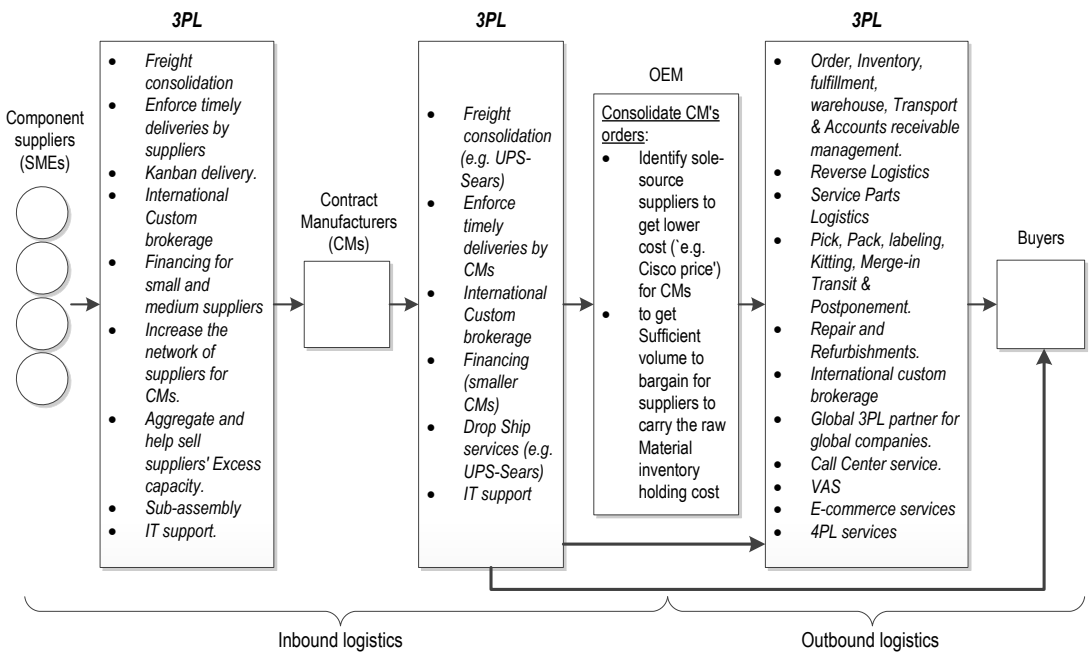

Figure 2-13 Logistics services provided by 3PL

Source: [Chew & De Graeve (2003)]

Moreover, 3PL services including design logistics systems, EDI capacity, report management, cargo consolidation, selecting carriers, freight forwarding, information management, warehousing, consulting, freight payment, and freight negotiations. 3PLs provide information services through logistics management information systems that support the integration of business processes and cooperation with partners. Examples of such information services are informing of consignment, delivering information, tracking the destination of products, providing updates on in-transit products (e.g., current transporting station and next transporting station), checking result of produces received, and level of stock [Li et al. (2006)].

Furthermore, the position of 3PL in the supply chain and basic service process can be described in the Supply Chain Operations Reference (SCOR) model (see Figure 2-14). The SCOR model is a process reference model developed by the Supply Chain Council (SCC) as the cross-industry de-facto standard diagnostic tool for supply chain management. It is a unified framework that links processes, performance metrics, best practices, and people. SCOR processes extend from the supplier's supplier to the customer's customer. They include all customer interactions from order entry through paid invoice; all product (physical material and service) transactions, including equipment, supplies, spare parts, software, etc.; and all market interactions, from understanding aggregate demand to the fulfillment of each order.

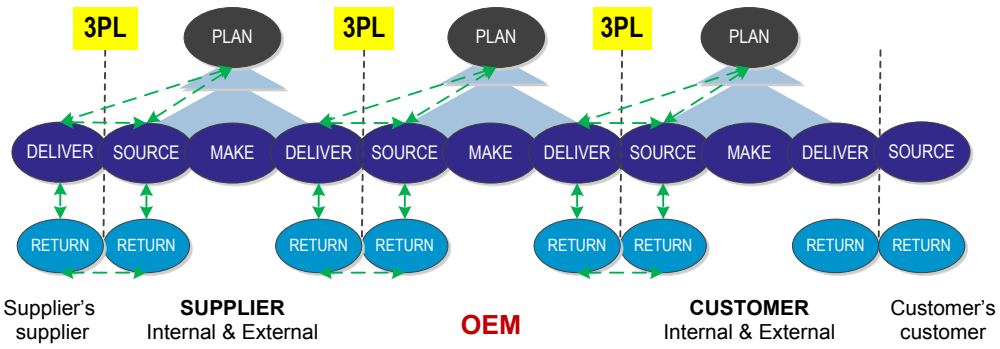

Figure 2-14 3PL in the supply chain

Source: adapted from 2010 Supply Chain Council, SCOR 10.0 [Council (2010)]

The SCOR model illustrates integration of knowledge and business processes by 3PL. The five management processes in SCOR model are plan, source, make, deliver, and return. Logistics services provided by 3PL involved in the process activities of plan, deliver, source, and return through transporting materials and transferring knowledge

between them. The position of 3PL providers in supply chain suggests that they offer either inbound or outbound logistics services for different buyers. When an OEM is requiring steel for production, it outsourced the business to a 3PL provider. The 3PL will acquire, deliver, transport the steel to the OEM according to its planed quantity, quality, time, and location. During this process, the 3PL provider needs to collect and apply various knowledge related to the required steel and all activities.

2.4.4 Characteristic of 3PL

3PL belongs to neither first party logistics (1PL) nor second party logistics (2PL). The first party is the shipper or supplier and the second party is the buyer. The third party is an external provider who manages, controls, and delivers logistics activities on behalf of a shipper [Hertz & Alfredsson (2003)]. It does not produce or sell goods, but provides professional, systematic, and individual logistics service to customers through collaboration (contract) with 1PL or 2PL.

3PL is conceived as an inter-organizational relationship between shippers and providers of logistics services in a supply chain [Marasco (2008)]. From a broad perspective, First Party Logistics (1PL) refers to the logistics activities organized by the seller, producer or supplier. The main business of these companies is producing and supplying goods, but they also need to invest in managing logistics networks and equipment, and infrastructure such as warehouses and trucks. These are used for production or sales. Second Party Logistics (2PL) are the logistics activities organized the by buyer, seller, or distribution firms, whose main business is purchasing and selling goods. They invest in logistics networks as well as logistics equipment and appliances, and operate logistics services for sales oriented businesses. This role is a kind of distributor. 3PLis a professional organization that provides logistics services to both 1PL and 2PL (Figure 2-15).

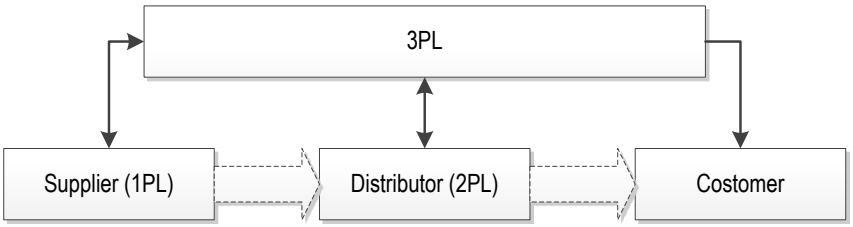

Figure 2-15 Relationship between 3PL and 1PL & 2PL (broad)

From a more narrow perspective (Figure 2-16), 1PL refers to the logistics service organized by the supplier, 2PL refers to the logistics service provided by firms that offer basic logistics services (e.g. transport, warehousing, circulation & processing), and 3PL refers to logistics services (e.g. designing, solution and operational business) provided by system logistics service providers.

Figure 2-16 Relationship between 3PL and 1PL & 2PL (narrow)

The features of 3PL include the provision of a broad range of services, a long-term duration, joint efforts to develop further cooperation, the customization of the logistics solution, and a fair sharing of benefits and risks [Marasco (2008), Skjoett-Larsen (2000)]. Logistics services provided by 3PL are usually associated with the offering of multiple, bundled services, rather than just isolated transport or warehousing functions [<Lea1995_5>]. They focus on the integrated management and execution of several logistical and (sometimes) non-logistical functions in a complex package of services [Klaus et al. (2011)]. Moreover, 3PL is experiencing new value chains, and complex networks of collaboration (e.g. party logistics networks, geographical networks of branches, projects of functional networks, intermodal logistics networks). Additionally, they always offer local service that is better for face to face meeting and communication.

Some researchers have categorized 3PL providers as focusing on either VAS and/or solutions [Andersson (1995), Christopher (1999)]. Berglund et al. [Berglund et al. (1999)], who made an extensive survey of Dutch, English, German, and Swedish 3PL firms and shippers, divided the 3PL industry into different segments based on the mission statements of 3PL firms (Figure 2-17). According to their capabilities in general problem solving and customer adaptation, Hertz and Alfredsson [Hertz & Alfredsson (2003)] classified 3PL service providers into four types: standard 3PL providers, service developers, customer adapters, and customer developers.

	Service	Solution	Examples
VAS	Value leader in global integrated logistics services for durable consumer goods	Provide consultative logistics solutions	Order processing kitting, repair / recycle, network design, inventory management
Basic service	Supporting companies in being more competitive	Provide complex 3PL solutions	Transport, warehousing, consolidation, labeling
Customer value proposition	Specific competitive service at low cost	Customized comprehensive offering at competitive cost	
Customers	-Many -Logistics is core -Standard concepts -Multiple sources	-Few, large -Logistics is non-core, -Complex situations, -Single sourcing	
Advantages	Focus, sharing, scale	-Complexity management subcontracting skills	
Examples	Less-than-truckload (LTL), express package/ freight, spare parts	Ambient food distribution European distribution centers (EDCs)	

Figure 2-17 Segmentation of 3PL industry

Source: [Berglund et al. (1999)]

2.4.5 KM in logistics and 3PL

Knowledge is a key strategic resource in complex and logistics supply chains. Today's logistics processes and systems are characterized by an increasing complexity and by the need for global networking to cope with the growing diversity of logistics problems [Neumann & Tomé (2006b)]. An enhanced ability to respond to a customer's needs, an increased learning capacity, as well as increased skills and knowledge in cutting-edge products and innovative solutions to problems, would ultimately improve the speed, quality, cost, and flexibility of logistics service [Neumann & Tomé (2006b)].

Prof. Pawlowsky and his team [Pawlowsky (2011)] have conducted a huge nationwide company survey (2010/11) on behalf of the Federal Ministry of Economics in order to capture the status quo of KM activities within the German economy. They acquired data from 3401 enterprises, with 225 (6.1%) samples being logistics service providers (Verkehr und Lagerei). The potential influencing factors of KM on business are company size, market dynamics and challenges, business strategy and competency, and management structure. They discussed possible measures and the most often used approaches of knowledge identification, diffusion, storage and application in industry.

It is important for success in business to apply KM in logistics and SCM [Su et al. (2010)]. Only discovering, excavating and sharing the knowledge in the supply chain can

improve the efficiency of the exchange of personnel and the information [Xu & Ma (2010)]. Current research on KM in logistics has discussed the importance of knowledge and KM in logistics ([Hult et al. (2003), Neumann & Tomé (2006a), Neumann & Tomé (2006b), Xu & Ma (2010)]), the relation between KM and logistics ([Neumann & Tomé (2005)]), the effect of KM in logistics ([Neumann & Tomé (2009), Cong & Gao (2010), Neumann & Tomé (2011)]) and techniques and technologies needed to apply KM in logistics ([Wang & Liu (2010), Wilk & Inteligencji (n.d.)]). There are, however, very few studies focusing on KM in 3PL ([Wu et al. (2007), Rajesh et al. (2011)]). Table 2-8 lists some ideas and findings of KM in logistics.

Table 2-8 Main findings of KM in logistics

Topic	Ideas and findings
Importance of knowledge and KM in logistics	Business processes related to integrated logistical services are much more complex and knowledge intensive than traditional single services, which requires the implementation of new management systems and the use of KM techniques within logistics service providers [Haasis (2008)].
	Knowledge in cutting-edge products and innovative solutions to problems, would ultimately improve the speed, quality, cost, and flexibility of logistics service ([Neumann & Tomé (2006b)]).
	Organizational memory-members' explicit as well as tacit knowledge about supply chain activities is a key element of the knowledge base ([Hult et al. (2003)]).
	Knowledge and KM was considered extremely important [Neumann & Tomé (2006a)].
	With the rapid development of information and communications technology, KM has increasingly become the "central nervous system" of modern logistics and SCM, which controls logistics integration and resource utilization [Wang & Liu (2010)].
	KM should be a supporting service addressing people, technology and organization [Neumann & Düring (2008)].
KM effect in logistics	Impact of KM on development of logistics enterprises: 1) regulating logistics knowledge; 2) finding and forming a business value chain to carry out differentiated competition; 3) strengthening both internal and external contacts to smooth the exchange of information; 4) optimizing logistics solutions to improve decision-making ability; 5) protecting the environment and promoting the development of green logistics ([Xu & Ma (2010)]).
	Effect of KM on logistics performance: 1) knowledge protection can help firms maximize competitive advantage and successfully compete despite limited knowledge resources; 2) knowledge acquisition enhances staff capabilities and cost-efficiency; 3) KM practices improve employees' performance and job satisfaction. Possible approaches are a bonus plan for knowledge innovation, incentive mechanisms, and person orientation ([Cong (2010)]).

	Knowledge as an important resource in logistics needs to be identified and actively dealing with the content [Haasis (2001), Haasis & Kriwald (2001)]
KM strategies in logistics	KM strategies for improving logistics performance, customer satisfaction, and sustainable growth: strengthen KM; build a positive atmosphere of motivating people in the business process; regard the customer as principal and employees as capital; adopt advanced technology and establish knowledge networks for reacting promptly in a dynamic competitive environment and hence improving organizational core competency [Cong (2010)].
	KM strategies for improving logistics competency: 1) applying information databases and systems to build a knowledge base for SC managers with decision support; 2) building a knowledge network to achieve the sharing of internal and external knowledge exchanges; 3) an emphasis on motivation; 4) changing the organizational structure and establishing a department of KM; 5) enhancing awareness of the law and respecting intellectual property rights ([Xu & Ma (2010)]).
KM techniques in logistics	Applying AI in SCM systems. Programs and tools need to adapt particular IT systems to SCM needs, and lead to improving logistic systems and maximizing effectiveness. ([Wilk & Inteligencji (n.d.)]).
	The construction and implementation of a knowledge map (a novel visualized KM tool) is an effective way to achieve a win-win scenario in the logistics supply chain network ([Wang & Liu (2010)]).
	The grid technology based logistic KM model is based on web services and grid services. Knowledge acquisition methods include manual and automatic methods as well as the existing intelligent knowledge processing methods, such as neural networks, genetic algorithms, fuzzy logic, and expert systems. The neural network technology is conducive to knowledge acquisition and classification in logistics. The customer need oriented logistics knowledge mining model based on filtration technology is conducive to a high degree of resource sharing and efficiency. Grid technology can achieve full connectivity of network resources, eliminate information silos, and provide mechanisms for sharing, coordinating and unifying various resources ([Su et al. (2010)]).

The essence of KM in logistics enterprises is to coordinate knowledge, market competition, management strategy, technology, organization, and people to serve organizational development. Enterprises participating in the supply chain must integrate and share not only general information, but also enterprise knowledge so as to realize the optimization of the supply chain in the network environment [Xu & Ma (2010)].

Neumann has studied on KM and logistics for years. Neumann and Tomé [Neumann & Tomé (2005)] conducted a comparative study of German and Portuguese logistics companies to study the implementation (e.g. role, need, priority, investment) of KM in companies, as well as to evaluate the impact of KM investments on logistics performance (with the equation $Y=aX+bKM+e$). They found that there was still a gap between theory

and practice. The biggest investments were in self-training, innovation practices, participation in conferences and workshops, participation in external knowledge sharing networks, and the establishment of internal knowledge sharing networks [Neumann & Tomé (2006a), Neumann & Tomé (2006b)].

Moreover, Neumann [Neumann (2006)] applies a KM perspective to logistics simulation projects and introduced a method for continuous knowledge documentation. This approach aims to enable people in a simulation project to act properly as knowledge stakeholders and knowledge users. It is used for acquisition and storage of knowledge about the structure and organization of logistics systems as well as processes, i.e. running, maintaining or re-designing. The vision of an automatically generated simulation project report is developed at the end [Neumann (2006)]. Further, a conceptual framework for KM support in logistics and supply chain simulations was proposed. The study relates logistics and supply chain modeling and simulation to knowledge flow analysis and KM methodology [Neumann (2007)].

Recently, Neumann studied KM within logistics problem-solving processes (logistics simulation projects), which requires a highly experienced problem-solving individual. An intelligent human-computer dialogue is required for accessing this knowledge that contributes to problem solving [Neumann (2011)].

In addition, Neumann [Neumann & Tomé (2011)] discussed the changing role of knowledge in companies and investigated how knowledge-based change processes in companies need to be launched. A methodological framework was proposed to help companies identify the needs for change and integration in processes, as well as selecting technology and systems, managing human resources, or changing the organization.

The topic of implementing KM in logistics has been increasingly discussed in the literature and applied in practice in the past few years, however, there are only a few discussions linking and focusing on KM and 3PL. [Wu et al. (2007)] Wu et al [Wu et al. (2007)] studied KM in 3PL regarding knowledge type, KM system structure and strategies. Knowledge in 3PL includes three levels: the operational level (e.g. warehousing, distribution, documentation), management level (e.g. personnel, vehicles, goods, CRM) and strategic level (e.g. concept, structure, competency). KM in 3PL includes the following four phases: collection, classification, storage, and application. The KMS model

is based on information system infrastructure and the network service platform, and combines business activities (knowledge content) with KM activities, as well as approaches (e.g. documentation, knowledge base, online learning, knowledge community).

Rajesh et al [Rajesh et al. (2011)] developed a generic taxonomy components framework (GTCF) for the implementation of KM solutions by 3PL service providers. They classified knowledge into two levels: corporate-related knowledge (objective, policy and strategies) and operation-related knowledge (details of business tasks or processes and used for decision making and problem solving). The main components of the GTCF model are: transportation, facility structure, human resources, information and communication, tender details, agreement details, quality control, and customer service ([Rajesh et al. (2011)]).GTCF can be a base and a devise according to the needs for implementing KM solutions in 3PL.

2.5 Summary and definition of terms

This chapter introduces the basic concepts and state of the art of knowledge, KM, business process, business process oriented KM, and 3PL. In particular, it defines process knowledge, presents KIBPM at the strategic and operational levels as well as KIBPM models and methods, and finally discusses KM and 3PL. In the course of this literature review, little research linking KIBPM and 3PL has been found; this is the research gap which this work sets out to fill. The possibility, necessity of, and mechanisms for applying KIBPM in 3PL will be discussed in the following chapters.

According to different bases (or orientations), knowledge can be classified in different ways. Table 2-8 gives some examples of knowledge types. Basically, knowledge can be divided into explicit knowledge and tacit (or implicit) knowledge. Furthermore, tacit knowledge has two component categories: tacit knowledge that it is possible to transfer, and tacit knowledge that it is impossible to transfer under current conditions, or communicable and non-communicable knowledge--codable and non-codable knowledge in other words. In particular, knowledge with respect to business processes generally includes knowledge about the process, knowledge within the process, and knowledge derived from the process.

Table 2-10 Knowledge classification

Basis	Knowledge classification
Form	explicit, tacit (implicit)
Source	internal, external
Unit	individual, group, organizational, inter-organizational
Type	know-what, know-how, know-who, know-why, know-where, know-when
Domain	market, customer, partner, product, norms, standards, rules, organization, methods
Level	data, information, knowledge, meta-knowledge, wisdom
Process	knowledge about the process, knowledge within the process, knowledge derived from the process
Competency	core knowledge, advanced knowledge, innovative knowledge
Life cycle	existing / new knowledge
Organization	strategic / operational knowledge, public/confidential knowledge

Source: extended from [Boppert, 2008;Maier & Remus 2002]

The development of knowledge and KM are driven by technology, people, organizations, and processes, though the people factor plays a more critical role. People determine fundamentally the quality of knowledge and KM in an organization. Core KM activities include generation, storage, distribution, and application. The theoretical and practical challenge is to effectively transform tacit knowledge in people's minds into explicit knowledge in organization memory. However, there are more theoretical discussions and practical activities focusing on the technology factor, explicit KM, and knowledge storage systems. Moreover, there is little link between KM and 3PL, which requires effective and efficient KM in the business processes. Therefore, this work will study the application of KIBPM in 3PL from both the theoretical perspective and the practical perspective (case study), emphasize tacit knowledge sharing and transfer with incentive measures, and highlight the dynamic and network characteristics of KM in 3PL.

The main terms that are used in this work are defined as follows:

Knowledge: Knowledge is information from multiple domains that has been synthesized through inference or deduction into new meaning or understanding. [Prusak (2001)]. Knowledge is the summary of humanity's understanding about nature, society, mental phenomenon and experience gained from practice. Knowledge can be statically regarded as product and be dynamically generated, transferred and used. It is mental phenomenon and human's most important achievement. [Wang et al. (2001)]. In logistics, it comes from logicians' experience, ideas, insights, methods and know-how in business processes.

KM: KM embodies organizational processes that seek a synergistic combination of data

and information processing capacity within information technologies, and the creative and innovative capacity of human beings [Malhotra (2005)]. KM embodies organizational processes that support knowledge sharing, acquisition, creation, storage, transfer, transformation, distribution, application, and retention by merging organizations and people with technology. KM in logistics consists of five rights: providing the right knowledge to the right people at the right time in the right place with the right context. It includes five main activities: knowledge procurement, knowledge production, knowledge warehousing, knowledge distribution, and knowledge application.

BPM: Business process management is a management approach focused on aligning all aspects of an organization with the wants and needs of clients. It promotes business effectiveness and efficiency while striving for innovation, flexibility, and integration with technology [Smart et al. (2008)].

KIBPM: KIBPM is based on models of dynamic change within organizations and administrations [Abecker et al. (2002)]. In order to provide knowledge for value adding activities within business processes KM instruments and KM systems have to be adapted to business and knowledge processes [Remus & Schub (2003)]. KIBPM is the adaption/application of KM instruments & systems to business processes. PKM initiatives are aimed at providing employees with task-related knowledge in the business process. On the one hand, they integrate KM into real contexts so that KM practices are more effective. On the other hand, they incentivize people to share knowledge in daily work so that KM activities are more efficient.

*3PL:*A third-party logistics provider is a firm that provides its customers with outsourced (or "third party") logistics services for part or all of their supply chain management functions. Logistics services, are performed in specialized systems for industrial and consumer goods production or retail, including complete systems for spare parts such as, among others, for automobile or electrical equipment industries [Klaus et al. (2011)].

Dynamic capabilities: Dynamic capabilities refer to the firm’s ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments [Teece et al. (1997)].

3 Applying KIBPM in 3PL: theoretical analysis

Logistics enterprises face high degree of standard operational process, intense competitive market and dynamic customer demands, thus they must face and adapt to the situation with competitive advantage [Wu et al. (2007)]. In the process of commodity circulation, 3PL plays an intermediary role of integrating the flow of logistics, capital, and information [Wu et al. (2007)]. Today, there is also one more knowledge flow in the value chain that we should pay attention to.

The quality of the logistics services and success of the logistics activities strongly depend on the knowledge, skills and abilities of people that design or operate the logistics systems and processes [Neumann (2006)]. In order to learn from previous experience, lessons, and expert knowledge, to identify and find the right knowledge at the right time, and to better solve problems and make innovative decisions, KM aims to enhance organizational quality and organizational performance [Wilcox King & Zeithaml (2003)] [Ahn & Chang (2004)]. KM in logistics is to help employees identify, classify, summarize and innovate organizational knowledge, encourage employees to exchange and apply knowledge, develop appropriate management techniques and help improve the organizational structure, profit, as well as to spur value creation [Wu et al. (2007)].

Effective KM in logistics enterprises has the following advantages. First, it enhances the adaptation capabilities and flexibilities of an enterprise to the competitive environment of the market. KM helps enterprises learn new knowledge of the market, maintain the market dynamic, and adjust directions and strategies. Second, it supports decision making and shortens the operation time. Application of KMS can automatically and promptly choose the optimal plan for customer needs and support employees finding solutions in a short time. Third, it can optimize resource allocation, improve customer service, and lower costs. KM establishes a knowledge interaction system with customers, which can strengthen two-way communication internally and externally. Furthermore, effective management of knowledge allows proper sharing of knowledge between the organization and its business partners and suppliers [Choy et al. (2006)].

However, KM is not and should not be static. According to Moore's Law, the number of transistors on a chip roughly doubles every 18 months, while the accumulation and innovation of knowledge is even faster. As a tangible asset, knowledge will also devalue

with the passage of time. Since the obsolescence of knowledge is unavoidable and rapid, it is necessary to update and modify current KM schemes and application in a timely manner. In addition, KM strategies and plans are quite different for different enterprises or development stages within the same enterprise. The management of knowledge must be dynamic and meet the changing requirements of the market, organizational objectives, and the needs of customers, suppliers and employees.

Recently a new concept and method of KM has been discussed in academia: process-oriented KM (PKM). This study defines it as "knowledge integrated business process management" (KIBPM). KIBPM integrates KM and BPM so that KM can better serve business processes, since business processes provide knowledge demand as well as the context for applying knowledge.

3.1 Application potential

3.1.1 Issues of KIBPM application in 3PL

In today's knowledge era, to keep a sustainable competitive advantage in the dynamic environment knowledge has been a strategic resource and asset for logistics service providers. With the latest knowledge of the market and industry, and professional knowledge of providing logistics solutions to customers, 3PL enterprises can keep their core competencies and achieve long term success. Knowledge is created and utilized during the execution of business processes. Knowledge should be attached to tasks executed, and participants must capture knowledge as part of their normal work to enable better performance [Han et al. (2008)]. APQC (2008) PCF points out that knowledge processes have been gradually integrated into business processes.

However, most of the valuable knowledge exists in people's brains. If this knowledge is not shared, transferred, and stored in the organization, it will be a great loss when people move, due to, for example, turnover or retirement. This knowledge loss is damaging to the future work and training of new employees. Management of talent and their knowledge is critical for success in the supply chain and in shipper-3PL relationships [Terry (2012)].

It is promising that more and more companies, including logistics service providers, have realized the importance of KM, and that they have started some projects and adopted various systems. Nevertheless, many of them have failed. One of the problems is that

people are too busy with work and have no time to share and store their knowledge. A truck driver, for example, is so busy with transporting goods to different places that he is only able to deliver the instance knowledge of the progress, but has no time to input new findings in the KMS.

Moreover, even some people have time to share and document their knowledge while working, they have no willingness or motivation to do. Some of them may be lazy about sharing knowledge, some may believe it will lose their position if others learnt from them, and some may be afraid of additional responsibility due to improper knowledge sharing.

Additionally, many KM projects are so strategic and general that they lack the requisite context and tangibility for application. Since there are always many different departments in a company, all with different objectives and work activities, a general KM project cannot attempt to serve all without losing its orientation and direction.

Last but not least, KM in many organizations puts more effort into information or explicit knowledge storage. They have used advanced systems to store all kinds of knowledge, but it is difficult to find the relevant knowledge when it is needed, or the related knowledge is out of date and cannot be useful to solve new problems.

3.1.2 Advantages of business process orientation

A major portion of organizational activity (exceeding 90% in some cases) can be described in terms of processes [Amaravadi & Lee (2005)]. Processes are a collection of series of related activities undertaken together to accomplish a goal or task. The types of process are: simple and highly complex processes, as well as management, core and service processes [Maier & Remus (2001)]. A process is a knowledge carrier, producer and user [Yu (2011)]. Knowledge is created within the processes and shared with other business processes [Maier & Remus (2001)]. Process knowledge is essential for training employees, establishing standards and communicating best practices within the organization [Amaravadi & Lee (2005)]. Instruction in working processes is a kind of representation of process knowledge, which is helpful for training employees to learn, practice and improve business processes.

Integrating KM into business processes has great potential from the perspective of analysis and planning, as they have a similar process: strategy, design, and implementation

[Abecker et al. (2002)]. Process orientation can offer guidance for KM implementation, organize knowledge scattered across multiple kinds of activities, solve the demand for knowledge at the micro level of the process, supply knowledge to those who need it most, and support process implementation [Yu (2011)]. The business process context also provides an assessment framework that makes it easier to evaluate the impact of KM efforts in improving business process performance [Raghu & Vinze (2007)]. The process of warehousing management, for example, requires knowledge about the procedure, know-how, and experience, and it generates the relevant knowledge in practice, which will contribute to knowledge distribution, storage, and application as well as KM performance assessment.

Business processes are strongly oriented towards customer needs and other external determinants. The perspective of KIBPM combines the RBV and the market-oriented view. The resource-based view is the main focus of KM, but it has the shortcoming of core rigidity (meaning that an organization does not consider market-oriented factors, like new business fields, customer groups, or new competitors, and therefore might lose competitiveness). The market-oriented view, on the other hand, is implicitly brought about by process orientation [Maier & Remus (2001)], and it helps to avoid core rigidity. Process integration considers market dynamics, not only the existing resources, including knowledge. When the customer needs change, old knowledge cannot help, but can only reduce competence, therefore, the logisticians should update knowledge and respond promptly, so that the service can better meet new requirements.

The process orientation of KM highlights the combination of KM and process. It analyzes the production, sharing and application of knowledge from the start of the process activity. It will also promote the efficiency and value of processes [Yu (2011)]. Moreover, process orientation contributes to process controlling, as well as to designing and introducing KMS [Maier & Remus (2001)]. In contract logistics, a feasible plan at the beginning is critical, and is the product of various types of knowledge consisting of customer needs, market price, and own capacity, among others.

Process orientation enables tailoring of KM to organizational realities (context), tracing knowledge flow along with the value chain, aiding navigation of existing information systems, and in particular facilitating easy access to and application of the knowledge

resource for daily work [Gai & Dang (2010)] [Maier & Remus (2001)]. Projects are the most important business processes. Reporting at the beginning and debriefing at the end are the products of KM [Beraha (2006)].

3.1.3 Potential benefits of KIBPM

The objectives of KIBPM are to provide employees with task-related knowledge in the organization's operative business processes [Maier & Remus (2001)], improve process performance, promote core competence [Zhang et al. (2008)], and maximize and optimize business performance [Han et al. (2008)]. Since 3PL services are quite knowledge and process oriented, there are some potential benefits to applying KIBPM in 3PL.

- *Enhanced ability to adapt to the external environment*

KIBPM can not only support improvement of the internal business process, but also contributes to better adaptability to the external environment. In the business process of a project or transport, it is very important to know the dynamics of the market, the information of existing and potential competitors, the real demands of customers, and the latest regulations and laws for industry. When business processes are running with the necessary knowledge, the organization will gain more competence, which allow them to better adapt to the dynamic environment.

- *Rational allocation of resources*

With the application of KM and KMS, 3PL enterprises connect the interspersed logistics facilities and resources that belong to different systems through virtual enterprise according to the demand of goods and supply characteristics. Through scientific planning and restructuring, logistics enterprises can make good use of facilities advantages, and improve service functions [Wu et al. (2007)].

- *Intelligent logistics strengthened*

KIBPM is present throughout the whole business process. KMS can quickly transfer customers' requirements to the responsible person, which will contribute to timely and flexible logistics services. With KM application, the information of customer needs, and supply information can be searched through knowledge network. For example, each

standard product is coded not only the type, specification, material, and technical requirement, but also the delivery time, route, progress. Customers can find the price and amount of their needed products, then the knowledge network makes a distribution plan and calculate the logistics cost in a short time.

- *Daily work fulfillment*

During daily work, such as transporting goods from Bremen to Munich, when drivers have the right knowledge about customers' required location, the route, weather, time, and products, and they transfer the real time knowledge about the transport to the company as well as customer, the service can be fulfilled on time with high quality.

- *Project completion*

For a project, such as building a warehouse in Hamburg for Aerospace, the process from planning, through implementation to operation, needs professional knowledge about the customer's industry, customer demand, market price, company resources, technology, construction, and so on. With the knowledge acquired from past projects and new knowledge from communication as well as practice, the project will be completed smoothly.

- *Logistics service improvement (value creation, flexibility and innovation)*

Prior logistics service provides both good experience and some problems, which are valuable knowledge for improving future service. When a logistician proposes a new idea for calculating price, or a customer confronts a new problem, or a truck driver finds a better way to reduce waiting time, they will contribute to improved logistics service and make the service more efficient, flexible, and innovative.

- *Business process continuous improvement*

The continuous improvement of the business process is a journey of "Plan-Do-Check-Act", which is also a knowledge management process. Knowledge in the business process is acquired, produced, stored, distributed, and applied in each step.

- *Cost reduction (time, finance)*

KIBPM can also contribute to cost reduction, as it saves time when the logicians prepare the right knowledge in advance and make decision according to dynamic knowledge, thus ensuring that the service will be more efficient. On the other hand, good KM can avoid repetition of the same problems and mistakes, which will reduce financial cost.

- *Organization learning and sustainable competitive advantage (talent/expert retention)*

The fundamental potential of KIBPM is its impact on organizational learning and sustainable competitive advantage. When people involve themselves more in KM, they make a greater contribution to organizational knowledge and learning capability, thus organizations can sustain long-term core competency.

3.2 Application proposal

KM has been widely discussed both in academia and industry. How to make KM create value in business is a crucial issue. This study introduces and applies KIBPM in 3PL enterprises, proposing a new way to improve business processes and logistics services. KIBPM considers the process to be the context of KM, wherein knowledge is required, transferred, and applied in business process.

3.2.1 Practical significance

3PL has been developing greatly during the past years and has increasingly become a powerful alternative to the traditional, vertically-integrated firm [Rabinovich et al. (1999)]. Traditional value chains in logistics include the flows of materials, capital, and information. Actually knowledge flow is another value chain alongside the material flow, and KM in logistics covers knowledge acquisition, knowledge production, knowledge warehousing, knowledge distribution, and knowledge application. Knowledge sharing and transport play very importance roles in KM. Figure 3-1 shows the knowledge flow between OEM, 3PL, and customers.

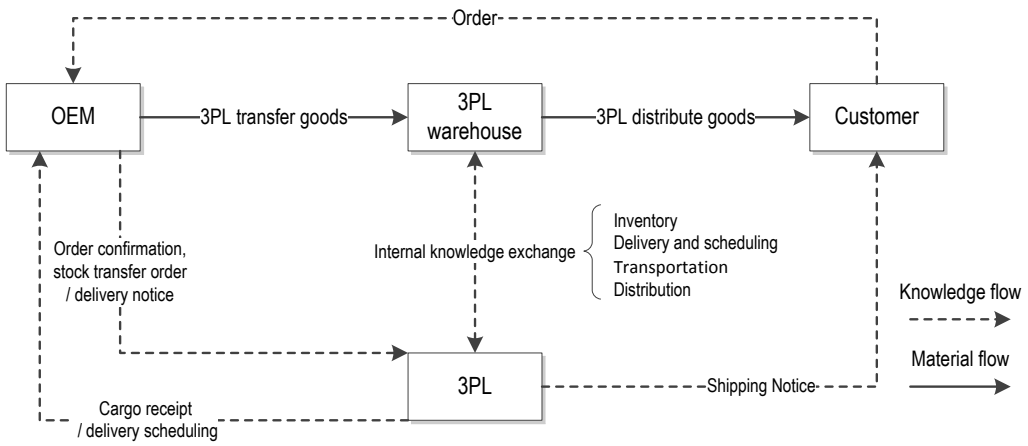

Figure 3-1 Knowledge flow between OEM, 3PL, and customer
Source: adapted from [Liu & Sun (2011)]

Knowledge and KM have become strategic tools for retaining sustainable competitive advantage. On the one hand, LSPs need more knowledge about environment, technology, customers, competitors, and partners, so that they can better adapt to the changes in the hypercompetitive market, survive among existing and potential competitors, collaborate with partners, and offer innovative services to meet customer requirements. On the other hand, the development of 3PL has also produced various knowledge about problems and business solutions outside and inside the organization, which are valuable for the smooth operation and improvement of logistics service, training new employees, promoting innovative solutions, and forming greater competency.

KM has been widely accepted and KM projects have been launched in many organizations. The results of KM practice indicate that some problems have arisen, such as “lack of context and reality”, “over focus on technology”, “overlooking the dynamic nature of knowledge”, “no motivation to share knowledge” or “limitation to internal knowledge”, among others . Nowadays a popular trend is to integrate KM in business processes. Process orientation considers the dynamic nature of knowledge and knowledge flow, instead of only the static entity. This will avoid the failure of KM due to an absence of context. KIBPM promises to solve the practical problems.

The logistics service offered by 3PL is always more process oriented than function oriented. Business processes in 3PL are dynamic and knowledge intensive. They must quickly respond to changes of the market, customers’ needs, and technology, as well as efficiently manage knowledge and make correct decisions regarding new questions. Knowledge is a

critical factor for logistics services. It can promote the creation of new knowledge and value for both the customers and LSPs. Therefore, it is necessary to apply KIBPM in 3PL enterprises and find an effective way to realize it.

3.2.2 Theoretical importance

KIBPM emerged as a new theory fifteen years ago and has been increasingly explored in the last decade ([Kwan (1999), Maurer & Holz (1999), Heisig (2001), Jablonski et al. (2001), Maier & Remus (2001), Maier & Remus (2002), Maier & Remus (2003), Remus & Lehner (2000), Remus & Schub (2003), Kwan et al. (2003), Woitsch & Karagiannis (2005), Beraha (2006), Han et al. (2008), Han & Park (2009)], [Gai & Dang (2010)], [Yu (2011)]). The application of KIBPM in 3PL has theoretical significance, and also provides some research opportunities.

A global Delphi survey on KM development organized by Fraunhofer and Humboldt University in 2002 showed that the future of KM depends on a shift of priority to human factors and the integration of KM activities into business processes [Scholl et al. (2004)]. Kwan [Kwan (1999)] pointed out that the core of KIBPM is to deliver the right knowledge at the right time to the right person. The approach is process oriented knowledge base. Diefenbruch [Diefenbruch et al. (2000)] suggested integrating the individual orientation and the process orientation of KM, which combines people, process and knowledge. Choi [Choi et al. (2004)] also proposed integrating KM and business processes, which supports the conversion of tacit knowledge to explicit knowledge. Records [Records (2005)] studied KM by analyzing its process and proposed a way to shorten process delays. Dalkir [Dalkir (2005)] stressed the importance of shared context: how to describe and organize content so that intended end users are aware it exists and can easily access and apply it. Without proper contextual information, knowledge can be isolated from other relevant knowledge resulting in a limited or distorted understanding [Han et al. (2008)].

- *Specific area of application*

Most of the available research on PKM is quite general, as it discusses the KM for very common business processes in companies. While this provides good guidelines for KM research and practice, there are few studies examining specific industries or areas of application, e.g. product development. Though logistics and 3PL have developed quickly

and require effective KM, there is little literature discussing the application of KM, let alone KIBPM.

- *Strategy to be considered*

The current KIBPM theories focus more on the process itself, but overlook the support from environment and organization. They lack an overall strategy and structure for applying KIBPM. An existing link between the strategic and operational perspective is the ICS. At the strategic level intellectual capital includes human capital, structural capital, relational capital, and other sources; at the operational level the knowledge process exists alongside business processes.

- *Process concept to be expanded*

The traditional business processes are based on Porter's value chain model, according to which an organization is divided into value creation activities according to business processes. New value creation activities, especially knowledge intensive business processes, require a more expansive model, e.g. "value shop" and "value network". Therefore, "Process" in KIBPM for 3PL should be redefined.

- *Approaches to be systematic*

The existing approaches of KIBPM theory emphasize technology more than people or organization. Technology approaches are more effective in managing explicit knowledge than tacit knowledge. KIBPM application should consider people and organization as well in designing and implementing KM.

There is little clear linkage between KIBPM and 3PL; however, there is already research that links KM and logistics enterprises, (e.g. 3PL), indicating that KM has become important for 3PL. The research gap and practical necessity suggest an opportunity to apply KIBPM in 3PL.

3.2.3 Theoretical feasibility

KIBPM and related theories provide the theoretical foundation and direction for this study. The basic idea of integrating KM and BPM ([Jung et al. (2007)], [Records (2005)]), the

general business process definition ([van der Aalst (2005), Fettke et al. (2006)]), the classification of process knowledge ([Amaravadi & Lee (2005)]), and the proposed KM approaches ([Zarate et al. (2005), Su et al. (2010)]), for example, are quite useful references.

Another reference source is the increased research on 3PL in recent years. Topics covered include 3PL selection ([Marasco (2008)], [Selviaridis et al. (2008)]), the role of 3PL in SCM ([Zacharia et al. (2011)]), strategies for 3PL ([Kim et al. (2008)], [Stefansson (2006)]), competitive advantage ([Xu & Xu (2011)]), logistics capabilities ([Wang (2011)], [Hamdan & Rogers (2008)]), organizational learning ([Panayides (2007)], [Shang (2009)]), and so on. According to these references, we can learn the dynamics of logistics and the challenges that 3PL are facing. In addition, a requirement of KM, knowledge identification, as well as core business processes can be extracted.

Moreover, a few researchers have tried to link KM and logistics, including 3PL ([Wu et al. (2007)]). They discussed the objective and effects of KM in logistics, the design of KMS and KM tactics ([Wu et al. (2007)]).

3PL enterprises provide services of transport, warehousing, VAS, consultancy, and so on. The organization of these businesses is usually process-oriented. A typical process is project management, e.g. contract logistics of warehousing management. A process is the "bridge" that combines customer and supplier, experts from different departments, past work experience and current tasks, and knowledge flow from the planning phase via the implementation phase to the final evaluation phase. Business processes make KM reliable and feasible. KIBPM will contribute to process improvement and value creation

In a word, KIBPM offers a new concept and method for applying KM in 3PL, and business processes of 3PL provide a proper context for KIBPM application.

3.3 Application framework

The intent of this study is to apply KIBPM in 3PL from both the theoretical and practical perspectives. In the current literature, there are already some discussions on KIBPM, which generally focus on knowledge intensive organizations and knowledge intensive processes. There is also some studies focusing on KM and logistics, but they only discuss the

relationship between KM effects and logistics companies. Quite few works focus on KM application in 3PL enterprises.

However, KM has been widely applied in large, small and medium-sized logistics enterprises, including 3PL service providers. 3PL has been developing very fast in the past decade. Some excellent 3PL enterprises have also offered 4PL services, which are more knowledge intensive. They have a high requirement for effective KM to provide better services and sustainable competitive advantage. The application of KIBPM in 3PL starts with the analysis of logistics capabilities: dynamic capabilities and operational capabilities. This study of KIBPM discusses both from the strategic level and operational level.

3.3.1 Application basis: logistics capabilities

In today's dynamic environment, logistics excellence has become a powerful competence and source of competitive advantage for many firms [Stank et al. (2005)]. Logistics is more than simply a source of cost savings. It is also the key to enhancing product or service offerings as part of the broader supply chain process to create competitive success [Mentzer et al. (2004)]. Logistics service providers need to develop and sharpen their logistics capabilities [Daugherty & Ellinger (1998)]. Logistics capabilities contribute to a firm's competitive advantage through creating efficiency (cost and capital reduction) and effectiveness (customer service) [Mentzer et al. (2004)].

Logistics capabilities have many aspects, e.g. dynamic capabilities, operational capabilities, learning capabilities, customer focused capabilities, supply management capabilities, integration capabilities, measurement capabilities, and information exchange capabilities [Esper et al. (2011)]. This work will study KIBPM based on dynamic capabilities (business strategy), operational capabilities (business processes, KM implementation) and learning capabilities (KM improvement).

Dynamic capabilities enable firms to react to changing market conditions by developing and renewing their organizational capabilities [Winter (2003)]. In order to sustain the competitive position, firms must possess the necessary logistics flexibility to respond to the changing nature of the marketplace [Esper et al. (2011)]. Moreover, interplay between new strategic moves and actions to heighten operational effectiveness is required to keep up with the dynamic business environment and to stay ahead of the competition

[Abrahamsson et al. (2003)]. KM, learning, cross-functional teamwork and supply chain relationships are the vital dynamic capabilities for the continuous development of the bundling of logistics processes [Sandberg & Abrahamsson (2011)].

Logistics-related operational capabilities are embedded in a company's activities and functions. They are valuable for improving a company's efficiency and/or effectiveness; they are rare assets that are not possessed by many other competitors; they are imperfectly imitable and too difficult or costly for other companies to obtain [Barney & Clark (2007)]. Furthermore, proper organizational processes with a formal reporting structure, explicit management control systems and compensation policies are necessary to exploit it [Barney & Clark (2007)]. Logistics operational capabilities include customer-focused capabilities, supply management capabilities, integration capabilities, measurement capabilities and information exchange capabilities [Esper et al. (2007)]. Logistics operational capabilities have a direct and critical influence on those business processes that have the closest relationships with customers.

In order to sustain the competitive advantage over time, dynamic capabilities are curtailed for the creation, extension and modification of operational capabilities [Helfat (2007)]. Cepeda and Vera [Cepeda & Vera (2007)] examined the relationship between dynamic capabilities and operational capabilities from a KM view. They found that as firms develop dynamic capabilities, the firm's KM infrastructure plays a key role in managing the organization's knowledge gap.

Organizational learning involves members of the organization acting as learning agents, responding to changes in the external and internal environment by detecting and correcting errors in how the firm functions, and embedding the results of their inquiry within the organization [Argyris & Schoen (1997)]. Effective learning combined with traditional logistics operations is more effective for managing logistics [Drew & Smith (1995)]. Logistics learning capability is defined as the ability of a logistics organization to 1) effectively maintain and manage learning organization characteristics and 2) convert learning outcomes to new logistics management strategies, tactics and operations in support of further developing other logistics capabilities [Esper et al. (2011)].

While dynamic capabilities are crucial to sustain competitiveness, learning is a primary vehicle for upgrading capabilities. Learning includes a process within an organization that

maintains or improves performance based on experience, while a dynamic capability is a learned pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness [Zollo & Winter (2002)].

In today's business environment, organizations are facing rapid environmental changes and challenges. In order to produce excellent logistics service with a competitive advantage, it is critical to apply knowledge in the business processes. KM can be critical to organizational success only if it is linked to a dynamic environment, as dynamic capabilities could enhance KM by linking external constant environmental changes and internal KM practices [Shang et al. (2009)]. Dynamic capabilities underpin KM processes [Verona & Ravasi (2003)] and enable an organization to exploit existing knowledge and explore new knowledge to form a competitive advantage [Eisenhardt & Martin (2000)]. They are integrated sets of KM activities that change, renew and exploit the knowledge-based resources [Nielsen (2006)]. Knowledge development, knowledge recombination, and knowledge use are key dynamic capabilities for KM activities, e.g. knowledge creation, acquisition, capture, assembly, sharing, integration, leverage, and exploitation [Nielsen (2006)]. KM as dynamic capabilities have become the key for achieving and sustaining a competitive advantage in turbulent environments of rapid and unpredictable changes [Nguyen & Neck (2008)]. Based on the structure of ICS, Figure 3-2 links KM and logistics capabilities.

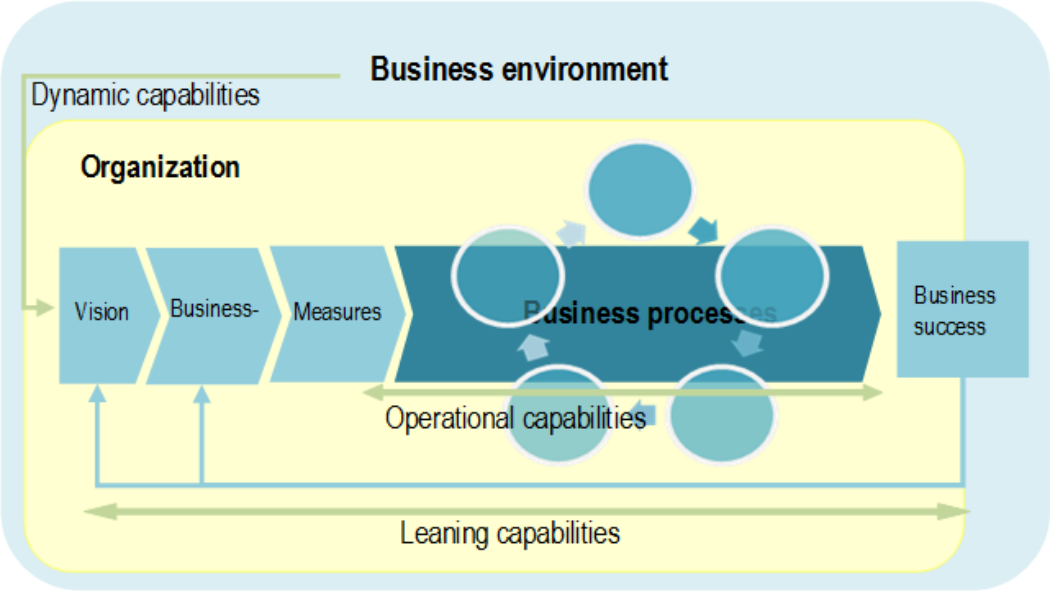

Figure 3-2 KM and logistics capabilities

The competitive business environment provides the external context that drives LSPs to consider changes in the market and to adapt their strategy and actions to them. The business processes provide the internal context that promotes knowledge flow and management. Both contexts will lead KM to go in the right direction, promote innovative solutions, and produce better performance. KM makes it possible to link the dynamic capabilities and operational capabilities of 3PL, and to enhance the learning capabilities that enable the enterprise to keep long-term competency and competitive advantage in the hypercompetitive market. Conversely, dynamic capabilities, operational capabilities and learning capabilities contribute to knowledge acquisition, production, distribution, application and update. These capabilities will enable knowledge to become a competency of the individual, group, and organization, which will finally contribute to a sustainable competitive advantage.

3.3.2 KIBPM framework

Overall, customer requirements and customer satisfaction are the core concern for 3PL enterprises when making business strategy and running business, since logistics services are customer oriented. When the strategy and operation meet customers' needs, promising profit and competitive advantage will be produced.

In the business environment, knowledge of market situation and trends, existing and potential competitors, customers' requirements and concerns, feedback regarding current business services, and the need for developing new businesses are the considerations for developing a strategy to improve business processes and to explore new business processes. For example, when the results of workload and profit show that there is a slack season for steel transport in August, but meanwhile there is a peak period for drinks, this knowledge will support a strategy considering a supplementary business in future. In addition, knowledge from the environment determines the specific strategy for different business processes, e.g. low cost strategy for transport, or professional strategy for contract logistics and consultancy.

Within the organization, there are various different processes (i.e. management processes, business processes, and support processes), which were mentioned in chapter 2. Business processes cannot work alone to fulfill a task. They need the strategy and specific plan from the management process, and they need technology, human resources, a budget, and

equipment from support processes. It requires a process network to handle business activities. Moreover, they need support from partners as well (e.g. sub-contractors to handle some orders).

In the core business process, the accomplishments of each business (e.g. project management in contract logistics), are based on multiple types of knowledge about the project acquisition, planning, implementation, evaluation, and so on. Besides collaboration with customers, businesses must communicate with other support processes, and they also need cooperation with other business processes, e.g. transport. Another example is intermodal transport. This is not pure road, rail, or air freight, but a highly effective connection and collaboration between different modes.

In summary, business processes need knowledge flow from the external environment to the internal organization, from the strategic level to the operational level, and from customer requirements to customer feedback. Efficient and effective KM will enable knowledge to flow smoothly in all channels, and contribute to logistics excellence.

Figure 3-3 describes the basic framework of KIBPM application in 3PL: KM provides knowledge for planning, implementation, and evaluation of business processes; BPM supports management, follow up, and monitoring of the execution of business processes; KMS serves KM and BPM with the knowledge resource and knowledge base [Yu (2004)]. This model has the following characteristics: 1) Integration: it combines business processes and KM activities. 2) Dynamic: it can better adapt to the requirements of knowledge, dynamically provide real time knowledge, and offer the required knowledge in a timely manner by finding and communication. 3) Network: 3PL has both external logistics networks with partners as well as competitors, and internal process networks with other business processes, as well as management and support processes. 4) Innovation: through knowledge sharing, communication and application in teamwork, KM can improve the whole team's knowledge, skills, experience and competency. Through continuous improvement of business processes, KM can contribute to process innovation as well as knowledge innovation [Zhang & Wang (2010)].

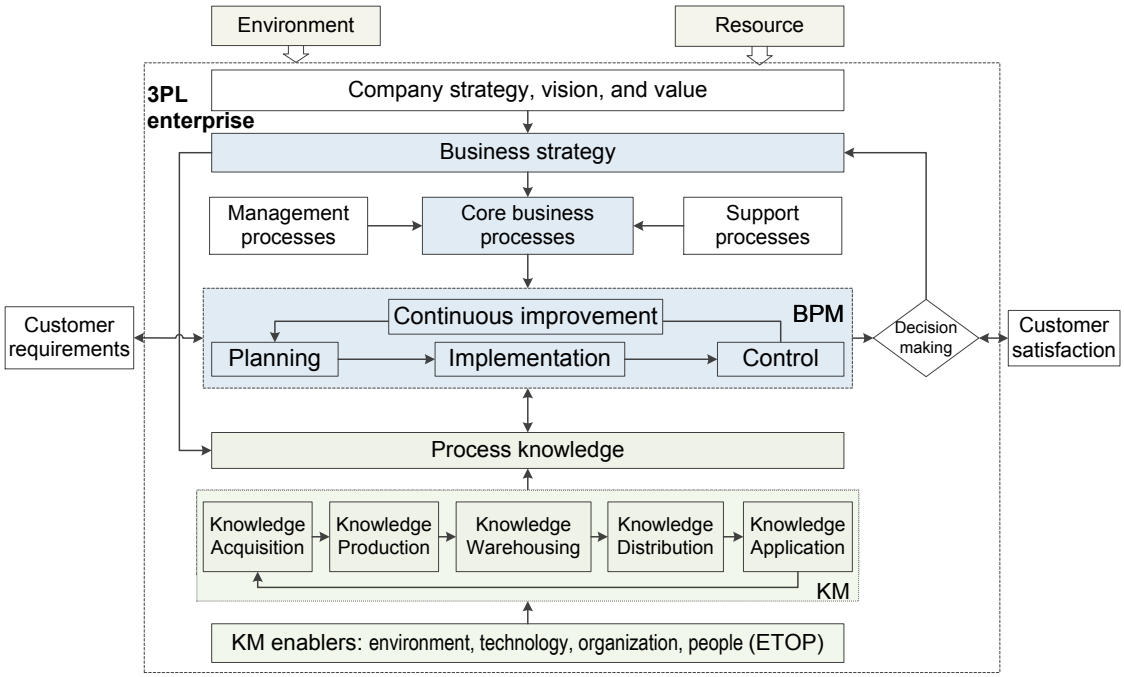

Figure 3-3 KIBPM framework

This KIBPM model consists of the following key parts:

- *Company strategy, vision, and value*

KM strategy should follow company strategy. Decision makers are the knowledge leaders who will decide the future strategy and knowledge demand. They will offer the vision for the company.

- *Core business processes*

KM cannot bring benefits to all the processes. Rather, only highly complex and knowledge intensive processes can be greatly improved though KM. Therefore, KM strategy should first identify such processes. Moreover, core business processes are not separate, but always cooperate with other management processes and support processes.

- *KIBPM*

During the planning, implementing and controlling of business processes, various kinds of knowledge (explicit & tacit) will be produced. For explicit knowledge and tacit knowledge that can be transferred to explicit knowledge, the focus should be on how to cultivate the environment for KM ("Ba" and SECI model). For tacit knowledge that is difficult to

transfer, decision making depends on the knowledge owner. Organizational culture, people and structure are important factors.

- *IT*

IT is an important support for KM in core business processes. It provides advanced systems and tools for more efficient knowledge acquisition, production, warehousing, distribution and application. Cloud logistics and open innovation are examples of advanced IT. However, processes and people are critical enablers of KM.

3.3.3 KIBPM implementation

In order to stay ahead in the hyper-competitive environment, companies have to focus on their core competency so that they can better allocate resources and improve efficiency. An increasing number of companies have outsourced some of their businesses, and 3PL is emerging to meet this requirement. They take responsibility for transport, warehousing, and VAS with professional solutions. Logistics service provided by 3PL need the support of knowledge about customers' needs and concerns, industry trends, different logistics functions, specific business operations, and the qualification and training of talent.

Meanwhile, KM has also been developed and practiced in the knowledge era. Knowledge has been recognized as a strategic resource for successfully maintaining a sustainable competitive advantage. KM has been applied in multinational corporations (MNCs) as well as small and middle enterprises (SMEs). Some famous LSPs, e.g. DHL, UPS, DB, have also launched KM projects. Knowledge and KM are important for 3PL enterprises as well. Application of one small idea from the front line can produce huge benefits for the whole organization. If all the required knowledge is well managed, it will generate more competencies and improve logistics performance. How to effectively manage knowledge in 3PL is a critical question, a possible answer to which is provided by the KIBPM approach.

The whole procedure of KIBPM in 3PL is a process for planning, implementing, and controlling knowledge flow in the core business processes. Planning considers the objectives and strategy of KM, the target business processes, the knowledge demand, the procedures of KM, the evaluation index, and so on. It combines both the external dynamic environment and internal business processes. Implementation is putting the planed tasks

into reality. It includes the core KM activities, main enablers and approaches. Controlling is evaluating the results and effects of KM, including both good aspects as well as those aspects that need to be improved in the new planning and implementation.

In order to effectively integrate KM into business processes, a clear objective and method are essential from the beginning. The goal of this implementation is to continuously improve business processes, which will lead to better and more innovative logistics service. The starting point is an analysis of the external and internal business process context for KM, and of the knowledge demand through a knowledge audit, so that KM can better supply the right knowledge. The knowledge audit supports decision makers in identifying the core business processes, and determining the most valuable knowledge, which will support goal setting [Guo & Dang (2003)], and the implementation and evaluation of KIBPM. Figure 3-4 shows the main steps required to implement KIBPM in 3PL.

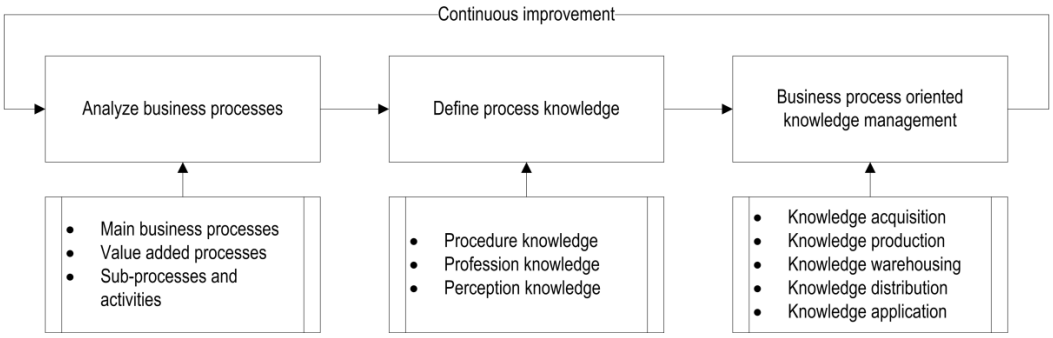

Figure 3-4 Procedure of implementing KIBPM in 3PL

First, 3PL providers should analyze the main business processes, identify the knowledge intensive core business processes, and describe the sub-processes and activities. The typical business processes in 3PL are: transport, e.g. road, rail, see, air freight, or intermodal transport; warehousing or contract warehousing, e.g. building a distribution center; customer service and support, consultancy, e.g. process reengineering; value added services e.g. packaging, bar coding, etc.

Second, it is necessary to define the process knowledge for business processes. Process knowledge can be explicit knowledge and tacit knowledge possessed by an individual, group, organization or inter-organizational entity. The knowledge audit needs to answer these questions: What are the types and content of process knowledge? What knowledge is required? What knowledge is already produced in the organization? What knowledge is important but is still missing? Further on, who needs the knowledge? Who has the

knowledge? How to enable knowledge sharing, generation, distribution and application? This work classifies process knowledge into three types: procedure knowledge, profession knowledge, and perception knowledge (Figure 3-5).

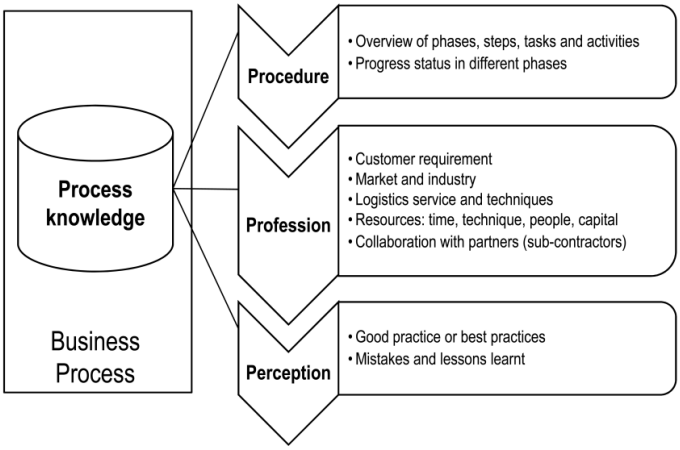

Figure 3-5 Classification of process knowledge in 3PL

Third, management of the process knowledge is a continuous process of knowledge acquisition, production, warehousing, distribution and application. It is an important value chain along with material and capital management in logistics. Knowledge is acquired from the practice of business processes, produced in the form of information and data, stored in different repositories (document, intranet, wiki, or video), distributed to the right people in time, and applied in the current and future business processes. Figure 3-6 shows these main activities of KIBPM in 3PL.

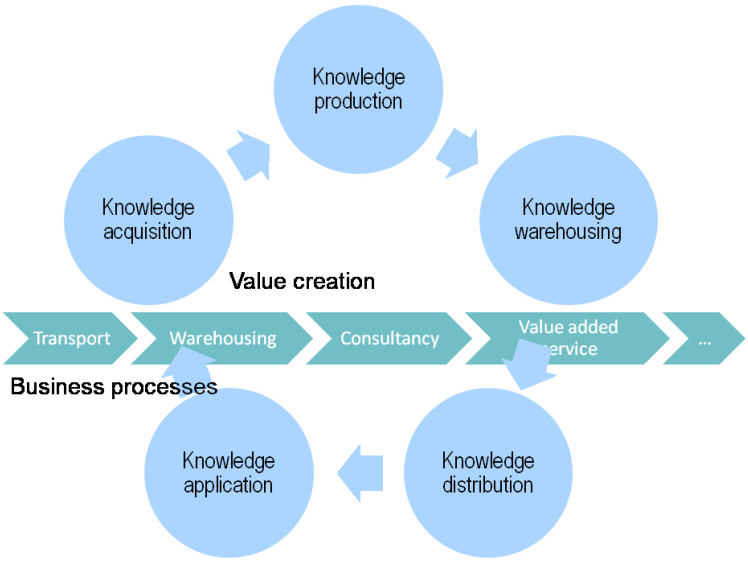

Figure 3-6 Main activities of KIBPM in 3PL

Finally, feedback and results of the application will contribute to improving new processes. This step can produce valuable knowledge that is helpful in optimizing business processes, updating old knowledge, avoiding recurring mistakes, and offering innovative solutions.

3.4 Summary

This chapter has analyzed the potential applications and the theoretical and practical significance of applying KIBPM in 3PL, and proposed an initial framework and procedure for implementing KIBPM in 3PL. First, KM and BPM in many companies face some practical challenges. Among these is the fact that most of the valuable knowledge exists in people's brains. Management of talent and their knowledge is thus critical for the success of 3PL services. Lack of time, motivation, and requisite context are the most critical issues facing KM. Therefore, integrating KM into business processes has great potential and advantages. 3PL services are quite knowledge intensive and process oriented, and the potential benefits to applying KIBPM in 3PL include: enhanced ability to adapt to the external environment, rational allocation of resources, daily work fulfillment, project completion, logistics service improvement, continuous business process improvement, and cost reduction.

Second, the application of KIBPM in 3PL has theoretical significance, and also provides some research opportunities. KIBPM and related theories provide the theoretical foundation and direction. Meanwhile, knowledge and KM have become strategic tools for retaining sustainable competitive advantage. KIBPM offers a new concept and method for applying KM in 3PL, while 3PL provides the proper context for KIBPM application.

Third, the application of KIBPM in 3PL starts with the linkage of logistics capabilities: dynamic capabilities, operational capabilities and learning capabilities. This section proposed a basic framework of KIBPM application in 3PL. This model has the characteristics of integration, dynamicity, networks, and innovation. When implementing KIBPM, 3PL providers should analyze the main business processes, identify the knowledge intensive core business processes, and define the process knowledge. Management of the process knowledge is a continuous process of knowledge acquisition, production, warehousing, distribution and application. Additionally, feedback from the application will contribute to improving new processes.

4 Applying KIBPM in 3PL: the modeling perspective

From the strategic perspective, KM can support the choice of business competitive strategy, and business process plan, design, and development. This will point to the right direction and objective, thus ensuring that 3PL enterprises do the right things.

Business environments characterized by rapid and radical change put a premium on continuous business model innovation to deliver novel, sustainable and competitively viable customer value propositions [Malhotra (2002.)]. Growing demands from customers, the deregulation and globalization of markets, the increasing role of the capital market, and, above all, the rapid development of information and communication technologies, have generated a fundamental intensification of competition [Rüegg-Stürm (2005)].

In today's hyper-competitive market, customer needs, market opportunities, information technology, and relationships with partners are changing considerably. Prompt adaption to these environmental dynamics is increasingly important, e.g. maintaining collaborative networks with customers, shippers, and partners, and adjusting the proper competitive strategy for specific business, and planning efficient business processes. Otherwise, enterprises will lose their competency, as slower fish will be swallowed up by quicker ones [Rüegg-Stürm (2005)].

4.1 Strategic issues of KIBPM in 3PL

To develop skills and competencies, and to gain scale/scope advantages are necessary to add customer value, and such a development necessitates creation of specific knowledge, co-utilization of resources, and coordination of the activities with customers [Hertz & Alfredsson (2003)]. A main challenge for any 3PL provider is striking a balance between being able to adapt effectively to individual customers and organize their systems, and the business of coordinating several customers [Hertz & Alfredsson (2003)]. The way this balanced is achieved will guide the strategic development of the 3PL providers and is of vital importance in determining the resources needed, activities to be performed, and core competence development.

4.1.1 Logistics networks

Networks are a typical characteristic of 3PL, in line with its role between shipper and

buyer, as well as sub-contractors. 3PL service providers need external collaboration with all parties in the network. In the network, firms have direct and indirect relationships not only with customers, but also with suppliers, partners, customers' customers and suppliers, and so on. The relationship involves economic, physical, technological, legal, knowledge, and social exchange between participants, to which trust and communication are vital [Axelsson & Easton (1992)]. Figure 4-1 shows the logistics network operated by 3PL. 3PL companies provide the integrated logistics service from shippers to buyers to meet customers' requirements. In the network, 3PL companies need both collaboration with shippers and buyers, and competition with other 3PL companies. Knowledge transfer and qualification between the partners and in the cooperation network is essential, which can be supported by information platforms as well as personnel measures, e.g. coaching, mentoring, inter-divisional teams [Haasis (2008)].

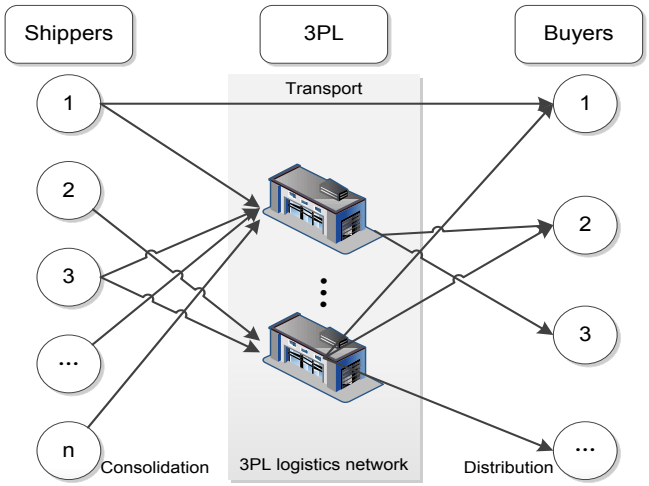

Figure 4-1 Logistics network of 3PL

Source: adapted from [Yi & Ju (2007)]

A firm in a supply chain network may influence its suppliers (of 3PL services, for example) and customers, but also its supplier's suppliers (e.g. hauliers) and its customers' customers [Skjoett-Larsen (2000)]. The performance of a firm does not just depend on how efficiently it cooperates with its partners directly, but also on how those partners cooperate with their partners [Skjoett-Larsen (2000)].

Service quality and the reliability of 3PL enterprises depend not only on themselves, but also on that of their partners, which will influence the choices and decisions of shippers. The size and number of suppliers and partners also influence the development of 3PL's

role to a large extent. The partners and suppliers have the expectation that they should develop together [Hertz & Alfredsson (2003)]. Improving the collaboration of actors along a supply chain requires knowledge paths [Haasis & Fischer (2007), Haasis (2007)].

3PL companies are in charge of all the integrated logistics services between suppliers and customers, according to the terms of a specific service requirement committed to by the 3PL companies. 3PL providers are perceived as supporting intermediaries between suppliers and buyers within the supply chain [Fawcett & Magnan (2002), Alfredsson & Hertz (2005)]. As an intermediary between buyers and sellers, 3PL need to understand the influence of the other connected actors, e.g. the customers'customer or supplier [Hertz & Alfredsson (2003)].

Figure 4-2 describes the roles (i.e. LSI, LSP, and carrier) of different 3PL types. It illustrates the interface and collaboration between all parties in the network. Furthermore, it highlights the material flow and information flow between them. However, there should also be knowledge flow in this network, which is especially crucial for 3PL to provide better service. Such a knowledge flow is a necessary value chain that is critical for not only 3PL, but also the shipper and receiver. Only when they communicate effectively, understanding the requirements and solutions very well, can they make feasible agreements, which will guarantee the quality and efficiency of the logistics service.

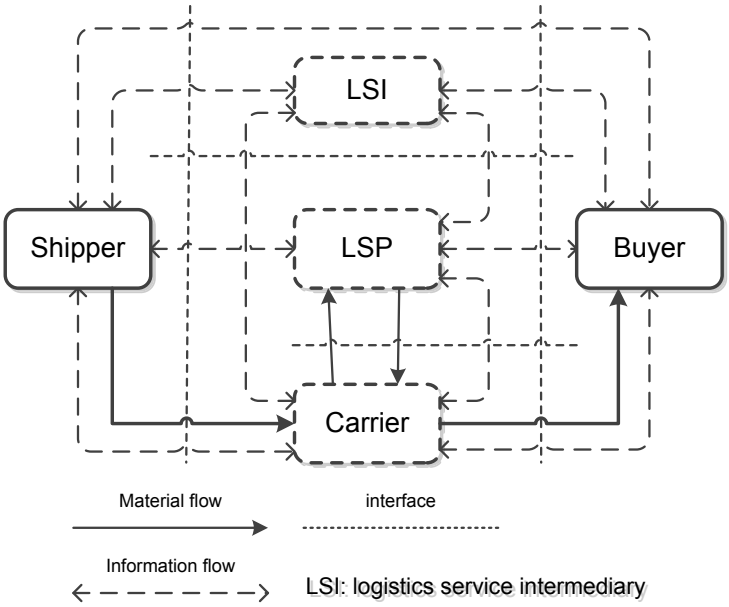

Figure 4-2 The collaborative logistics network of 3PL

Source: [Stefansson (2004)]

Moreover, in the logistics network, 3PL service providers need to cooperate with other 3PL enterprises or 4PL enterprises. For example, when a 3PL company is undertaking the large project of building a service center for one steel manufacturer, some of the transport work may be shared with another 3PL company, while the required IT system can sometimes be designed by a 4PL company, or some additional workers can be temporarily hired by an external personnel company.

In addition, the customer as well as the customers' customer and supplier must be considered in the logistics network. It is necessary to understand how the existing customers work and for what purpose the customers use the 3PL provider. In some cases, it has been rather the customers' customers that were initiating development and continued integration while the customer relationship was more stable [Hertz & Alfredsson (2003)]. Cooperations not only are restricted on suppliers and customers, but also on other partners, stakeholders and competitors [Haasis & Fischer (2007)].

LSPs of the supply chain should cooperate and share knowledge with each other. The common understanding and knowledge of party logistics service providers' visions and attitudes, combined with positive experience from earlier relations, play a major part in the development of third party cooperation [Skjoett-Larsen (2000)].

"If you understand the customer's business model, the markets and geographies it wants to penetrate, the verticals it wants to target, its different manufacturing options and so on, you can continue to find low-hanging fruit. But if your relationship is just as a vendor of logistic services, you hit a brick wall." [Murphy (2005)]

Relationships are long term. Once established, they have a tendency to continue the integration process. Due to vested interests, knowledge, and the mere risk of changing, there is inertia to change [Ford et al. (2003)]. Network structures are both stable and dynamic [Skjoett-Larsen (2000)]. Party logistics service providers keep a relatively stable relationship with contracts. However, such relationships change due to the dynamics in the competitive environment. Cooperation between the parties of logistics service providers has become more long-term and mutually binding in nature [Skjoett-Larsen (2000)]. KM is used to improve the personnel, process-oriented, informational, and technological interfaces between the network partners [Haasis (2005)].

4.1.2 Business competitive strategy

According to Porter's generic strategies, three general types of strategies are commonly used by businesses to achieve and maintain competitive advantage. These three generic strategies are defined along two dimensions: strategic scope and strategic strength. Strategic scope is a demand-side dimension and looks at the size and composition of the market one intends to target. Strategic strength is a supply-side dimension and looks at the strength or core competency of the firm. He identified two competencies in particular that he felt were most important: product differentiation and product cost (efficiency). Figure 4-3 describes the three strategies for achieving above-average performance in an industry. The cost leadership and differentiation strategies seek competitive advantage in a broad range of industry segments, while focus strategies aim at low cost or differentiation in a narrow segment [Porter (1998)].

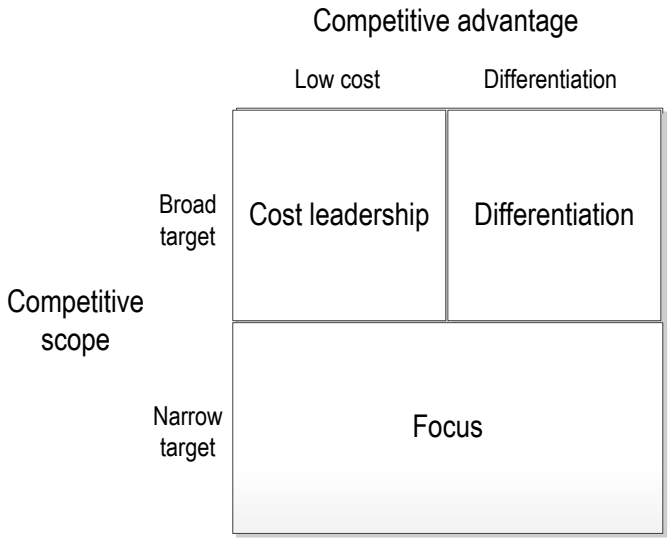

Figure 4-3 Porter's generic strategies

Source: [Porter (1998)]

3PL decision makers must consider and choose the right strategy for their business operation. Whether they choose the cost leadership strategy, differentiation strategy or segmentation strategy depends on a lot of factors and knowledge about the market, the strength of competitors and themselves, the features of each specific business process, and communication with shipper and buyer.

A second consideration is the strategy of individualization vs. standardization. This depends on the industry of the logistics service, e.g. fast food, or steel. For the former, it

is easily to standardize the service and serve more than one customer. However, for the latter it is quite difficult to use the standardization strategy. An individualized service must be designed for each specific customer, requiring a special warehouse, route, and equipment. Based on their earlier experiences and existing relationships, 3PL providers are more or less inclined to develop the resources, skills, and competencies necessary to increase either the adaptability to different customers and/or the general capability of problem solving [Hertz & Alfredsson (2003)].

New firms from different fields are entering the market and competing with the traditional transport and warehousing firms [Hertz & Alfredsson (2003)] as well as existing 3PL enterprises. An example could be consultants joining 3PL firms with advanced knowledge of transportation management and warehousing [Hertz & Alfredsson (2003)]. International alliances or mergers and acquisitions offer opportunities to get new customers, but there is also a risk of losing customers.

Nevertheless, there is not a state of pure competition in the market; rather, more and more collaboration is emphasized. Both always exist. In the long term, the red sea strategy is not the priority, but the blue sea strategy is a benign development to gain sustainable competitive advantage. The collaboration of decision makers along the logistics chain requires a knowledge-bas[Haasis (2008)]KM can result in a more economic and reliable sequencing of tasks in and between companies [Haasis (2008)].

4.1.3 Business process design and development strategy

A general division of the contract logistics (3PL) market exists between “consumer contract logistics and distribution” and “industrial contract logistics” [Klaus et al. (2011)]. “Consumer contract logistics and distribution” refers to the market for supply chain management and the distribution of consumer goods to the retail sector and private customers. “Industrial contract logistics” is “business-to-business” logistics services (critical in the manufacturing sectors of the economy). The focus here is on the procurement and distribution of production materials and components in the various stages of the industrial process, on “intra-plant” logistics and, to a lesser extent, on the movement of industrial parts between second-tier, first-tier, original equipment manufacturers and their respective business customers [Klaus et al. (2011)].

Which industry and product 3PL will serve is a core question for 3PL when designing and developing the business processes. Knowing why and how to make the right choice requires a lot of knowledge from both external and internal sources. On the one hand, this decision making needs to refer to market trends and change. Which industry and products are more in demand? How many existing competitors and potential entries are there? On the other hand, it should also ask further questions about the reality within the organization. What are your own strengths and weaknesses? Is it feasible and profitable to design this business process? What are the possible threats and risks, and how can big risks and losses be best avoided?

As illustrated in Figure 4-4, based on knowledge of logistics operations (e.g. the stock keeping unit (SKU), stock dimension and weight, logistics services requests), the goal and content of a logistics strategy is formulated by strategy planners who seek appropriate knowledge from organization knowledge and individual experience, retrieve similar past cases and modify them to fit the given situation [Chow et al. (2005)]. A systematic approach for logistics service providers to capture, store, and apply the relevant knowledge for logistics strategy formulation is critical.

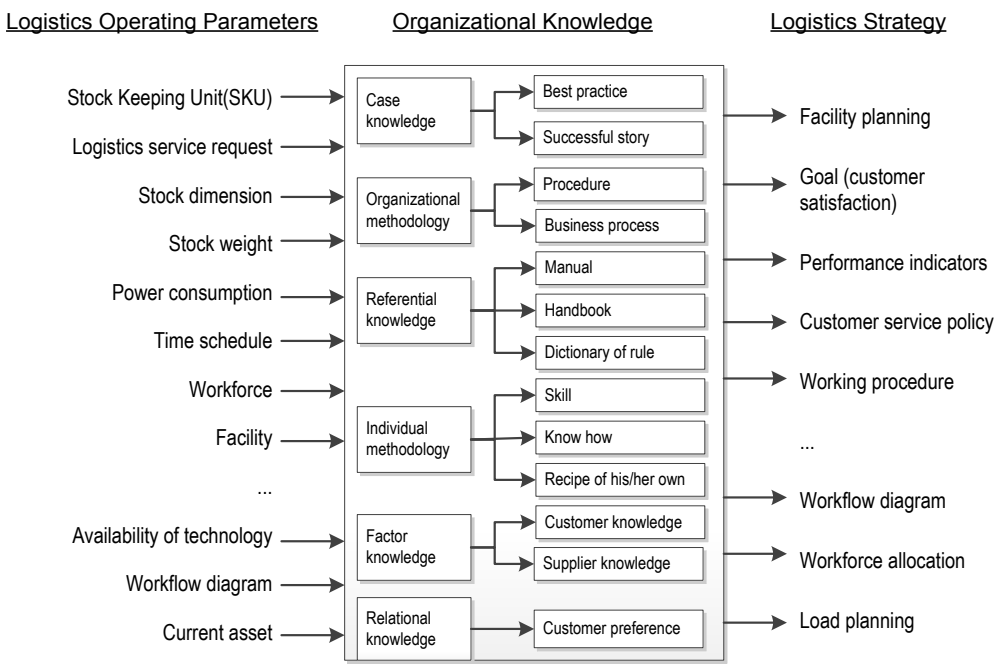

Figure 4-4 Logistics strategy planning process

Source: [Chow et al. (2005)]

The value chain begins and ends with the customer [Rüegg-Stürm (2005)]. In order to be able to survive in this time-based competition, the company's processes must be slimmed down as far as possible and directed towards reinforcing the firm's own core competencies [Rüegg-Stürm (2005)].

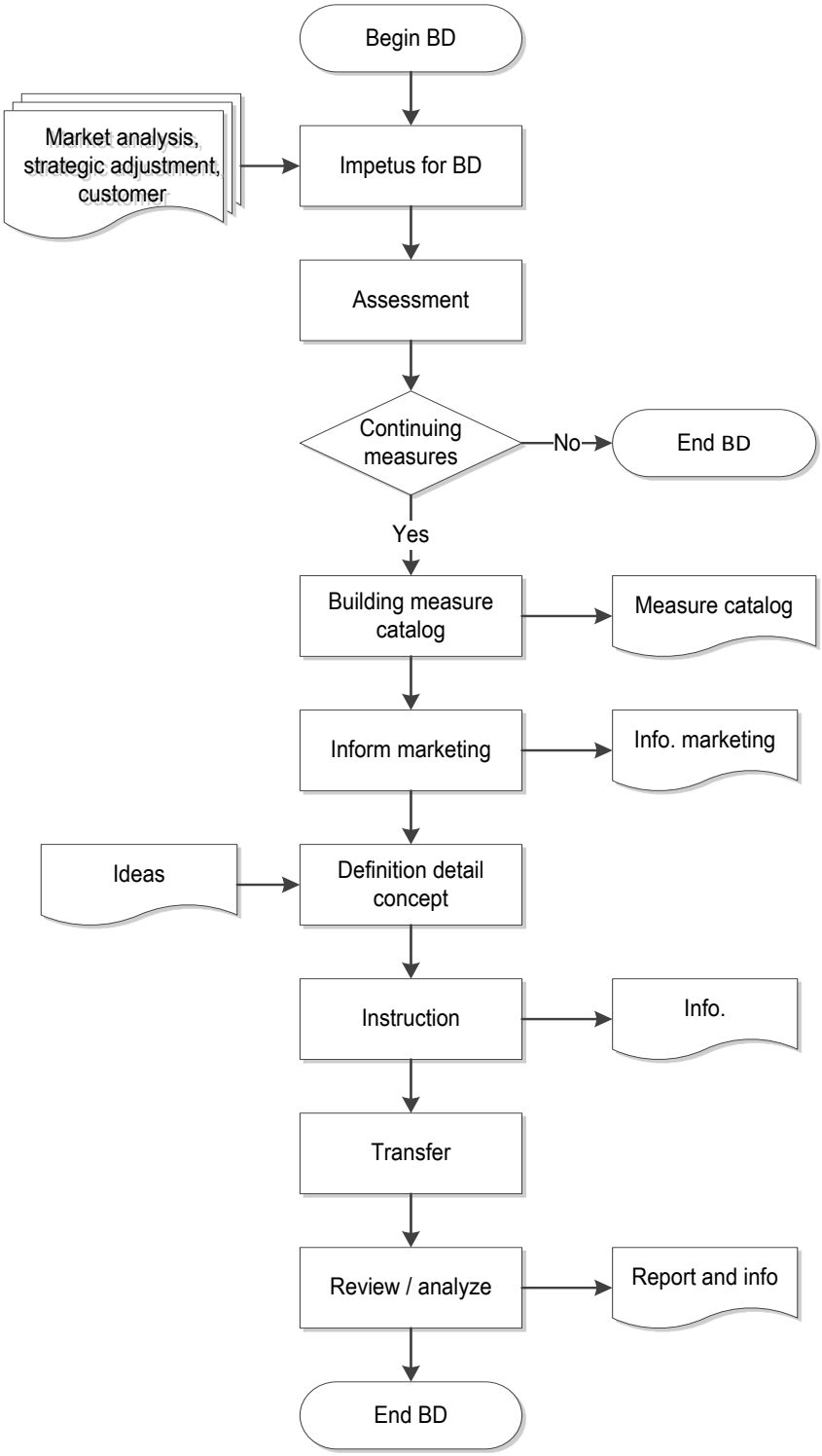

Figure 4-5 Process of business development

Business development comprises a number of tasks and processes generally aimed at developing and implementing growth opportunities. It is a highly knowledge intensive decision making process. An example of the business development process in 3PL is shown in Figure 4-5. This process the market analysis, strategic assessment, establishment of measures, and the definition, transfer and review all require various knowledge from the market, business performance, communication and knowledge sharing.

In addition, in the process of order fulfillment, the customer stands both at the beginning of the process (e.g. initial contact with the sales representative), as well as at the end (e.g. delivery of goods, the customer's payment of the bill or any after-sales support services).

4.1.4 Strategic requirements of KIBPM in 3PL

Application of KIBPM in 3PL should consider the following aspects:

- *Explicit and tacit knowledge*

Explicit knowledge has been paid attention to and well managed especially with the availability of increasingly advanced information management systems. This is a part of KM that contributes to work efficiency, e.g. knowledge about project progress or transport progress. However, another important part of KM is the tacit knowledge that comes from practice and combines innovative thinking. It is even more valuable when this kind of knowledge is shared and applied in business processes. Good practices or lessons learnt from past projects, for example, can produce constructive knowledge for future projects.

- *Static and dynamic knowledge*

Regarding the nature of knowledge, it is both static and dynamic (nature of wave-particle duality). As a resource, knowledge has its entity and carriers. As a process, knowledge is actively moving. It can be shared, transferred, distributed, and applied in business processes. It is possible to convert individual knowledge to organizational knowledge, and vice versa. Furthermore, knowledge itself is changing due to the dynamics of the market as well as business development. Static KM is focused on storing all kinds of knowledge, documents, and information in the database. Dynamic KM makes the stored knowledge active, distributes the right knowledge to the right person, and applies it in the right place. Static KM is the base for dynamic KM [Du (2008)].

- *Internal and external knowledge i*

Business processes are easily seen as internal activities, but these activities cannot be separated from external dynamics, such as market trends , requirements and feedback of customers, potential competitors, and communication with partners. Therefore, KM in 3PL must include these external knowledge sources, especially in the business processes of project management and consultancy. Environment is the formation and development foundation of KM [Zhao & Zhao (2009)]. The utilization of KM should analyze and operate in the specific environment [Chunhui (2006)].

- *Process-orientation*

In order to be more efficient and effective, KM needs real context, e.g. business processes. Process orientation provides clear objectives and knowledge demand for KM by defining specific targets, tasks, activities, and measurements. When such required knowledge is available, business processes are able to run smoothly and achieve the right goal. When new knowledge is produced during the business processes, it saves time for KM on the one hand, and, on the other hand, offers the instance knowledge of the business, which guarantees the following progress.

- *Technology, organization and people*

Since knowledge is not just information, KM is not equal to information management. Technology plays the important role of supporting information management and KM. Nevertheless, it is neither the only nor the best instrument, particularly in tacit knowledge management. KM is more enabled by approaches considering organization and people. Key elements are culture, structure, involvement, motivation, incentive measures, and leadership, among others.

During the evolutionary development of KM, much attention has been paid to explicit, static, and internal knowledge, as well as to general KM in business process operation enabled by technological means. The trends of KM are tacit, dynamic, and external knowledge, process-oriented KM, and the utilization of organization and people approaches at the strategy level(see Figure 4-6).

Current KM	Future KM
Explicit	Tacit
Static	Dynamic
Internal	External
Knowledge and process separated	Knowledge and process integrated
Business process operation	Business strategy
Technology enabled	Organization and people enabled

Figure 4-6 Development trend of KM

Source: adapted from [Wang (2008)]

4.2 Knowledge in 3PL

4.2.1 Knowledge component in processes

3PL enterprises all have their own particular knowledge area, e.g. distribution, warehousing management, forms processing, logistics center planning or logistics operations. Such knowledge in all kinds of business processes is critical for their survival, development and sustainable competitive advantage. Business processes integrate various logistic functions, e.g. transportation, warehousing, VAS. Logisticians integrate a professional knowledge of each of these functions to coordinate resources in an organization. The explicit and tacit knowledge includes a complex combination of organizational processes, information technologies and creative human capacities.

According to the knowledge demand in 3PL, knowledge supply needs to consider these aspects: 1) transportation, 2) facility structure, 3) tender, 4) agreement, 5) human resources, 6) information and communication, 7) quality control, and 8) customer service [Rajesh et al. (2011)].

Table 4-1 Knowledge in organizational processes of 3PL

Process	Sub-process	Critical knowledge
Management Process	**Strategy**	Vision Objective to achieve in 3 years Market dynamics Industry trend Market orientation Logistics resource planning Strategy choice
	Business development	Target business process Performance review Decision for future development of existing business Setting up new business Business process reengineering
	Performance evaluation	Key performance index (KPI) establishment Performance measurement Key data for evaluation (e.g. revenue, working days) Logistics system performance Personnel performance
Business Process	**Transportation**	Freight bill information Transportation booking information Pick-up and delivery procedures Transit time information Insurance and reliability requirements of freight Carrier problems and solutions Government regulations for transportation Security of goods in transportation Transportation performance measures and indicators Transportation network design Shipment problems and solutions Routing and scheduling of vehicles Maintenance of equipments Dock information
	Warehousing	Warehouse insurance information Consolidation process Facility security information Shipment problems and solutions Handling of exceptions and failures in warehouse Load planning information Warehouse network design Warehouse requirements Packing information Storing system information Warehouse equipment and shipment tracking and tracing database
	Tender	Best practices in tender Benchmarking in tender
	Contracting (agreement)	Contractual issues Tender agreement parties Definition of agreement terms Object of agreement Liabilities and obligations estimates Terms of delivery and packaging Payment terms Ownership of goods in warehouse Early termination

		Liability for damages Product liability Applicable law and settlement of disputes Time of validity and termination Ownership of intellectual property rights and improvements
Support Process	**Quality control**	Product audit Quality regulatory requirements Quality policies Quality performance indicators Quality process flows Quality control manuals and procedures Audit manuals Process audit
	Customer service	Customer emergency orders Customer database Customer complaint and feedback system Customer performance indicators Customer satisfaction monitoring plans Customer related problems and solutions Quality deviations Customer database
	Information and communication	Best practices in IT system Warranty information Wireless and mobile solution information Business to business portal information E-commerce information Global positioning system information License for information system
	Human resources	Time standards Work load planning and scheduling

Source: extended from [Rajesh et al. (2011)]

Table 4-1 describes the critical knowledge components in 3PL organizational processes. In management processes, knowledge includes the market, industry, and resources for formulating a logistics strategy, evaluating business performance and developing new business. In business processes, knowledge of freight bill information, transportation booking information and security of goods is essential for transportation practice; knowledge about handling of exceptions and failures in the warehouse, shipment problems and solutions, and warehouse requirements are critical for warehousing management; knowledge of payment terms, liability for damages, time of validity and termination, and ownership of goods in the warehouse of agreement are crucial for contracting [Rajesh et al. (2011)]. In support processes, workload planning and scheduling, and best practices in IT systems are the prime knowledge for logistics service; product audits, quality process flows, quality policies and audit manuals are important for quality control; a database of the customer's customers, customer performance indicators and customer emergency orders are significant for customer service.

4.2.2 Knowledge levels[3]

Knowledge in 3PLs can be divided into different levels based on the knowledge entities and the management level (see Table 4-2).

Table 4-2 Knowledge levels in 3PL

Entity	Explicit Knowledge	Tacit Knowledge
Individual	operation procedures, basic theories	operational skills, experiences, lessons, methods
Group	department regulations, business procedures, cooperation ways,	work skills, methods in the group, solutions from team work
Organization	technology, patent, management standard	organizational culture, competency, organizational capabilities
Inter-organization	market, technology, data analysis of the industry	customer knowledge, knowledge in inter-organizational project team

Source: extended from [Chang (2007)]

First, individual knowledge includes operating procedures and basic management theory (explicit knowledge), operational skills and experiences. Second, group knowledge contains both business departments (e.g. transport, storage, distribution, etc.) and knowledge teams in the organization. Group knowledge includes department regulations, business procedures, methods of cooperation, and basic knowledge of team work (explicit knowledge), as well as those work skills and methods in the group (tacit knowledge). Third, organizational knowledge includes technology, patent, and management standards (explicit knowledge) as well as organizational culture (tacit knowledge). Lastly, inter-organizational knowledge includes technology, market, and data analysis of the industry (explicit knowledge), and customer knowledge and knowledge in inter-organizational project teams.

According to the levels of management in 3PL, knowledge exists in all three levels : operation, management, and strategy. First, operational level knowledge contains four aspects: warehouse knowledge (e.g. loading & unloading, inspection, handling, storage, replenishment, processing, scrap), distribution knowledge (e.g. dispatching, scheduling, shipment, exception handling), document knowledge (e.g. materials filing, form handling, logistic collection, customer service), and supporting knowledge (e.g. business, accounting, finance, public relation, R&D, quality).

[3] The content of section 4.2.2 is adapted from [Zhang & Haasis (2012b)]

Second, knowledge at the management level contains five aspects: personnel management (e.g. recruiting, training, performance evaluation, compensation & benefits, etc.), vehicle management (e.g. vehicle safety, image, efficiency), goods management (e.g. security, right goods, stock control), storage management (e.g. storage safety, tidiness, efficiency), and customer relations management (e.g. customer files, registration materials).

Third, knowledge at the strategic level contains six aspects: management philosophy (e.g. establishment, elaboration, passing on), organizational culture (e.g. building, creating, and cultivating), strategic planning (e.g. forming, executing, evaluating), organization structure (e.g. function design, organization learning), core competency (e.g. competitive advantage, logistics value innovation) and systems organization (e.g. quality of system, logistics system, knowledge economics program).

4.2.3 Knowledge sources

The task of KM includes two aspects: identifying the real knowledge demand, and supplying the required knowledge. Similar to logistics service, customer demand comes first and LSP supplies the corresponding solution, which can better meet customer needs and improve logistics performance. As discussed in chapter 2, there are generally two knowledge sources: external and internal.

From the strategic perspective, KM needs knowledge from both sources. External knowledge sources include knowledge about the market, customer, competitors, policy and regulations, industry, products, and technology. Internal knowledge includes knowledge about the organization, business process, work experience, lessons learnt, project management, teamwork, etc. in individual, group or organizational memory. Figure 4-7 shows the knowledge sources in 3PL. The internal knowledge source can be divided into logistics business knowledge and support knowledge.

The knowledge source is the channel of knowledge acquisition, and the application area of business operations within companies. Logistics business knowledge, such as distribution, processing, and finance, is acquired from the existing knowledge base, which will generate new knowledge that can be updated and applied in the future.

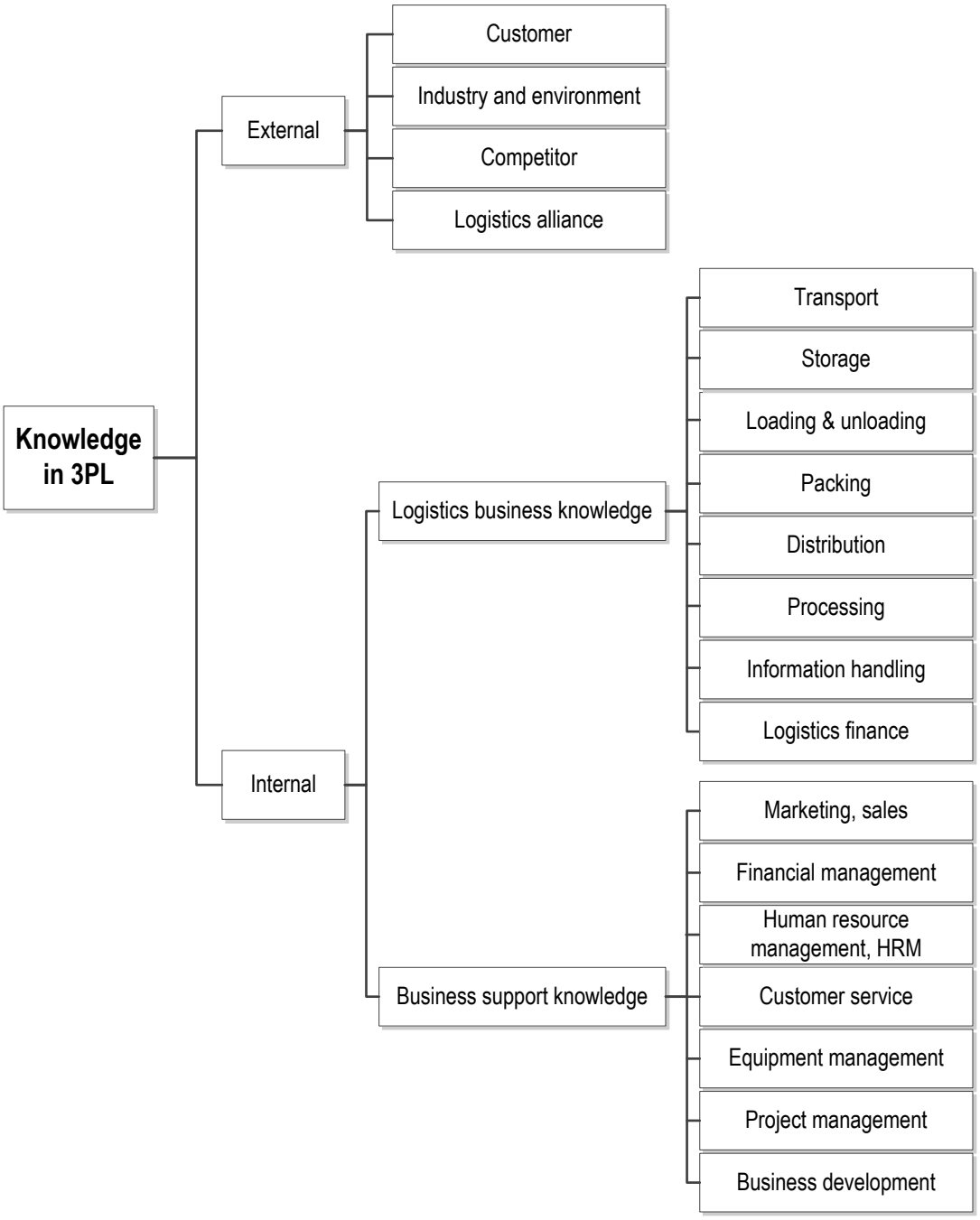

Figure 4-7 Knowledge sources in 3PL

Source: translated and adapted from [Wang & Liu (2010)]

Moreover, it is necessary to know the selection criteria used by clients of 3PL providers, e.g. capability/technical competence, capacity/flexibility, client references/provider reputation, communications, compatible IT, creative management, expertise/specialist knowledge, financial stability/strength, service quality, price/cost, knowledgeable sales

force, harmonized planning horizons, geographical coverage/networks, network customization, experience in handling specific product types, sub-contracting practices, supply of critical information, responsiveness/ability to meet promises, reliability/on-time shipment and delivery, personnel quality/human resource management, performance measurement, top management availability, experience in specific industry, familiarity with industry regulations [Selviaridis et al. (2008)]. This knowledge will increase the successful acquisition of offers from shippers.

4.3 Managing knowledge in 3PL through dynamic capabilities[4]

4.3.1 Dynamics in logistics

With the rapid development of the knowledge-based economy, the world's economic and commercial law is undergoing rapid change, development and intense turbulence [Zhao & Zhao (2009)]. To respond to market opportunities effectively, management must understand the dynamics and complexity of the marketplace in which it operates [Peters et al. (1998)]. [Haasis (2008)]

Knowledge is also dynamic, as it is an active process of knowing and updating rapidly. It can be transformed from an individual to an organizational asset, from tacit to explicit knowledge. This is the process which constitutes organization-wide sharing and learning. Knowledge is an indispensable resource, a strategic asset that is fluid, intuitive and complex [Leonard-Barton (1992), Nonaka & Takeuchi (1995), Zander & Kogut (1995)].

Furthermore, management should be dynamic as well. It learns and adapts to changing circumstances, refining and revising goals as often as needed so that action is always guided by the latest, best, and most informed thinking [Zhang (2010)]. In view of the increasingly dynamic environment, knowledge and KM have become important factors for affecting the performance of logistics enterprises. Usually, the typical action of static KM is to store all kinds of knowledge, documents, information, and so on in the office automation (OA) database for employee reference. Conversely, dynamic KM is to actively motivate employees to share and transfer their individual knowledge into organizational

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[4] The content of section 4.3, and 4.4 is a part of the article [Zhang & Haasis. (2012a)]

knowledge, while simultaneously applying the organizational knowledge to the business processes [Du (2008)].

Due to the trend towards dynamicity and complexity in environment development, enterprises must create sustainable competitive advantages through KM on the basis of adaptability to environment. However, competitive advantages from existing enterprise knowledge systems can only be temporary, and will become rigid, if they cannot respond in a timely manner to changes and improve their adaptability [Zhao & Zhao (2009)]. Therefore, enterprises should not stay with the existing competitive advantages and static KM solutions, but should implement dynamic KM.

The dynamics from outside and inside of logistics enterprise drives the organizations to identify and manage their knowledge in the business process, and adapt to new changes. 3PL enterprises must always update and create knowledge, so that they can keep sustainable competitive advantages. The market for 3PL logistics services—i.e. individualized logistics services of some complexity and customer specificity, which are provided in the context of longer-term contracts— has been one of the most attractive for growth oriented logistics service providers in the last few years [Klaus et al. (2011)].

Table 4-3 Global 3PL revenues up for 2010-2011

Region	2010 (US$ billions)	2011 (US$ billions)	Percent Change (%)
Europe	165.1	160.4	- 2.8
Asia-Pacific	157.6	191.1	+ 21.2
North America	149.1	159.9	+ 7.2
Latin America	27.5	39.5	+ 43.6
Other Regions	42.3	65.2	+ 54.0
Total	541.6	616.1	+ 13.7

Source: [Associates (2013), John Langley & Capgemini. (2013)]

The results of the 2013 17th Annual Third-Party Logistics Study once again reaffirmed that 3PL providers continue to provide strategic and operational value to many shippers across the globe. The 3PL markets of Europe and North American are mature, while the global 3PL revenues of the Asia-Pacific region (+43.6%) and Latin America (+54.0%) are

growing dramatically (see Table 4-3). Shippers consider logistics and supply chain management to be key contributors to their overall business success, and approximately three-quarters of survey respondents say 3PLs provide new and innovative ways to improve logistics effectiveness. [Terry (2012)]

Market dynamics include increased customer awareness of outsourcing potential, an increasing downward pressure on pricing, and a renewed interest in single 3PL agreements, i.e. one-stop shopping. [Haasis (2008), Randall et al. (1996)] There are both external and internal contexts to these dynamics. The external environment includes several economic, regulatory and technological drivers, among them: increased global competition, deregulation of the transportation industry, rising customer expectations of superior logistical service, increasing popularity of just-in-time (JIT), and a revolution in communication technology. The internal context has three main characteristics: network complexity, process complexity, and product complexity [Marasco (2008)].

These dynamics make it necessary for 3PL service providers to choose the right strategic behavior. Choices include those between standard services versus logistics solutions, and traditional, basic logistics activities (e.g. transportation and warehousing) versus value added logistics [Berglund et al. (1999)], as well as finding a balance between general problem-solving capability and a degree of customer adaptation [Hertz & Alfredsson (2003)]. Table 4-4 summarizes these aspects of 3PL.

Table 4-4 Dynamics, problems and opportunities for 3PL

Dynamics	Problems	Opportunities
• Growing customer interest in outsourcing • Downward pressure on 3PL prices • Increased customer desire for one-stop-shopping • Increased CEO/CFO participation • Outsourcing by customers to reduce costs • Outsourcing to stick to core competencies • Entry of new 3PL companies	• Systems development cost • Matching promise with reality • Compatible cultures & relationships • Development of appropriate pricing system • Finding qualified people • Contract rigidity • Client rigidity • Rapid pace in technology & social change	• Continued internationalization • Competition /cost pressures • Facing 3PL users • Emphasis on core competencies • Further IS • Rationalization of 3PL providers • VAS • Further integration of supply chain • Horizontal integration • Consumer globalization

Source: compiled from [Randall et al. (1996), Peters et al. (1998)]

4.3.2 Dynamic capabilities

The concept of dynamic capabilities was introduced by Teece [Teece & Pisano (1994), Teece et al. (1997)]. Teece et al. [Teece et al. (1997)] define dynamic capabilities as "*the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments*" (p.516). This concept emphasizes the development of management capabilities and the unique combination of organizational, functional and technological skills that address the changing environment and enable firms to sustain their competitive advantages.In today's dynamic markets characterized by rapid and unpredictable changes, dynamic capabilities have become the source of sustained competitive advantage. Dynamic enterprises collaborate with their suppliers, customers and even competitors, in sharing information and knowledge to create a collaborative supply chain that is capable of competing [Liu & Sun (2011)]. Table 4-5 shows the main definitions of dynamic capabilities in the literature.

Cepeda and Vera suggested that definition of dynamic capabilities can consider four critical aspects: 1) capabilities are organizational processes and routines rooted in knowledge, 2) the input of dynamic capabilities is an initial configuration of resources and operational routines, 3) dynamic capabilities involve a transformation process of the firm's knowledge resources and routines, 4) the output of dynamic capabilities is a new configuration of resources and operational routines [Cepeda & Vera (2007)].

The dynamic capabilities theory identifies three classes of factors that determine a firm's distinctive competences and dynamic capabilities: processes, positions, and paths (3Ps). The essence of competences and capabilities is embedded in organizational processes. The content of these processes and the opportunities they afford for developing competitive advantages are shaped significantly by the assets the firm possesses and by the evolutionary path it has inherited [Liu et al. (2007)].

In the current turbulent environments, firms are competing based on their ability not only to exploit, but to renew and develop, their existing resources and organizational capabilities, enabling firms to react to changing market conditions, thereby achieving and sustaining a competitive advantage [Nielsen (2006)], [Verona & Ravasi (2003), Winter (2003)]. Dynamic capabilities are important for 3PL enterprises striving to obtain sustainable competitive advantage and good performance.

Table 4-5 Main definitions of dynamic capabilities

Orientation	Definitions
New opportunity, competency, process	The subset of the competences and capabilities that allow the firm to create new products and processes and respond to changing market circumstances [Teece & Pisano (1994)]
	The firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments [Teece et al. (1997)]
	The ability to sense and then seize opportunities quickly and proficiently [Teece & Teece (2000)].
	Dynamic capabilities can be disaggregated into the capacity (a) to sense and shape opportunities and threats, (b) to seize opportunities, and (c) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets [Teece (2007)].
Routine, competitive advantage	Organizational and strategic routines by which firms enhance existing resource configurations in the pursuit of long-term CA (RBV's logic of leverage) and achieve new resource configurations in the pursuit of temporary advantages (logic of opportunity) when markets emerge, collide, divide, evolve and die [Eisenhardt & Martin (2000)]
Activity, routines, effectiveness	A learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness [Zollo & Winter (2002)].
	Those (capabilities) that operate to extend, modify, or create ordinary capabilities [Winter (2003)]
Resource, routine	The abilities to reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate by its principal decision maker(s) [Zahra et al. (2006)].
Process, conditions, assets	Dynamic capabilities are complex, higher order organizational processes which provide adequate conditions for the modification and renewal of the firm's stock of business assets. DCV provides adequate conditions for the development and renewal of a firm's stock of business assets, allowing them to adapt to external change and remain competitive [López (2005)].
Resource	The capacity of an organization to purposefully create, extend, and modify its resource base [Helfat (2007)]

4.3.3 KM and dynamic capabilities

Dynamic capabilities enable organizations to exploit existing knowledge and explore new knowledge to form a competitive advantage [Eisenhardt & Martin (2000)]. Dynamic capabilities are critical to knowledge creation, knowledge acquisition, knowledge integration and knowledge reconfiguration, because these KM processes are underpinned by the organizational dynamic capabilities [Verona & Ravasi (2003)].

KM can contribute decisively to organizational success only if it is linked to a dynamic environment. Thus, the concept of dynamic capabilities, with its focus on the exploration and exploitation of internal and external resources, plays an important role in enhancing the usefulness of KM [Shang et al. (2009)].

The world is constantly changing, and so are the requirements and availability of knowledge [Peter Haase (2005)]. Knowledge is ever-evolving. Unlike product manuals, which are typically tailored to a static state, customers' experiences are dynamic and ever-changing. [Badjatia (2008)]. When knowledge is being updated rapidly, KM should also keep pace. Knowledge resources are critical for achieving and sustaining competitiveness [Tidd et al. (2005)].

KM processes that change, renew and exploit the knowledge-based resources of the firm can be seen as an integrated set of dynamic capabilities [Nielsen (2006)]. They create flows to and from the firm's stock of knowledge, thereby not only generating new knowledge but also changing the state of knowledge-based resources under consideration [Nguyen & Neck (2008)].

In summary, there are some common key features of dynamic capabilities which link KM and dynamic capabilities: 1) Dynamic capabilities are broad and knowledge based, combining knowledge from different core functions, technologies or activities; 2) dynamic capabilities enable a firm to recognize the value of new, external knowledge, and to assimilate and apply it to commercial ends; 3) the creation of dynamic capabilities requires continuous learning [Shang et al. (2009)]. Knowledge change and adaptation is related to the concept of learning [Eisenhardt & Martin (2000), Zollo & Winter (2002)].

4.4 Sustaining competitive advantage through dynamic KM

4.4.1 Dynamic KM in 3PL

Facing rapid environmental changes and challenges, enterprises must keep KM adaptable. By leveraging people, technology and organizational context, KM in logistics intends to integrate internal and external knowledge that will enhance enterprises' ability to meet challenges from a turbulent environment [Chiu & Chiang (2005)].

KM can be enhanced through dynamic capabilities of a recursive flow of integration,

learning, and reconfiguration. This helps management sense the changes, identify the opportunities and threats, reevaluate customer demands, reconstruct the processes, extend and renew the knowledge base, optimizing the routines, and eventually accomplish a successful service innovation [Shang et al. (2009)].

KM application processes (i.e. using knowledge to solve new problems, to improve efficiency, to react to changing competitive conditions and taking advantage of new knowledge) were found to have the major influence on organizational competitiveness [Nguyen & Neck (2008)].

Dynamic KM is expected to adapt quickly to a changing environment, promote knowledge sharing, transfer and innovation, integrate internal and external knowledge, effectively allocate knowledge resources, consequently sustain competitive advantage, and continually improve organizational performance. When enterprises encounter sudden changes (e.g. the cancellation of customer orders or a technical hitch) logistics performance will be affected if the existing knowledge cannot solve the problems. Those facing such a situation must find a new proper solution, which will be transferred into organizational knowledge. An effective management of knowledge allows a proper sharing of knowledge between the organization and its business partners and suppliers [Choy et al. (2006)].

4.4.2 Conceptual framework of dynamic KM

The knowledge possessed by 3PL enterprises is the foundation and guarantee of their competitive advantages. The existing knowledge resources and assets are important parts of the position of the organizations. So are the KM infrastructures: technology, management, and culture, as well as current KM activities. However, if the existing knowledge and KM are static, 3PL enterprises cannot keep a long term competitive advantage because of the dynamics of the competitive environment, market, technology, cooperative partners and policy. They must sense these changes in time, identify the opportunities and threats, and seize the opportunities to extend, renew, upgrade, and protect the knowledge base, so that they are able to adapt to and better survive in the changing business ecosystem.

Therefore, 3PL enterprises must improve their knowledge systems and KM capabilities to obtain sustainable competitive advantages. This is a process of integration, reconfiguration

and innovation, which will create new competitive advantages and lead to improved performance. Figure 4-8 shows the conceptual framework of dynamic KM in 3PL enterprises. This framework is meant to illustrate the overall strategy of analyzing company position, sensing environmental dynamics, seizing opportunities, and shaping dynamic capabilities, so that 3PL can acquire sustainable competitive advantage. These dynamic capabilities through learning and innovation will enable companies to be more flexible and agile in the changing business environment.

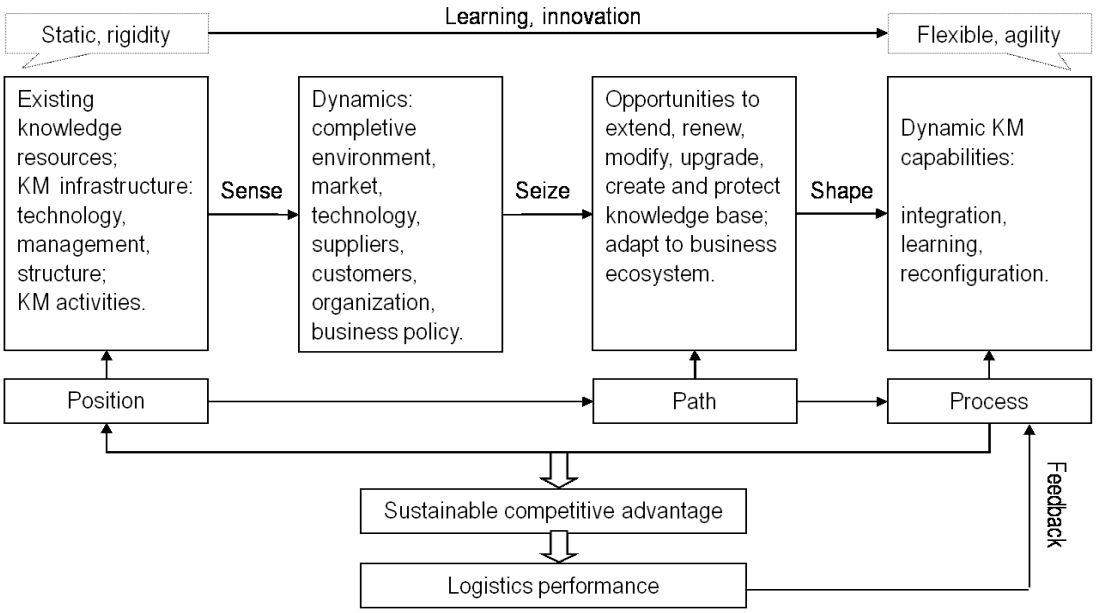

Figure 4-8 Conceptual framework of dynamic KM in 3PL

4.4.3 Key components of the dynamic KM framework

- *Position*

The strategic posture of a firm is determined not only by its learning processes and by the coherence of its internal and external processes and incentives, but also by its specific assets [Liu et al. (2007)]. KM implementation depends on organizational assets and resources. Since logistics service emphasizes standardization, there is no much difference in hardware facilities, and competitive advantage relies on organizational knowledge.

3PL enterprises are collective bodies of knowledge consisting of different explicit knowledge and tacit knowledge. The fundamental guarantees for sustainable competitive advantage are: explicit knowledge, e.g. training manuals; tacit knowledge, e.g. experience

and skills retained in the minds of individuals; unit knowledge in the business process; intangible knowledge of brand and reputation; internal knowledge in individuals, groups, teams, departments, business processes, and organizational routines, etc.; and external knowledge of collaborative organizations.

Moreover, knowledge in 3PL has different domains. Employee knowledge is individual experience about specific order procedures and group understanding about project development; that is, it exists in the brains of employees and in their daily work. Customer knowledge includes knowledge about customers, knowledge for customers, and knowledge from customers [Henning Gebert (2003)]. These knowledge types are helpful for developing new markets, reducing potential risks, and avoiding investments in improper services, since the objective of logistics service is to meet customer needs and improve their satisfaction and loyalty. Supplier knowledge includes knowledge about requirements, preferences, and selection criteria, etc. It is used to assist the decision-making process by linking customer demands and supplier capabilities, which can guarantee minimization of stock and achieve competitive advantage [Yeniyurt et al. (2005)]. Competitor knowledge includes knowledge about competitors' market share, strategies, and structure. It is crucial for 3PL enterprises to design strategy and keep competitive advantage in the dynamic and uncertain environment.

Furthermore, different people have different ideas and knowledge, and different situations and problems need different knowledge and decision making. When customers change orders or some special orders cannot be finished, 3PL enterprises need to redesign and reorganize the business process promptly to adjust to the new situation. Through dynamic KM, enterprises can accomplish organizational learning, capabilities transfer and knowledge innovation, which help to keep and create sustainable competitive advantage.

In order to implement KM effectively, the fundamental precondition is the construction of the proper infrastructure for knowledge sharing, exchange, application, and innovation. Technology, structure, and culture are critical dimensions of KM infrastructure.

Modern technologies, especially the internet, make it more convenient and efficient for enterprises to apply KMS. In a dynamic competitive environment, KM in 3PL enterprises depends more and more on technology. The application of KMS (e.g. groupware, wiki, intranets, knowledge map, experts yellow page) supports knowledge collection, creation,

storage, distribution, application, and renewal. In this way, the organizations provide better learning platforms. Advances in ICT allow knowledge-based systems to utilize the tacit and explicit knowledge within an organization and afford greater possibilities for individuals and organizations to create and to share that knowledge [Alavi & Leidner (2001)]. However, developing and implementing KMS is a part of KM, with KM approaches including non-technological designs as well, e.g. human and managerial, structural, and cultural.

In order to survive in dynamic business ecosystems, 3PL enterprises must keep their difficult-to-imitate competitive advantage. Structure optimization and management innovation are basic methods. It is important to establish a dynamic learning organization, which allows effective communication and knowledge flow. The structure should be flexible and efficient. On the one hand, it is easier to manage internal knowledge and adapt to changes; employees and team members share their ideas and experience freely, and older staff members support new ones. On the other hand, it is better to absorb and make use of external knowledge. Collaboration with suppliers and dealers helps them reduce costs and improve service, which will benefit 3PL enterprises.

Cultural atmosphere is essential for KM in 3PL enterprises. If the culture encourages employees to learn, share, and exchange knowledge with each other, the useful knowledge will be precipitated, transferred, distributed, and utilized. Their contributions will enhance the transformation of knowledge from tacit into explicit, and from individual to organization. If the culture fails to motivate knowledge sharing and communication, there will be great barriers for KM implementation. People are the creators of knowledge and pushers of KM. KM is the arrangement, training, and management of knowledge owners. 3PL enterprises should recruit creative employees, stimulate and train employees, and encourage cooperation and communication between them as well as with organizations.

- *Dynamics*

The growing importance of logistics, as well as the increasing dynamic complexity of markets, technologies, and customer needs, has brought great challenges to logistics. Knowledge based resources are seen to contribute most to performance in a dynamic, changing environment [Lee & Hong (2002)]. The dynamics from outside and inside of the logistics enterprise drive the organization to identify their knowledge, manage that knowledge in the business process, and adapt to new changes.

Logistics service is a dynamic and knowledge intensive service. It has a very close relationship with the customers. It must actively respond to their changing demands and always find innovative solutions. However, new matters may accrue, and there may be no right solution available. If, for example, customers change their orders or suppliers cannot provide the goods on time, 3PL enterprises must redesign and reorganize the original resources and processes. In order to adapt to such new situations, the processes are dynamically modified, and this modification will be stored and maintained, so that it can be traced and referenced for future.

In order to survive and develop with the rapid development of knowledge-based economy, 3PL enterprises need to continuously improve their environmental cognitive ability, predict unforeseen changes and grasp the trends so that they can seek new competitive advantages [Zhang & Zhao (2010)]. 3PL enterprises need to acquire knowledge about customer needs, competition status, technological change, policy and regulations. They learn and adapt to changing circumstances, refining and revising goals so that their actions are always guided by the latest thinking. Knowledge renewal and upgrading are essential, as they will support new knowledge generation and application, and create new competitive advantages.

- *Path*

Development trends depend on history and organizational learning relies on past actions. Because learning is a process of experimentation, feedback, evaluation, and re-experimentation, enterprises can accumulate more knowledge, adapt to changes, reduce the negative effect of path dependencies, effectively make use of past and current knowledge, and finally achieve competitive advantage [Wang (2011)].

- *Process*

Organizational processes have three roles: coordination/integration (a static concept), learning (a dynamic concept), and reconfiguration (a transformational concept). 3PL enterprises create and accumulate knowledge, facilitate organizational supply chain integration, and reconfigure relative resources.

Based on the existing knowledge and KM, 3PL enterprises identify new knowledge, and integrate the knowledge from employees, customers, suppliers, and market into the

organizational knowledge. However, it is difficult for enterprises to maintain a long-term competitive advantage in the dynamic environment. Organizational learning ability is very difficult to imitate and provides the power for the sustainable competitive advantage. Dynamic KM is enabled by organizational learning, which motivates knowledge sharing, communication, application and innovation [Wang & Zhao (2004)]. Knowledge reconfiguration is based on the original KM. It is an internal process of sublimation, and involves knowledge variation, choice and maintenance [Dong et al. (2004), Zott (2003)].

4.5 Strategies of KIBPM in 3PL

According to Maier and Remus [Maier & Remus (2001)], some KM strategies have been discussed in literature and adopted in practice, e.g. (1) mapping sources of internal expertise, (2) creation of a (virtual) work environment which enables the sharing of tacit knowledge, (3) supporting knowledge flows in an organization, (4) KM as a business strategy, (5) customer-focused knowledge, (6) intellectual asset management strategy. This work will discuss the following strategies of KIBPM in 3PL: environmental scaning, knowledge supply network, knowledge alliances, and knowledge integration strategy.

4.5.1 Environmental scanning

KM strategies are determined by the decision makers' sense of the external environment, and analysis of the opportunities and threats. Examples of main approaches are environmental scanning, competitive intelligence, and business intelligence. However, the individual capability and preferences of decision makers also influences the sense of environmental change and the response of the organization. Table 4-6 lists some environment factors for KM.

Table 4-6 Environmental factors for KM

Author	Environmental factors
Porter [Porter (1998)]	existing competitors, new entrants, buyers, suppliers, substitute products or services
Fahey, Narayanan [Fahey & Narayanan (1989)]	Customer, competitor, technological, political, economic, social
Jauch, Glueck [Jauch & Kraft (1986)]	Customer, competition, technological, political, social economic, suppliers
Daft [Daft et al. (2006)]	Customer, competition, technological, regulatory, economic, social cultural

Environmental scanning is done through observation and searching in formal or informal ways. The knowledge sources are mostly public newspapers, multimedia sources, government reports, libraries, and online databases, as well as communication with customers, partners, industry associations, boards, competitors, conferences, and officers

4.5.2 Knowledge supply network

The knowledge supply network is quite like the cross docking center, which unloads materials from an incoming semi-trailer, truck or railroad car and loads them directly onto outbound trucks, trailers or cars. This is done to change the means of conveyance, to sort materials intended for different destinations, or to combine materials from different origins into transport vehicles/containers with the same or similar destination.

The goal of the knowledge supply network (KSN) is to promote more effective and efficient collaboration and communication between different parties in the logistics network. The KSN combines the knowledge demand and knowledge supply for all participants. It is a highly efficient platform for knowledge sharing and knowledge use. If such a KSN is established, it will greatly reduce the cost and time of knowledge sharing between 3PL providers and other participants in the network.

Moreover, KSN is also effective for internal knowledge sharing and exchange. 3PL should first build an internal network with the IT and BM systems, which are prepared to store and transfer knowledge in a database. The internal network can support e-mail and video conferences, thus making KM more efficient.

4.5.3 Knowledge alliances

The knowledge that 3PL acquires from the external environment is mainly explicit knowledge. A larger amount of tacit knowledge needs to be acquired by a knowledge alliance. There are different types of knowledge alliance: 3PL-customer, 3PL-partner, 3PL-supplier, etc. Dynamic KM in 3PL enterprises is a process of innovation that enables the transition from static KM to dynamic KM. This will avoid rigidity and improve the agility and flexibility of the organization.

Establishing knowledge alliance is an effective way to integrate external knowledge resources [Hong-Minh et al. (2000)], through the association of 3PL enterprises with other

enterprises or institutions to create and transfer knowledge. To create a successful knowledge alliance, alliance members must set up a long-term mutual trust relationship to reduce transaction costs. Reducing each other's knowledge protection awareness creates a good learning environment for exchanging knowledge [Zhao & Zhao (2009)].

In addition, knowledge innovation can create difficult-to-replicate advantages, and accelerate the sustainable development of the enterprises. In addition, feedback is necessary for enterprises to update existing knowledge and adjust themselves to a changing environment. In 3PL enterprises, employees have new ideas about better solutions to old or new problems; these ideas exist in the employees' minds as tacit knowledge. When they share and discuss such knowledge, and prove that it is effective for organization, the knowledge will be updated or created as organizational knowledge.

4.5.4 Knowledge integration

Knowledge integration strategy includes the integration of KM and BPM, the combination of business processes and functions, and the integration of KM and organizational learning.

Organizations with a flexible structure and communication channels can facilitate knowledge flow, study and innovation more efficiently. The number of levels in the organization should be minimized, and inter-departmental communication, contact and cooperation strengthened, so that knowledge can flow more smoothly. Organizational learning is a crucial tool for acquiring, producing, and renewing knowledge. Survival of the fittest also applies in the business world. Learning, adaptability and innovation are vital for 3PL enterprises to keep a sustainable competitive advantage in a dynamic environment. Innovation factors like communication, systems integration, logistics product planning and skills are of vital importance [Haasis (2006)].

4.6 Summary

In summary, this chapter has analyzed the strategic issues and requirements of KIBPM in 3PL, discussed general knowledge and KM with dynamic capabilities, proposed a conceptual framework for dynamic KM, and finally explained some strategies for integrating knowledge and KM in BPM.

First, integration of knowledge into BPM must consider the logistics networks within which 3PL companies collaborate and compete with other participants to provide logistics services. In order to attain an above-average competitive advantage, 3PL companies should make a choice of business strategy, selecting and implementing the strategy of cost leadership, differentiation, or focus. Choices made vary widely from industry to industry, and from business to business. Under the specific business strategy, business processes need to be well designed in order to achieve the desired objective. Moreover, businesses development is a critical part of BPM and an important issue in practice. The decision making in all these aspects needs knowledge support. Application of KIBPM in 3PL should consider not only explicit knowledge but also tacit knowledge, not only the existing knowledge but also new knowledge within and outside of the company, not only technological instruments, but also organizations and people instruments.

Second, KIBPM in 3PL should consider both knowledge demand and supply. The critical knowledge component in 3PL consists of these aspects: 1) transportation, 2) facility structure, 3) tender, 4), agreement, 5) human resources, 6) information and communication, 7) quality control, and 8) customer service. Moreover, knowledge can be divided into 3 levels: operational, management, and strategic. Knowledge acquisition normally has two sources: external (e.g. market, customer, competitor, policy and regulations) and internal (e.g. organization, business process, work experience).

Third, this work proposed a conceptual framework, which illustrated the overall strategy of analyzing company position, sensing environmental dynamics, seizing opportunities, and shaping dynamic capabilities, which will contribute to a sustainable competitive advantage and the improvement of logistics performance.

Fourth, this work discussed the following strategies of KIBPM in 3PL: environmental scanning, knowledge supply network, knowledge alliances, and knowledge integration. Environmental scanning is done through observation and research in formal or informal ways, e.g. public newspapers, multimedia sources, government reports, libraries and databases, as well as communication with customers, partners, industry associations, etc. The knowledge supply network is analogous to the cross docking center. A knowledge alliance is a means for 3PL enterprises to associate with other enterprises or institutions to create and transfer knowledge. Knowledge integration strategies include the integration of KM and BPM, business processes and functions, and organizational learning.

5 Implementing KIBPM in 3PL: the business perspective

From the operational perspective, the objective of implementing KIBPM in 3PL is to do things right, i.e. to support business process execution, control, optimization and improvement. KIBPM influences not only the business strategy, but also the operation of business processes.

First, KIBPM implementation needs to identify the core business processes, and knowledge-intensive core business processes and process networks, which are of higher importance for producing applying knowledge. Moreover, knowledge demand and resources in the core business processes and networks should be identified so that the organization has a better understanding of the knowledge gap.

Second, a crucial challenge is to motivate employees to share and transfer knowledge in 3PL. The sharing and transfer of knowledge are the foundations of KMKM in 3PL, and are present throughout the whole process of KM. Understanding knowledge sharing and the practice of motivating people to share knowledge are the most critical issues for implementing KM in business processes and process networks.

Third, KM activities include knowledge acquisition, knowledge production, knowledge warehousing, knowledge distribution and knowledge application. The enablers are both internal and external. In order to fulfill the operation of business processes, it is necessary to learn knowledge from the environment, technology, organization and people. KM approaches and methods in business processes are correlated with their enablers.

Last, KM is an instrument that contributes to business process management and organizational competence, the foundations of sustainable competitive advantage through organizational learning.

5.1 Core business processes and process networks

5.1.1 Core business processes

Building on Porter's Value-Chain Model, Li et al. [Li et al. (2006)] proposes a framework for the 3PL business process, which classifies the business processes in 3PL as strategic processes, operational processes and enabling processes. These categories have the same theoretical foundation as the St. Gallen model and similar trichotomies. Operational

processes are a series of processes which range from developing customer's requirements to satisfying them. This category is quite similar to the business processes in the St. Gallen model. The main operational processes in 3PL include customer order fulfillment, transportation management, stock management, return management, customer relationship management (CRM), and customer service management.

Business processes in 3PL are those important services that 3PL provides to meet customer demand. 3PL companies offer a wide range of such services. The most frequently offered logistics services are: warehouse management/operations, transportation management/services, value-added services (labeling and packaging, relabeling and repacking, product assembly, product testing), freight consolidation and distribution, logistics consulting, logistics information systems, inventory management, spare parts, cross docking, product returns, order management (order processing, order fulfillment), product returns, rate negotiation, carrier selection, and fleet management/operations services [Randall et al. (1996), Xiao et al. (2009), Rabinovich et al. (1999)].

Each business process usually includes several sub-processes. Customer order fulfillment management is the basic sub-process for different business processes in 3PL (see Figure 5-1). This process links the customer, manufacturer, and 3PL providers; combines the flow of materials, knowledge and finance; and integrates warehousing and transport. The key challenges are optimizing the order fulfilling process, decreasing the total logistics cost and seamlessly integrating this process into the overall supply chain [Li et al. (2006)].

Transportation management and stock management are the traditional and most important business processes in 3PL. The main tasks are to assign the orders, arrange the schedule and route, organize the vehicles, and stock the products to meet the requirements of customer needs. In addition, customer service and CRM are essential throughout the entire business processes. Customer service extends from the beginning of contact with the customers to after completion of logistics service [Li et al. (2006)]. Good customer service management can enable better understanding and meeting of customer requirements. CRM supports the identification of the key customers and the maintenance of long-term cooperation with them, which provides valuable knowledge for decision making regarding business process design, development, operation and evaluation.

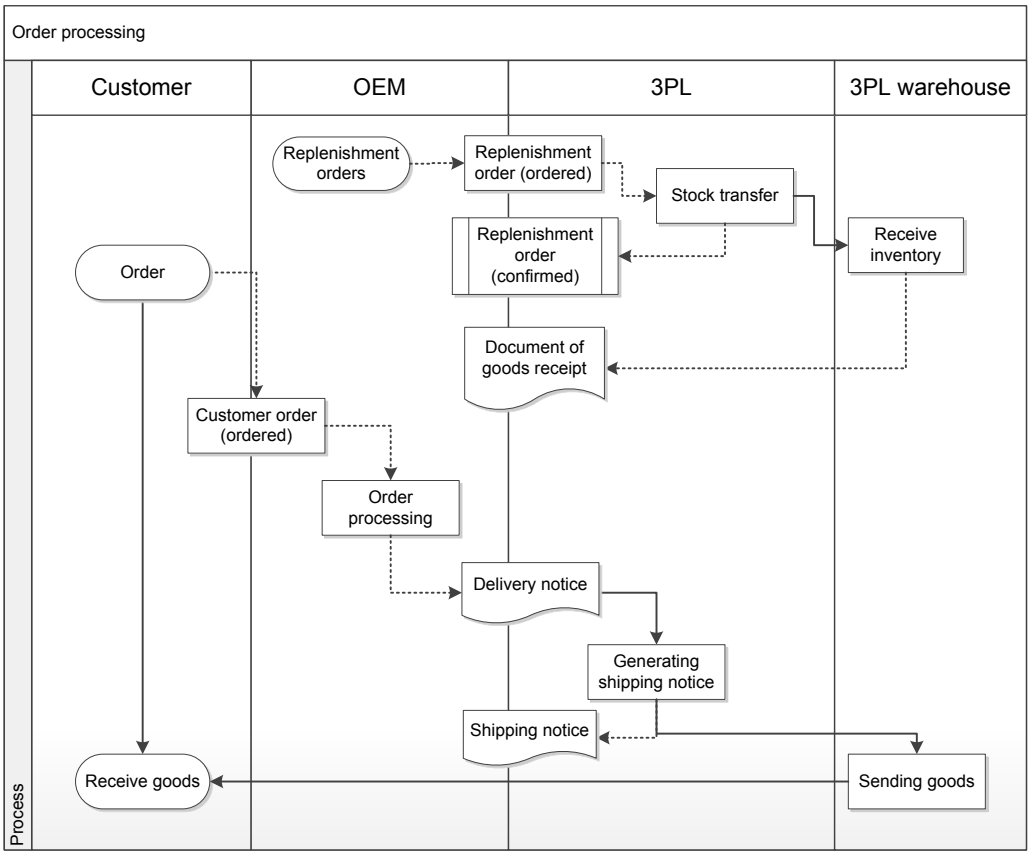

Figure 5-1 Order processing in 3PL
Source: [Liu & Sun (2011)]

The “20-80 rule” and “ABC Classification” also apply to business processes, which can be divided into core business processes and support business processes [Huang (2002)]. The core business processes are those which provide a superior customer benefit, as compared with competitors [Rüegg-Stürm (2005)]. They are those dominant processes that create the most value for the organization, e.g. the warehousing management process. They are indispensable parts of the organization that contribute to organizational performance, innovation and sustainable development [Zhang & Wang (2010)]. Support business processes provide information, resources, and services to the core business processes.

Identification of core business processes is helpful in making use of limited resources (e.g. time, people, capital, assets). There are two basic methods for identifying the core business processes. In the external environment, core business processes are determined by customer/market requirements. Core business processes are those that are essential to improve customer satisfaction. In the internal organization, core business processes are those that affect current operations and work [Liu (2005)].

In order to evaluate the core business processes, we should analyze them from the perspectives of external environment, internal organization, and knowledge characteristics in the business process. 1) Analysis of external environment: core business processes and activities determine the satisfaction of market and customers requirements, and have considerable influence on service quality and meeting the external demand. 2) Analysis of internal environment: first identify those processes that are necessary to complete key objectives, then analyze the competitive advantage, and the degree of influence on culture. Furthermore, confirm the business processes that have significant influence on strategic goals, organizational profit, development, competitive advantage, and value. 3) Analysis of knowledge: knowledge in core business processes is the special and difficult to learn knowledge that is accumulated during development, and which is imitated by competitors. Only when a business processes meets all these three criteria simultaneously, can it be regarded as a core business process.

Business processes in 3PL are: warehousing management, transport management, VAS, and consultancy. The warehouse management service 3PL enterprises offer is organized as projects. A project process includes project acquisition, project management, project implementation and project completion. This process has to consider more factors from the market as well as the organizational context (see Figure 5-2).

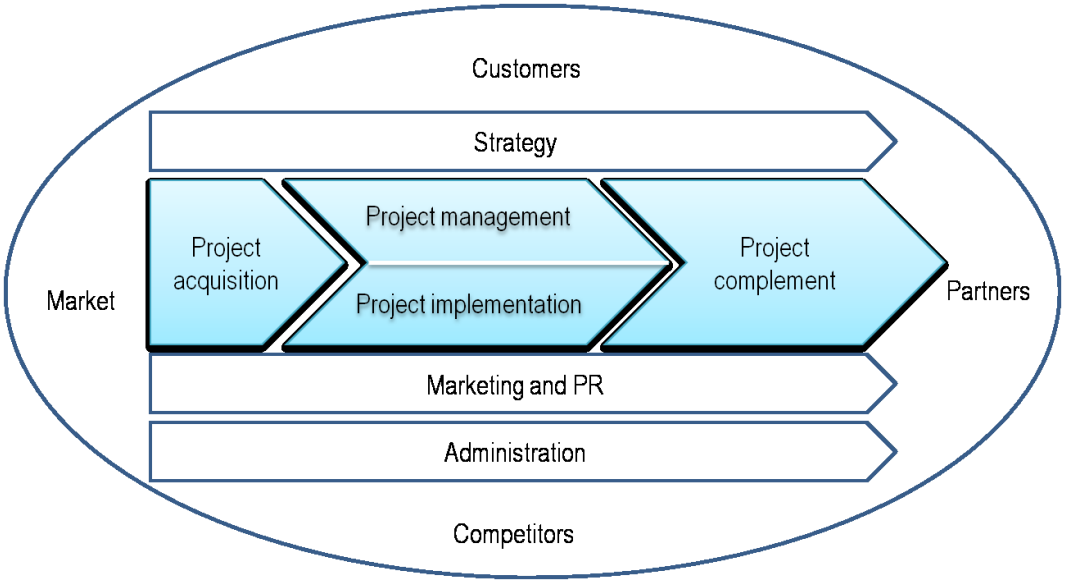

Figure 5-2 Project management process

Source: [Mertins & Seidel (2009)]

The business process of project management links both external and internal parties. The business strategy of project management, acquisition and support requires more knowledge from the external market, customers, competitors, and partners. Project implementation and completion need more knowledge of each step and activity from internal operations. Meanwhile, the project management process also links the management and support processes. The management process plans the goal, the procedure, the resource assignment, and the evaluation index, as well as monitoring project progress and measuring the performance of project execution. The support process includes marketing, PR, and administration, while IT provides information, knowledge, tools, etc., to the whole process of the project.

Taking warehousing management and operation as an example, we can analyze the process from three points of view. First, according to the environmental aspect, the business process of warehousing management comes from the requirements of the market. Considering cost and efficiency, more and more companies have outsourced some or all of the logistics process to 3PL service providers, becoming the customers of 3PL. Their specific requirements are valuable knowledge for 3PL to provide the right solution and better service. Sometimes, they need VAS, e.g. packaging, or site monitoring. Sometimes, they may need consulting service for a particular project. 3PL service providers, in order to obtain the project, usually need to make a fitting and appealing project plan, because they are competing with other 3PL service providers for customers. When they obtain the project and implement their plan, some of the processes need a partner's support, e.g. construction or extra human resources.

Second, according to the project procedure aspect, 3PL companies may acquire a project from within their own system, via customer recommendation, or through the market. Once they obtain the project with a reasonable proposal, they will promptly organize a team to manage the project. This project manager needs to consider the whole process and the required resources. When all necessary matters are settled, the project begins, which brings the plan from the mind into reality. The completion of the project ends with a review and feedback encompassing the whole project.

Last, according to the organization process aspect, the process of project planning, management, implementation, and completion not only depends on the business process (e.g. warehousing and transport), but also on the management and support processes (e.g.

marketing, IT, personnel and administration).

In short, it is a collaborative KM network for a project process. Effective communication and coordination between 3PL and customers, as well as partners, and between the business and management processes, as well as the support process, contributes to the success of a project.

Transport is an important traditional and modern service offered by 3PL companies. It is one of the core business processes that create great value for customers and generate high profit for 3PL providers. Transport services include road, rail, sea and air freight, as well as intermodal transport that combines some or all of the mentioned modes. Consultancy and VAS are usually a part of contract logistics. When customers have some special requirements, they will inform 3PL and write them into the contract. When there are changes made after project completion, the consultancy service is utilized. Changes may be about, for example, reengineering the warehouse or a new way to use the warehouse from the finished project.

5.1.2 Knowledge intensive core business processes

Business processes require knowledge [Davenport (2005), Remus (2002)]. However, the demand for KM can differ significantly, and only knowledge intensive processes are supported by specific KM solutions [Kern & Boppert (2010), Mertins et al. (2003)].

Knowledge intensive business processes are those that contain a high density of knowledge. Knowledge plays a significant role affecting decision making or the output of products/services [Tao & Min (2009), Van Leijen & Baets (2003)]. Such business processes are the key areas for KM. KIBPM should first define the knowledge intensive core business processes that strongly require knowledge and contribute to more output.

Knowledge intensive processes have, among others, the following characteristics [Gronau (2003), Davenport (2005)]: variability and exceptions (ability to schedule knowledge demand), diversity and incertitude of input and output, variety of sources and media, variance and dynamic development, many participants with different areas of expertise in the process, high degree of innovation, disposable scope for decision-making and insertion of creativity, complexity of work (meaning interpretation and judgment are required in the

process), a degree of recurrence, business criticality, requirement of experience, and requirement of a training period.

A method for diagnosing the knowledge intensive core business processes can be found in Figure 5-3 [Zhang & Wang (2010)]. It measures the importance of the business process and knowledge intensity and defines four categories. The knowledge intensive business process is in the starred box.

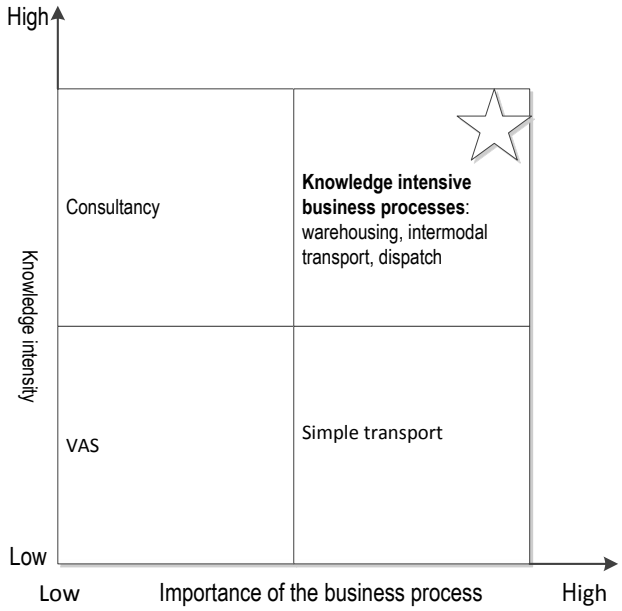

Figure 5-3 Knowledge intensive business processes

Source: adapted from [Zhang & Wang (2010)]

In 3PL, warehousing management/operation is the most knowledge intensive of the classical business processes, i.e. transport, warehousing management, consultancy, and valsue added services. It is usually a project with a 3 to 5 year or even longer contract. It also brings 3PL the most important customers and biggest profits, despite high demands in terms of time, cost, and human resource to do the project. A high level of professional experience and innovative solutions are also required to meet customer requirements. Warehousing management/operation also asks for considerable communication and cooperation to ensure the each step of the project runs smoothly towards the final achievement. Thus, it is the most knowledge intensive core business processes.

Moreover, the intermodal transport and dispatch processes are also knowledge intensive. They are more complex processes in terms of time and technique requirements. In order

to transport the goods to customers on time with high service quality and low cost, the assignment of the orders, mode, and route must consider all necessary aspects, among them: policy, finance, capacity, feasibility in planning, weather, time and quality in transporting, as well as tracking and tracing during the process. Intermodal networks have to handle network complexity (e.g. the amount of interrelated process decisions and the number of interfaces within the network), time challenges, and diversified customer requirements, bottlenecks in resources and capacities, safety and security [Haasis (2005), Haasis & Szafera (2005)].

Consultancy services are also highly knowledge intensive, but not as important as warehousing and intermodal transport. While simple one-mode transport is important, it is not normally especially knowledge intensive. Additionally, VAS too is less knowledge intensive business process.

5.1.3 Business process networks

Knowledge intensive core business processes have the characteristics of high importance, long-term duration, complex operation, experience base, etc. One more characteristics of them is the process network that highlights the difficulty and complexity of KM.

The integrated services of 3PL are always collaborative process. Generally the service includes: through transport service from suppliers to customers (optional), consolidated transport service from suppliers to distribution centers (optional), distributive transport service from distribution centers to customers (optional), and storage service conducted in the distribution centers. Also normally included are the related value-added services, such as handling, loading and unloading, and information services [Yi & Ju (2007)].

A narrow focus on the optimization of isolated business processes is too limited, and organizations should therefore investigate, support and improve their networks of business processes, especially focusing on interactions between them. The same situation applies to, and is even more critical for, 3PL, where processes are not operating separately, but interact with each other. Business processes range from developing customer requirements to satisfying them. This includes customer order fulfillment, transportation, warehousing, and customer service management. Management processes are responsible for planning strategy, designing the structure of the logistics network, and other tasks

which are critical to the operation and evaluation of business processes. They determine the competitive strategy, customer allocation strategy and location strategy that will guide the business process in the right direction. Support processes ensure the success of the strategic and operational processes, and include human resource management (HRM), information system management, infrastructure management, and financial management, among other ancillary activities [Li et al. (2006)].

The typical business process networks in 3PL include project cooperation, intermodal integration, and geographic collaboration. Project cooperation links the business, management, and support processes. Intermodal integration combines different modes of transport and storage. Geographic collaboration brings together the efforts and knowledge of various branches. The cooperative activities are typically temporary, dynamical with respect to their members, geographically distributed, flexible and quickly responsive to market demands [Sandkuhl et al. (2005)].

- *Project cooperation among business processes*

The contract logistics in 3PL are organized as a project of collaboration with different organizational processes. According to the St. Gallen process management model, there are management processes, business processes and support processes in an organization. The typical business processes in 3PL are: transport, warehousing; consultancy; and VAS. The planning, implementation and controlling of the project cannot be done only by a single business process, but through cooperation with other management and support processes. Figure 5-4 illustrates some examples of the three processes in 3PL, and the relationship between business processes and management/support processes.

There are both material and knowledge flows in the business process. These two value chains run well with the help of a good plan and strategy from the management process, as well as quality, systems, manpower, and financial guarantees from support processes. In particular, the knowledge flow within the project process, knowledge acquisition, storage, and distribution activities are supported by them. The project is a good example, within which team members usually come from different business processes (e.g. transport, warehousing), management processes (e.g. manager in business development), and support processes (e.g. IT engineer, accounting).

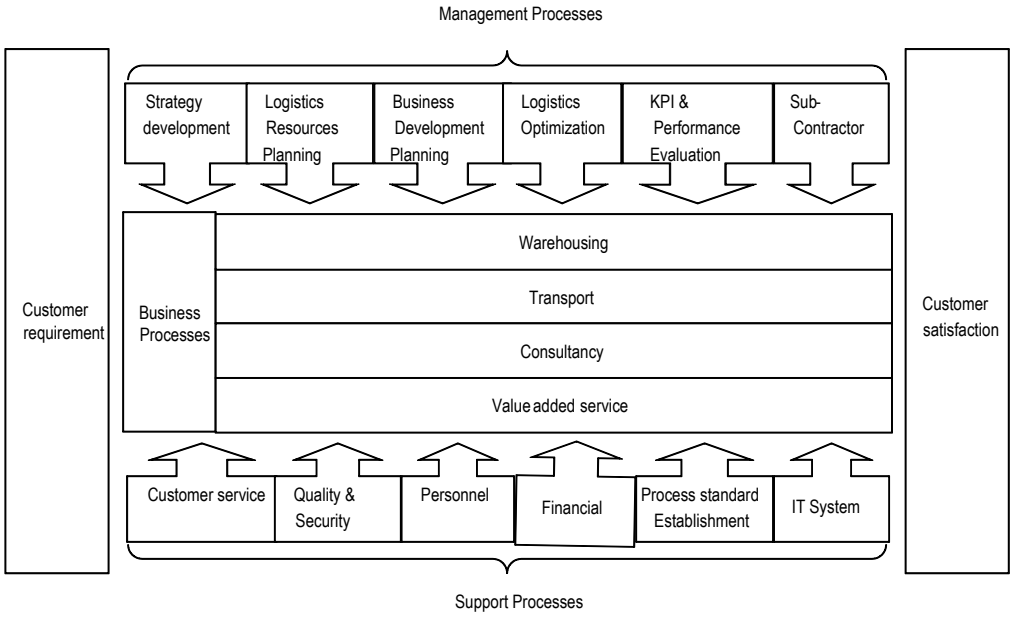

Figure 5-4 Organizational processes in 3PL enterprises

Source: extended from [Haasis et al. (2009), Wildebrand (2008)]

- *Intermodal logistics linking transport modes*

"Intermodal transportation is the movement of goods in one and the same loading unit or road vehicle, using successively two or more modes of transport without handling the goods themselves in changing modes [Muller (1999), for Europe (n.d.)]." It offers manufacturers a full range of transportation modes and routing options, allowing them to coordinate supply, production, storage, finance, and distribution functions to achieve efficient relationships [Rondinelli & Berry (2000)].

3PL is an activity that augments the transport system, which can strengthen the cooperation of different transport modes [Selviaridis et al. (2008)]. Intermodal transport is a typical network and collaboration in 3PL.This intermodal integration needs a strategic plan and the support of IT, human resources, and cost calculation, as well as knowledge and expertise regarding mode connection.

On the one hand, an effective integration of intermodal transport must have a feasible plan that will ensure high efficiency, quality, and security, and lower cost. The implementation of intermodal transport will be promoted by a proper IT system. On the other hand, both the strategic plan and operations must be based on understanding and experiencing solutions from different modes. The integration of multiple transport modes

requires a process or approach for execution and "*a higher degree of skills and broader knowledge of the transportation/supply chain processes… equipments, and infrastructures*" [Muller (1999)]. The success of intermodal transport depends largely on the knowledge sharing between multiple players. Knowledge sharing can generate more knowledge, skills, competences and resources for these players, thus enhancing competitive capabilities and improving responses to business opportunities [Liu et al. (2011)].

- *Communication between geographic networks*

With the fast growth of 3PL, many 3PL service providers have national and international branches. Sometimes a project or a transport order needs communication and collaboration between different branches. In this case, the collaboration can be the sharing of a vehicle and/or knowledge that will improve efficiency and lower the overall cost.

More often, branches need to discuss lessons learnt from projects, the practice of customer management, or new systems for coordinating with partners. For example, two branches may use the same sub-contractor. If they have no centralized management arrangement with the sub-contractor or timely communication, they may make duplicate contracts, but with different articles, which will increase the cost but decrease company work efficiency. If there is a centralized system for inputting the sub-contractor information, it will generate better performance with higher efficiency and lower cost.

5.2 Knowledge in core business processes and process networks[5]

Process knowledge in this paper is classified into three types: procedure knowledge, profession knowledge, and perception knowledge.

5.2.1 Procedure knowledge

Procedure knowledge is the process related knowledge, including the overall phases, steps, tasks, and activities required to manage a project. Another dynamic part of procedure knowledge is the real time progress of project operation. Each member knows the current situation of the project, whether it is going well or not. This kind of knowledge includes the

[5] The content of this section is a part of the article in [Zhang (2013)]

use of time, quality, and resources. Figure 5-5 describes the process of offer management in contract logistics. It is a kind of knowledge representation, and points out the necessary knowledge demand in contract logistics, e.g. project data, documents, reports, and plans.

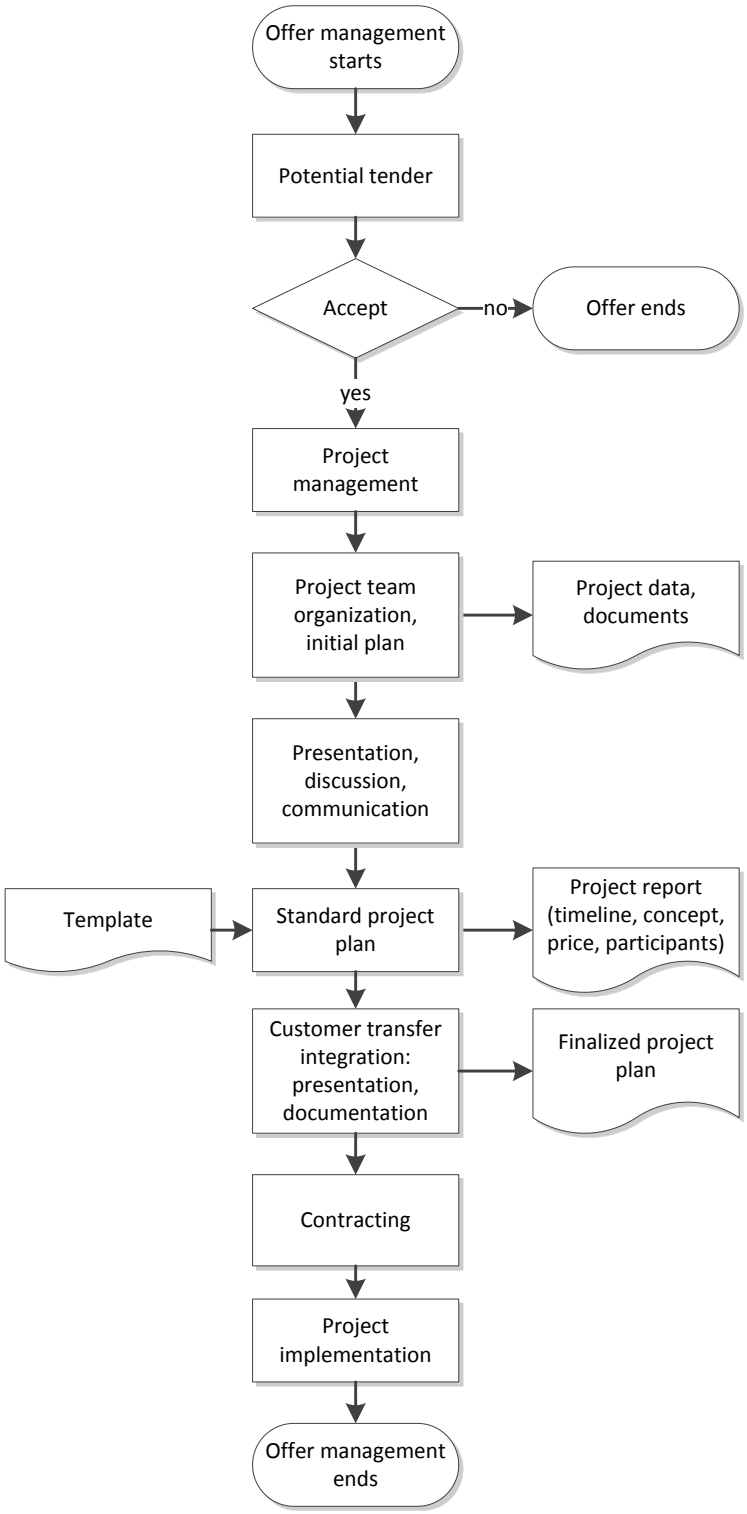

Figure 5-5 Procedure of offer management in contract logistics

5.2.2 Profession knowledge

Profession knowledge is the domain related knowledge in business processes. It covers various aspects, among others: business service expertise and experience, customer requirements, market and industry, logistics, sub-contractors, and logistics performance. Contract logistics services require professional planning, development and implementation of integrated logistics solutions. These solutions need knowledge and expertise in the fields of project experience, resources, techniques, IT, and construction.

- *Market knowledge*

Good project planning and implementation also need updated market knowledge. When the tender center calculates the price of renting a warehouse, they should know the latest prices and compare them with different offers. In addition, the plan flexibility, the legal requirements, and proper technical equipment are also of crucial importance.

- *Customer knowledge*

Customer knowledge includes customer requirements and characteristics of the specific industry. Knowledge and understanding of customer requirement are the basic considerations. Extensive knowledge of the industry is the premise for offering the best business solutions tailored to customer requirements. In order to focus on their competency, many 3PL enterprises occupy niches in certain industries, e.g. automotive, steel, aerospace, paper, high tech/computers, and retail/wholesale. Understanding customers' situations and developing knowledge about customers' business are of vital importance to being trustworthy as a 3PL service provider [Hertz & Alfredsson (2003)]. References from existing customers represent the most important method of finding new clients [Peters et al. (1998), Hertz & Alfredsson (2003)].

- *Logistics knowledge*

The field of logistics knowledge contains procurement and production logistics, distribution logistics, and spare parts logistics. The primary business activities include the storage, supply and delivery of production components, finished goods, semi-finished goods and spare parts, and customized value-added services and personnel acquisitions.

- *Knowledge about resources*

Resources in contract logistics include physical assets, human resources, capital, time, etc. The assets (e.g. one's own warehouse or a truck) are the foundation for managing a project. Human resources may be employees within the company or people from an outside company. Employees with different qualifications need to be coordinated and incorporated in a very short time to quickly create a strong team so that smooth operation and optimum results are ensured. Sub-contractors are an important partner of 3PL in supporting some parts of the business processes, e.g. construction or transport. Knowledge about the collaboration plan and progress contribute to the fulfillment of the project.

- *Project experience*

A professional planning and effective implementation of the proposed solution are extremely important. During the planning phase, knowledge from past projects will enable the team to quickly identify weak points and avoid potential danger. Meanwhile, collaboration with customers to define the processes and responsibilities from startup, to design the plan and put it into operation is crucial. There are some key questions before construction: Is it an existing property or a new construction? What is the predominant mode of transport links? How close is the object located to the facility? Knowledge about the answers to these questions will pave the way for a smooth project implementation.

- *Knowledge of technique*

Customer demands are diversified and dynamic. The use of appropriate storage technology, trucks, machinery and facilities, as well as a lot of other technical equipment are one of the prerequisites for the successful handling of logistics. The success of logistics solutions depends significantly on the implemented IT infrastructure. An advanced warehouse management system and modules from which to choose proper IT systems are necessary supports for logistics services.

- *Knowledge of security and sustainability*

The issues of quality, safety, health and environment are significant in planning and operating business processes. Sustainability is also a crucial consideration [Haasis (2004)]. Quality knowledge (e.g. knowledge of quality policies, quality process flows, goods

security during transport, waste, emission, and energy use) will contribute to customer satisfaction and service improvement.

5.2.3 Perception knowledge

Perception knowledge is the results-related knowledge. It comes from experience with business processes and will enrich both procedure knowledge and profession knowledge. Some ideas or methods contribute to optimizing the processes or activities (e.g. improved CTI procedures), while other knowledge supplements or updates logistics service.

Table 5-1 Knowledge content in intermodal transport

Orientation		Knowledge items
Time		Technical speeds of different traffic modes; Limitations of infrastructure capacity, and legal capacity to these speeds; Route distances impact on the timeliness of different traffic modes; Extra handling time (transfer of loading units between modes, services or players); Scheduled time table;
Cost		Budget of total cost; Price of different transport modes and infrastructures; Indemnity agreement of loss or damage insurance; Intangible cost (disturbance of ecosystem, obtrusive to urban and social groups); Invoicing issues;
Reliability	Matched capacity	Analysis and assessment of opportunities; Route choices at the planning phase; Simulation and prognosis of the transport capacities needed; Adaptability to the operation environment;
	Punctuality	Percentage of shipments arriving late; Degree of delay;
	Security& safety	Awareness on the subject of safety issues; Safety quality of candidates; Solutions for loss and damage control; Causes of damages;
Flexibility		Requirements and conditions of dangerous goods shipping; Unforeseen changing circumstance and disturbances (natural disasters, war, strike etc.); List of circumstances which would require using alternate traffic modes;
Legitimization		Border procedures (customs inspections, official quarantines); Current situation and tendency of related laws and regulations.

Source: [Wu & Haasis (2012)]

There are generally two parts to perception knowledge. On the one hand, good practice includes dos, such as contract checklists, improvement of customer claims management, and innovation of knowledge sharing systems. On the other hand, lessons learned include don’ts, such as mistakes to avoid in calculation, problems of quality and security to consider during construction, and so on. Knowledge can come from different entities, among them customers, shippers, the market, partners and even competitors.

Besides the above mentioned classification, another way to define the knowledge in 3PL service is according to the orientation of knowledge content. Table 5-1 gives an example of knowledge content in intermodal logistics.

5.3 KM foundation: knowledge sharing and transfer

As discussed in chapter 2, knowledge can be classified into two types: explicit and tacit knowledge. While explicit knowledge contributes to the planning, accomplishment and improvement of business processes, tacit knowledge plays a central part in a firm's sustainable competitiveness, because is hard to copy [Nelson & Winter (1982)]. The daily work of transport in 3PL requires the workers to be familiar with the order processing knowledge, driving skills, goods and customer information, most of which are explicit knowledge. However, intermodal transport needs much more tacit knowledge besides the above mentioned explicit knowledge. Before transporting the good, a feasible plan is the premise for ensuring the success of the whole process. This plan requires a profound understanding of the integrated modes, rich experience in route designing, solutions for possible problems in the process, and so on.

Since tacit knowledge is a valuable asset for companies, it is necessary to organize and manage such knowledge so that it can be reused and create more value. How to manage the knowledge? The foundation of this management is knowledge sharing and transfer. The success of KM initiatives depends on knowledge sharing [Wang & Noe (2010)], as knowledge must be shared to be useful and applicable [Raghu & Vinze (2007)]. Knowledge sharing is a cross docking center to which people contribute their own knowledge, acquire knowledge, and learn from others. In 3PL, it can exchange individual knowledge, as well as complement and refresh existing organizational knowledge. Knowledge sharing is the source of knowledge flow, and knowledge transfer is the wheel of KM.

5.3.1 Issues of knowledge sharing and transfer

In the knowledge intensive core business processes of 3PL, knowledge sharing and transfer are critical for improving business process performance. Knowledge sharing refers to the provision of task information and know-how to help or collaborate with others in order to solve problems, develop new ideas, implement policies or procedures [Wang & Noe (2010)]. The forms or ways of sharing knowledge include job-related documents, organizational rules, working procedures, personal experience, or face-to-face communications through networking with other experts [Cummings (2004), Pulakos et al. (2003), Lu et al. (2006)]. Knowledge transfer involves both knowledge sharing by the knowledge source and knowledge acquisition and application by the recipient [Wang & Noe (2010)]. Nevertheless, they are not separate activities. Knowledge sharing is the action and behavior, while knowledge transfer is the objective and result. They both move together before, during and after KM implementation.

Knowledge sharing is the foundation of KM, and the basis for organizational learning. It is the fundamental means through which employees can contribute to knowledge application, innovation, and ultimately the competitive advantage of the organization [Jackson et al. (2006)]. If knowledge stays in the individual mind, it can be neither transferred from tacit knowledge to explicit knowledge, nor from the individual to the team and organization, In this case, there is no chance to learn and manage knowledge in order to improve business process management and organizational competency. Due to failing to share knowledge, Fortune 500 companies lose at least $31.5 billion per year [Babcock (2004)]. The success of KM initiatives depends on knowledge sharing [Wang & Noe (2010)]. Only when knowledge is shared is it possible to acquire, produce, store, distribute and reuse it.

Knowledge is critical and can bring considerable benefits for 3PL providers. Knowledge sharing enables inter-process and inter-organizational networking and collaboration. When organization members compliment each other's limitations i organizations can specialize, and develop superior knowledge [Wijnhoven (1998)]. Furthermore, the sharing of explicit and tacit knowledge within or across teams and organizations is a valuable source of competitive advantage, helping organizations promote best practices and reducing redundant learning efforts or 'reinventing the wheel' [Hansen (2002)]. In general, knowledge sharing potentially contributes to reductions in production costs, improved

team performance, firm innovation capabilities, and firm performance [Arthur & Huntley (2005), Cummings (2004), Lin (2007), Mesmer-Magnus & DeChurch (2009)].

Compared with material sharing in logistics management, knowledge sharing has some similarities. They move in two important flows in the same logistics process and networks. They can both be shared in order to improve efficiency and lower transaction cost. Moreover, they interact with each other as material flow provides knowledge and knowledge supports material flow. However, knowledge sharing also has several differences. First, knowledge is an intangible asset, it cannot be stored and transferred like goods that can simply be packed and moved, although knowledge can be packaged after codification as informational products (e.g. software, information systems) or solutions. These require transport and interpretation, during which distance can be more easily overcome by IT communication, although cultural differences are more difficult to solve [Wijnhoven (1998)].

Knowledge sharing is critical not only in business processes (e.g. transport, warehousing and consultancy), but also in business process networks (e.g. project management, intermodal transport plan and operation, and collaboration between branches). In project management, knowledge sharing and transfer are the premises for a professional effective project planning, organization, operation and controlling. In intermodal transport, knowledge sharing is the basis for efficient communication and coordination. The required knowledge includes position of freight and vehicles, expected arrival and waiting times, alternative routes, transport modes, and so on [Bernaer et al. (2006)]. Moreover, some business processes are accomplished by collaboration between branches; knowledge sharing and transfer are indispensable for successfully running a business and improving performance .

However, it is still a great challenge to motivate knowledge sharing within an organization. Because knowledge sharing relates to estimation of cost and benefit, knowledge power and sense of security, individuals are often unwilling to share core knowledge, which is always tacit, as they do not want to share the knowledge that builds their core competencies. The key factors that enable or hinder knowledge sharing and transfer include the organization, people, and technology. Cultural, structural, competency, and external environmental contexts [Dixon (2000)] are especially vital for knowledge

sharing. The motivation for knowledge sharing includes external and internal motivation, as well as self motivation.

5.3.2 Game analysis of knowledge sharing and transfer

In 3PL, knowledge sharing and transfer include four aspects of cooperation: that between 3PL companies and other participants in the logistics network, between individuals, between team members, and between organization and individual. This section will study the last three aspects of knowledge sharing within the organization.

- *Knowledge transfer between individuals*

When deciding whether or not to share knowledge, employees will estimate the cost and benefit of doing so, They naturally all hope to obtain the best utility for themselves, therefore, there is a game process. Suppose that employee A and employee B make a game for knowledge sharing. They are both rational people, and their knowledge is useful for the organization. They both have two choices: sharing knowledge, or not sharing knowledge. The interaction of these choices can be expressed as an equation.

U_{A1}, U_{B1} are the non-transferable values of participant A and participant B.

U_{A2}, U_{B2} are the transferable values of participant A and participant B.

U_{A3}, U_{B3} are the joint value when participant A and participant B share knowledge. Joint value is the value of newly acquired knowledge from knowledge sharing between participants, due to the difference of core competency of different employees [Loebbecke et al. (2001)].

U_{A4}, U_{B4} are the added value when participant A and participant B share knowledge. Added value is the capability of the receiver to enhance their competency by using others' knowledge.

U_{A5}, U_{B5} are the negative effect when participant A and B share knowledge.

α_A, α_B are the knowledge absorption capability coefficient of participant A and B.

Hence, the profit matrix is as follows in Table 5-2.

Table 5-2 Profit matrix of knowledge sharing between employees

Employee A	Employee B	
	Sharing	Not sharing
Sharing	$\alpha U_{B2}+U_{A3}+U_{A4}-U_{A5}, \alpha_B U_{A2}+U_{B3}+U_{B4}-U_{B5})$	$(-U_{A5}, \alpha_B U_{A2}+U_{B4})$
Not sharing	$\alpha_A U_{B2}+U_{A4}, -U_{B5})$	$(0,0)$

Source: adapted from [Zhang & Wang (2010), Hao & Yanmei (2009)]

In general, joint value relates to negative effect. Low joint value comes with low negative effect, while high joint value comes with high negative effect.

Table 5-3 Result of knowledge sharing game between employees

	Equilibrium Outcome
$U_{A3}<U_{A5}, U_{B3}<U_{B5}$	(not sharing, not sharing)
$U_{A3}<U_{A5}, U_{B3}>U_{B5}$	(not sharing, not sharing)
$U_{A3}>U_{A5}, U_{B3}<U_{B5}$	(not sharing, not sharing)
$U_{A3}>U_{A5}, U_{B3}>U_{B5}$	(not sharing, not sharing), (sharing, sharing)

Source: [Zhang & Wang (2010)]

- *Knowledge transfer between individual and team*

The team is important in 3PL, especially in project management. Every team member has some unique knowledge, which will benefit both the individual and the team if they are willing to share their knowledge. Knowledge sharing between team members is a dynamic and repetitive game process of incomplete information. Normally if one member shares his or her knowledge, he or she can also acquire knowledge from other members. If one member chooses not to share knowledge at the first stage, then others won't share knowledge with him or her in the next stages. In this game process, the situation can be cooperative or non-cooperative. Figure 5-6 shows this game model of knowledge sharing between team members.

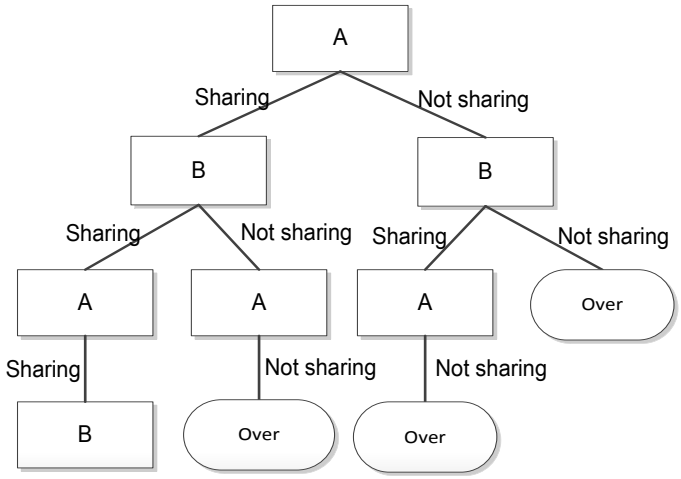

Figure 5-6 Game model of knowledge sharing in a team

Source: adapted from [Huang et al. (2007)]

This is a cooperative game. If member A chooses to share knowledge at the beginning, and member B makes the same choice, then the game will continue. If member B chooses not to share knowledge, he or she may obtain profit once. However, the team knowledge sharing game is repeated, so member A and member B will meet in the next game stage., B will then lose the trust of, and knowledge sharing with, member A, hence the game is over. If member A shares knowledge with member B at the beginning, and member B knows this choice, then B won't share knowledge regarding personal interests. This ends the game process. If member B doesn't know the choice of member A (i.e. not sharing knowledge), he or she may choose to share knowledge, thus member A can profit once. In the next stages, though, member B won't share knowledge and the game is over.

For the team and organization, knowledge sharing between team members will improve the knowledge level of the whole team, as well as overall productivity and competency. If team members share knowledge, this will generate more complex and valuable knowledge [Nonaka & Takeuchi (1995)]. For example, in warehousing management, if a member shares his or her knowledge of a lower price for some construction materials, this will contribute to project planning and implementation.

However, the team members may not be willing to share knowledge, because doing so will decrease the benefits of remuneration, reputation or status in the organization which a knowledge monopoly brings. Therefore, team members generally hope to share others' knowledge, but not to actively contribute their own knowledge.

- *Knowledge transfer between individual and organization*

For the organization, it is best to make employees share their core knowledge with other employees, thus enabling the transfer of individual knowledge to organizational knowledge, and increasing or updating organizational knowledge. If all employees are willing to share knowledge, this will improve individual knowledge and benefit the whole organization. However, knowledge sharing depends on the willingness of the knowledge owner. Since it is difficult for organizations to measure the behavior of employees' knowledge sharing, there is game between organization and employees. Because it is difficult to measure knowledge sharing and transfer by employees, organizations cannot calculate the cost of motivation according to the amount of knowledge sharing and transfer by employees, the choice will be motivating or not motivating.

Knowledge sharing at this level can be understood with the following formula. The cost and benefit of employees' knowledge sharing and transfer is the function for knowledge shared by employees (k). W is the cost to the organization of motivation. $C(k)$ is the cost of knowledge transfer by employees. This cost includes two parts. One is the time and energy cost, as well as the competency loss of the knowledge owner. The other one is the time and energy, as well as the opportunity cost of the knowledge receiver. $\pi(k)$ is the output gain of the organization from knowledge sharing and transfer. The profit matrix of knowledge sharing between employees and organization is shown in Table 5-4.

Table 5-4 Profit matrix of knowledge sharing between employees and organization

Employee	Organization	
	Motivating	Not motivating
Transferring	$(\pi(k)-W, W-C(k))$	$(\pi(k), -C(k))$
Not transferring	$(-W,W)$	$(0,0)$

Source: adapted from [Zhang & Wang (2010)]

From this profit metric, we can learn that the best choice for the organization is to not motivate, and the best choice for employees is to not transfer. (Not motivating, not transferring) is a Nash equilibrium, and the game of knowledge transfer from employees to the organization is a "Prisoner's Dilemma", though it is good for both parties. As public goods, a knowledge supply of Pareto Optimality (Pareto Efficiency) is greater than that of

the Nash balance, so the individual willingness to supply knowledge leads to an insufficient knowledge supply in the organization. Therefore, it is difficult to realize knowledge sharing and transfer.

5.3.3 Motivation of knowledge sharing and transfer

Table 5-5 Factors influencing knowledge sharing

Factor		Examples
Organizational context	Organizational culture and climate	Trust, innovation, learning culture, norms of reciprocity in communities of practice
	Management support	supervisory control (i.e., perceived supervisor influence over utilizing the KMS in the organization appropriately),control of rewards for desired behavior (i.e., reward power)
	Organizational structure	less centralized organizational structure, open workspace, communication across departments and informal meetings, job rotation
	Rewards and incentives	recognition and rewards (promotion, bonus, and higher salary), performance-based pay system, cooperative reward system, competitive system, piece-rate and tournament incentives individual- and group-based incentives, billable hour system
Cultural characteristics		national cultures and languages
Interpersonal and team characteristics	similarity-attraction paradigm,	team communication styles
	Diversity	Team characteristics and processes, acknowledgement of team members' expertise
	Social networks	communities of practice
Individual characteristics		individual personality or dispositions, openness to experience, level of education and longer work experience, confidence of sharing useful knowledge
Motivational factors	Beliefs of knowledge ownership	internal satisfaction derived from sharing knowledge, increased internal satisfaction, perceived obligation to reciprocate the knowledge, technology-aided sharing context, time and familiarity with the subject
	Perceived benefits and costs	trust and justice, distributive justice, procedural justice, and cooperativeness
	Individual attitudes	expectations of the usefulness of knowledge and relationship improvement, subjective norms and physicians' intention, senior managers' perceptions of encouraging knowledge sharing, organizational attitudes including job satisfaction and organizational commitment

Source: extended from [Wang & Noe (2010)]

According to Maslow's hierarchy of needs [Maslow et al. (1970)], human behavior is motivated by five classes of needs: basic (e.g. food, water), safety (e.g. secure environment), belonging (e.g. love, affection), esteem (e.g. self-respect, recognition from others), and self-actualization (e.g. reaching one's full potential). The motivation for knowledge worker comes from his three highest hierarchical levels [Tampoe (1993)]. Knowledge-sharing behaviours are also influenced by individual, interpersonal and organizational factors, such as organizational context, interpersonal and team characteristics, cultural characteristics, individual characteristics, and motivational factors [Wang & Noe (2010)]. Table 5-5 describes some factors and examples.

How to motivate knowledge sharing is a critical issue. In general, the motivation of knowledge sharing should basically concern the enablers/barriers to technology, organizations, and people. This study will focus on people and organizations. There are two measures to motivate the sharing and transfer of process knowledge. One way is through the business process and KMS, and the other way is through incentive mechanisms. Figure 5-7 shows the overall incentive measures for knowledge sharing and transfer in 3PL.

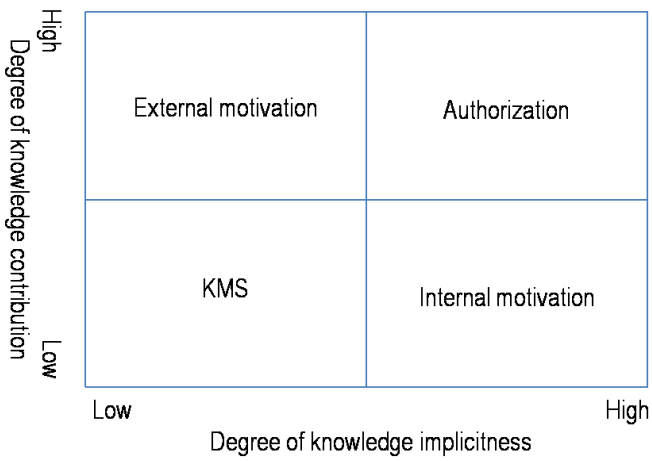

Figure 5-7 Incentive measures for knowledge sharing and transfer

Source: [Zhang & Wang (2010)]

For knowledge that has low degrees of contribution and implicitness , e.g. the loading and unloading process of trucks, KMS can support and realize knowledge sharing and transfer. For knowledge that has a low contribution degree but a high implicitness degree, e.g. personal report writing skills, sharing and transfer depend on the knowledge owners' own initiative. For knowledge that has a high contribution degree and a low implicitness

degree, e.g. better route design for intermodal transport or a lower warehouse renting price, external motivation for knowledge sharing should be adopted by the organization so that it can improve business efficiency and performance. For knowledge that has high degrees of contribution and implicitness, e.g. innovation of core technique for system development, it is appropriate to authorize and delegate the knowledge owners to share their knowledge.

The rapid advance in information technologies facilitates knowledge sharing. ICT can enhance knowledge sharing by lowering temporal and spatial barriers between knowledge workers, and improving access to knowledge [Hendriks (1999)]. Examples of ICT tools for facilitating knowledge sharing are intranet [Marshall (1997)] amd multi-agent knowledge sharing platforms [Wu & Haasis (2012)].

Table 5-6 ICT support for knowledge sharing

Knowledge	Goal	Example
Knowledge	Remove barriers Provide access to information Improve process	Groupware Intelligent agents, DIS CBR, expert systems
Meta-knowledge	Locate knowledge carriers or seekers	Automated knowledge maps

Source: [Hendriks (1999)]

The touchstone for successful ICT applications for knowledge sharing is the question of how they relate to these ambitions, and to the motivation of knowledge workers to meet them: [Hendriks (1999)]. Tacit knowledge can be divided into two types: knowledge that can be transferred, and knowledge that cannot be transferred. For the former category, we can employ incentive measures, including positive and passive incentives (carrot-and-stick), physical or mental incentive measures, or explicit and tacit incentives [Stenmark (2001)]; for the latter knowledge category, incentive measures do not always succeed. One solution to this problem is delegation and authorization.

Figure 5-8 is a motivational model of knowledge sharing and transfer from the people and organizational perspectives. In order to motivate knowledge sharing in core business processes of 3PL, the context should be constructed. The environment (e.g. culture) and reality (e.g. business process) are the basis ("Ba"). At the individual level, trust, communication, confidence, and a tutoring system, for example, are important for allowing employees to share knowledge with others. At the group level, an open

environment for communication, such as meetings, seminars and self management teams, are critical. At the organization level, authorization, flexible working hours and location, and promising career development are essential. Overall, a knowledge community, organizational learning culture are fundamental for knowledge sharing and transfer.

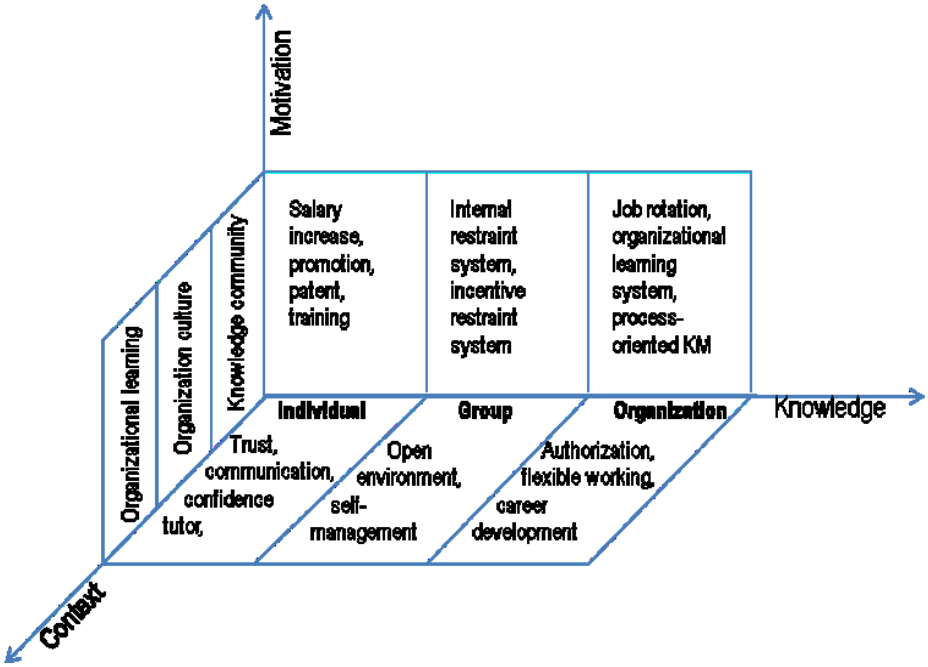

Figure 5-8 Motivation of knowledge sharing and transfer

Source: adapted from [Zhang et al. (2008)]

Base on the context construction, incentive mechanism with effective tools must be established to motivate knowledge sharing in different levels and processes. At the individual level, incentive measures include salary increase, promotion, patent rights, and training. At the group level, an internal restraint system and an incentive restraint system can promote knowledge sharing in teams. At the organization level, job rotation, an organizational learning system, and process-oriented KM will motivate knowledge sharing and transfer. In addition, the combination of traditional communication channels and modern information technology (e.g. synchronous multimedia technology, such as video-conferencing) is effective for knowledge sharing.

Effective motivation should match the behavior of the agent with the expectation of the principal. On the one hand, the information balance between principal and agent is incomplete and asymmetrical. It is impossible to achieve perfect information symmetry, so the goal of motivation is to minimize the information asymmetry. On the other hand,

the motivation should combine both internal and external incentives, as well as positive and negative incentive measures. Internal incentives are the cultivation of the conscious awareness of employees by enlightening them, and by making them develop the idea of knowledge sharing and undertake the expected actions. In this way they should gradually come to regard the organizational concept as a self standard. External incentives involve adopting some measures to reward the employees for behaviours that match the expectations of the organization (positive incentive), while punishing behaviors that are opposed to organizational interests (negative incentive), i.e. carrot-and-stick instruments.

Positive incentives include physical and mental varieties that pull the agent to behave according to the principal's wish. These are 1）salary, 2) promotion, 3) training, 4) culture and atmosphere, 5) structure, 6) knowledge community, 7) interests and options, 8) knowledge acknowledgement, and 9) authorization. When an employee shares his/her knowledge, thus contributing to logistics service, he/she should be rewarded.

Negative incentives include measures that punish agent when they violate the agreement so that they won't do it again. These incentives motivate people to avoid wrong actions, thus directing them toward right actions. The elimination of employees who fail to keep pace with new knowledge is one kind of negative incentive measure. It can be evaluated by annual examinations, the content of which is the updated knowledge in the logistics industry and the department; employees who are in the bottom 30% will be warned with yellow cards the first time, red cards the second time, and will be fired the third time. Additional incentives include power constraint, competition incentives, moral incentives.

Nevertheless, in 3PL enterprises, some tacit knowledge in the core business process has accumulated over a long period time, and is difficult to transfer, thus requiring more time and money to motivate knowledge sharing. A better choice for 3PL is to delegate the decision making to the knowledge owner, and support them with some incentive measures, so that the employees will spontaneously and consciously share their knowledge. It is worth noting that authorization should have different degrees: 1) constraint authorization, 2) flexible authorization, 3) incomplete authorization, and 4) complete authorization.

Principal-agent theory aims to model the relationship between principals and agents, in order to better motivate agents to behave in ways more beneficial to principals. Suppose

that there are two persons, one is the principal, and the other is the agent. The principal hopes that the agent will behave in his/her interest, but he/she cannot see directly what behavior the agent has chosen, only some other incomplete information. The issue is how the principal can motivate the agent to choose behavior that benefits the principal most, according to the observed incomplete information.

5.4 KM implementation: activities, enablers and approaches

5.4.1 Core KM activities

The goals of knowledge processes focus on knowledge adjustment, effective distribution to business parts and knowledge sharing, knowledge storage, and enabling effective and efficient knowledge combinations [Wijnhoven (1998)]. The availability of required knowledge in the relevant process has to be guaranteed by keeping the employee in the process or by codification and dissemination of his tacit knowledge. The demanded knowledge has to be presented to an employee or the process by means of instructions, procedures, lists of jobs, and so on. [Kern & Boppert (2010)].

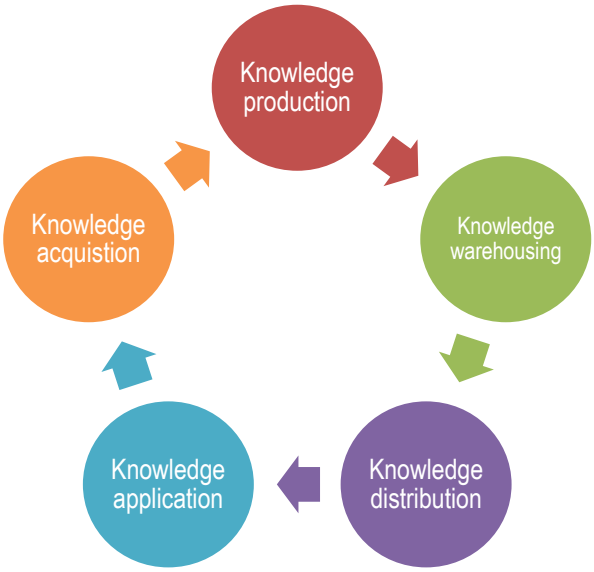

Figure 5-9 Core activities of KM

This work defines the core KM activities from the perspective of logistics management: knowledge acquisition, knowledge production, knowledge warehousing, knowledge distribution, and knowledge application [Zhang (2012)]. Figure 5-9 describes these activities in the KM process. These activities are adopted from the concepts of logistics management, since they have similar flows, and requirements of quality, time, context,

security, and sustainability. Moreover, in this process, KM needs to consider many aspects, such as knowledge sharing, transfer, quality, time, cost, security, and other. These are quite similar to the requirements in the logistics management process.The differences between them are the intangible nature of knowledge, the transfer media, and the difficulty of transparency.

Knowledge acquisition: Knowledge acquisition refers to knowledge sources and the ways to get access to such knowledge. Knowledge is acquired from either external or internal sources, and in three main processes: communication (talking to somebody), transaction (buying a document or transferring a certain form of property rights, such as patents or copyrights), and cooperation (working together on a project).

Knowledge production: Knowledge production refers to how the acquired knowledge is represented and expressed so that others can understand it. The raw materials of knowledge production can be data, information, or knowledge, and the products are always in the form of information and data.

Knowledge warehousing: Knowledge warehousing refers to the repositories for storing knowledge, either in documents or systems. The forms and places are kinds of warehouse, with different functions, locations, pallets, cargoes, containers, and so on.

Knowledge distribution: Knowledge distribution refers to the means of delivering knowledge to the people who need it.

Knowledge application: Knowledge application refers to where and how the stored knowledge is used and updated. It is the most important activity and the fundamental objective of KM. Performance improvements from KM and associated technologies result when knowledge is actually applied [Alavi & Leidner (2001)].

This circle describes the core activities of KM, or the management activities of knowledge flow. However, there are some points to clarify. First, the process is not strict but flexible. Knowledge is intangible; it is different from the tangible resource (e.g. material) and the flow process is not as strict as that of the goods flow. It can start from any stage. For example, starting from knowledge application, the practice generates knowledge, this knowledge is acquired and then produced, stored, distributed, and finally applied.

Second, the KM must sometimes cover not all, but only some activities, depending on the situation. For transport by rail, for example, the main activities are knowledge acquisition, warehousing and application, since most of the knowledge is explicit. For intermodal transport, however, more complex knowledge is needed about the different modes and more communication is needed between different agents; the KM activities thus include more than knowledge acquisition and application.

Third, besides these activities, there are other activities and possibilities to consider. During delivery or transport of the knowledge, there should be a way to check knowledge quality, to make sure that the knowledge is correct and updated, and to guarantee the security of the core knowledge. The conservation and updating and continuously controlling of knowledge are of vital importance for the success of KM activities [Haasis (2008)].

KM can be understood through the concept of logistics and supply chain management. KM is about knowledge demand and knowledge supply, and the core process activities can be summed up as "plan, source, make, deliver, return". Along with these activities, knowledge sharing runs through the whole process of this chain. Moreover, knowledge delivery, including transfer, warehousing, and distribution is knowledge logistics.

5.4.2 Enablers for KIBPM implementation

Factors enabling KM can generally be grouped into the following categories: environment, technology, organization and people (ETOP). both internal and external to the organization (see Figure 5-10). Specifically, external environmental factors include market dynamics, industry competition and cooperation, and development trends. External technology includes the updated logistics systems and communication tools applied in 3PL. External organizational factors include exiting and potential competitors, partners such as sub-contractors. External people factors include communication and interaction with people from different organizations, industries, or locations.

Internal environmental factors include organizational culture, networks and atmosphere. Internal technology factors include information and communication technology, while organizational factors include leadership, structure, management support and organizational rewards. People factors include enjoyment in helping others and knowledge self-efficacy. This chapter will focus on the internal ETOP factors.

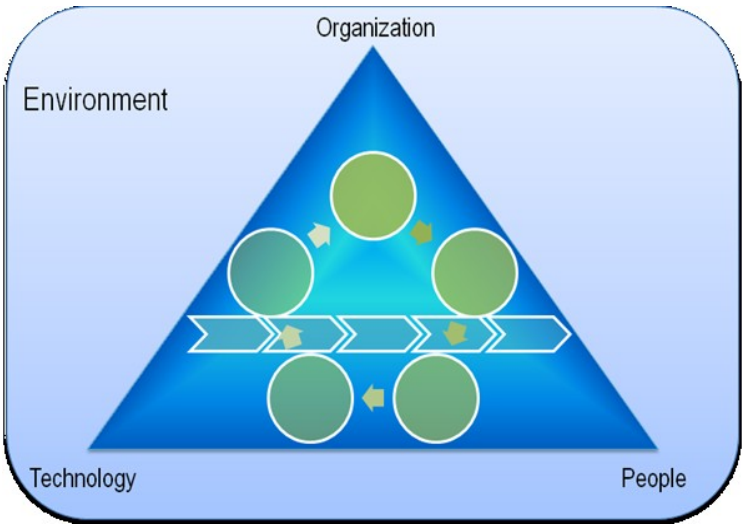

Figure 5-10 KM enablers

Source: [Zhang (2012)]

Environment: it is normally easier to enable KM in an open, friendly, and mutual-trusting environment, which provides employees more freedom and consciousness to share knowledge, so that knowledge can be acquired, stored, distributed and applied in business processes. Moreover, networks of different processes, departments, transport modes, and locations emphasize the collaboration and necessity of KM.

Technology: effective KM solutions need integration and cooperation with different KM systems to achieve common business goals [Rollett (2003)]. Typical KM systems are yellow pages, process communities and knowledge networks, knowledge maps, content management system (CMS), database management system (DBMS), office automation (OA) [Gai & Dang (2010)].

Organization: a culture emphasizing trust and innovation is conducive to knowledge sharing. Process-oriented structures and mixed structures combining processes and functions are more efficient and effective at supporting business and knowledge flow. Knowledge sharing should be demonstrated by emphasizing sharing "lessons learned" instead of "mistakes made" [Teo (2005)]. Additionally, leadership, structure, management support, business processes, and organizational rewards are the key factors of organization that influence KM strategy and implementation.

People: enjoyment in helping others and knowledge self-efficacy are beneficial here. People in business processes are the knowledge carriers and enablers. Knowledge is generated from people's practice and thinking. When they are willing to share knowledge,

it is possible to store that knowledge in organization memory. The valuable knowledge can then be distributed and applied in business processes towards improved performance and sustainable competitive advantage.

5.4.3 Approaches to KIBPM implementation

Table 5-7 KIBPM approaches

KM \ Enabler	Technology	Organization	People
Knowledge acquisition	Subscription, database, forum, expert directory, groupware, search engine, wiki/blog, knowledge map, knowledge dictionary	Community of practice, forum, interview, training, workshop, knowledge manager, idea management,	Subscription, action learning, checklist, coaching, community of practice, debriefing, forum, portal, training, workshop
Knowledge production	Database, discussion forum, manual, model, wiki/ blog	Community of practice, workshops, knowledge manager	Action learning, coaching, community of practice, idea management, training, teamwork
Knowledge warehousing	Best practice, database, discussion forum, portal, FAQ, groupware, organizational instruction, wiki/blog, knowledge dictionary	Subscription, debriefing, portal, interview, enterprise newspaper, knowledge manager	Subscription, debriefing, manual
Knowledge distribution	Subscription, best practice, discussion forum, portal, FAQ, manual, organizational instruction, visualization technique, wiki/blog, knowledge map	Subscription, best practice, coaching, portal, training, enterprise newspaper, knowledge manager	Action learning, checklist, coaching, community of practice, forum, experts directory, interview, workshop, teamwork
Knowledge application	Checklist, experts directory, FAQ, manual, model, search engine, knowledge map, knowledge dictionary	Best practice, coaching, debriefing, organizational instructions, training, knowledge manager	Checklist, coaching, debriefing, experts directory, manual, model, teamwork

Source: compiled and extended from [Fraunhofer (2011), Haasis (2008), Haasis & Kriwald (2001)]

Various KM approaches has been discussed in the literature and used in practice, with the aim of enabling the ETOP factors and overcoming the barriers. There are two basic approaches of managing process knowledge: making the process itself more intelligent (adequate for simple processes), and making the employees concerned with the process (suitable for more complex processes) more intelligent [Engelhardt et al. (2004)]. This section chooses some possible KM approaches for application in the business processes of 3PL enterprises (see Table 5-7).

5.5 KM improvement: communication and learning

KM is important for 3PL in modern society, but it is challenging. On the one hand, knowledge sharing must be motivated, so that KM is possible. On the other hand, KM is just a way to actively enable knowledge flow in business processes and to support organizational goals. In order to improve KM continually and keep sustainable organizational competency, KM should consider and pay attention to transparency and organizational learning.

5.5.1 Knowledge transparency and communication

A very common and typical issue in KM is the transparency of knowledge during knowledge exchange. Here knowledge exchange includes both knowledge sharing (employees providing knowledge to others) and knowledge seeking (employees searching for knowledge from others) (e.g., [Cabrera et al. (2006)]). Usually it is not fully transparent to the network members, which knowledge is available at which intensity, at which partner's site ,at which cost, and how to access it. It is difficult to collectively bring together all participants and ensure a common level of knowledge, understanding, and commitment [Sandkuhl et al. (2005)].

The basic approach to improving the transparency of KM is communication with interactive feedback. Figure 5-11 shows the basic model of interactive communication. It also explains the knowledge flow from knowledge sender to knowledge receiver. Knowledge might be missing, distorted or misunderstood, so feedback is critical in evaluating whether or not the knowledge is bring decoded correctly. Especially for the tacit knowledge that is hard to transfer, feedback by word and action is required. This is very critical in practice. In the business process of contracting, customer transparency is

fundamental if logisticians are to make a feasible plan, while transparency of the proposed solution to the customer is also essential for smooth implementation and evaluation in practice.

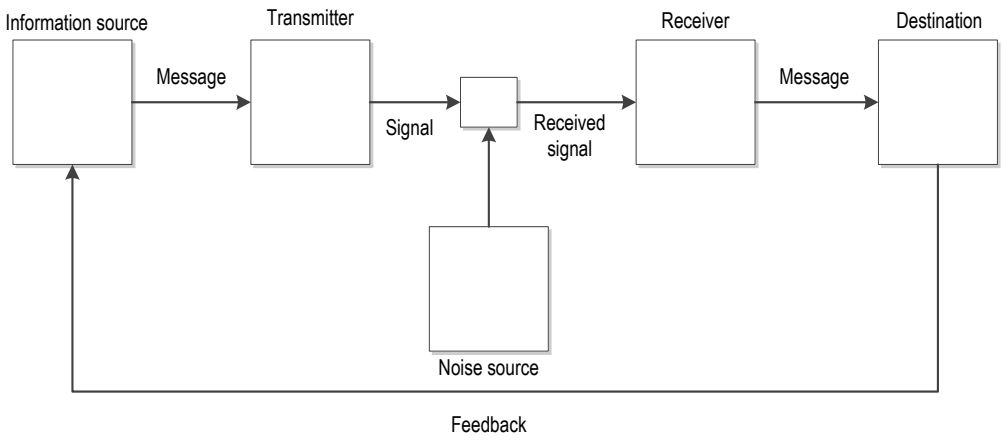

Figure 5-11 An interactive communication model

Source: [Wiener (1948), Wiener (1988)]

Communication with feedback is the first step in guaranteeing the transparency of a knowledge transfer. With regard to tacit knowledge, the transfer from the sender to the receiver is a process of conversion to explicit knowledge with the SECI model: socialization →externalization →combination →internalization. Combining the communication model and the SECI model, Figure 5-12 shows the communication and interaction process between tacit knowledge and explicit knowledge.

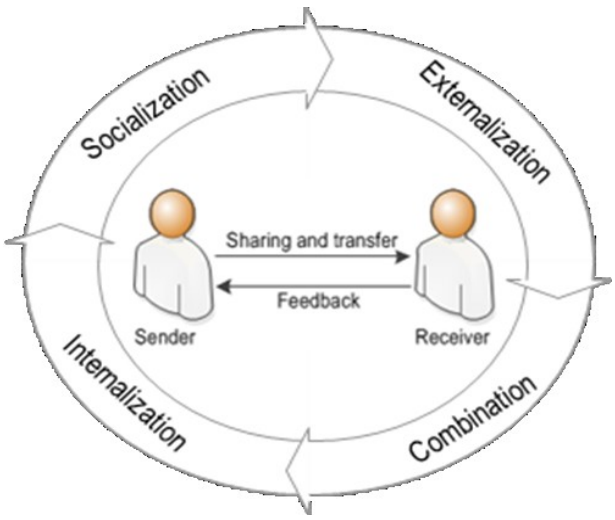

Figure 5-12 Communication and interaction between explicit & tacit knowledge

5.5.2 Organizational learning

The extraction and creation of new knowledge involves learning. Learning is the acquisition and application of new knowledge. Learning leads to changes in behavior and performance. Learning processes are associated with exploration, exploitation and sharing of human knowledge enabled by appropriate technology and cultural environments to enhance an organization's performance [Kay (1995)]. Effective learning can improve KM through acquiring new knowledge, rethinking and updating existing knowledge.

Organizational learning is described as the way organizations build, supplement and organize knowledge and routines around their business activities and business cultures, as well as the way they adopt and develop organizational efficiency by improving the use of the broad skills of their workforces [Fiol & Lyles (1985)]. Organizational learning can be considered a systematic behavior for acquiring capacities for dealing with the needs and challenges of organizations in competitive environments [Kumaraswamy & Chitale (2012)].

Managing knowledge in 3PL enterprises is an important activity. On the one hand, they need to evolve learning technologies that help the employees to master new knowledge at a fast pace to gain growth in the industry. On the other hand, transforming individual learning into organizational learning is essential. Organizational learning is the capacity to maintain or improve performance based on experience.

Organizational learning in 3PL also needs collaboration. In the process of collaboration, people can see different aspects of a problem, constructively explore their differences and look for solutions that go beyond their own limited vision [Tiwana (2000)]. For example, in a project management of warehousing, besides learning from past projects, team members need to learn the requirements of the new project, especially customer knowledge and market knowledge, the relative knowledge from each other, and finally apply them in the project. Through collaborative learning and implementation, can the project better accomplished.

5.6 Summary

This chapter studied the implementation of KIBPM in 3PL from the business perspective.

First, KIBPM should be implemented in those core business processes and process networks which are highly knowledge intensive and create the most value for the organization, e.g. warehousing management process and intermodal logistics, and dispatch processes, as well as process networks. The typical business process networks in 3PL include project cooperation, intermodal integration, and geographic collaboration. 3PL companies should not only focus on the optimization of isolated business processes, but should also consider business process networks and interactions between them.

Second, process knowledge is classified into three types: procedure knowledge, profession knowledge, and perception knowledge. Procedure knowledge is the process related knowledge, including the overall phases, steps, tasks, and activities. Profession knowledge is the domain related knowledge in business processes, including business service expertise and experience, customer requirements, market and industry, logistics service knowledge, sub-contractors, and so on. Perception knowledge is the results related knowledge, which enrich, update, and improve the procedure and profession knowledge.

Third, management of the process knowledge is a systematic journey of knowledge sharing, KM implementation and improvement. Knowledge sharing is the source of knowledge flow, and knowledge transfer is the wheel of KM. Incentive measures for knowledge sharing and transfer depend on the degree of knowledge contribution and implicitness. For tacit knowledge, motivation and authorization, rather than KMS, should be strengthened. The core activities of KM are knowledge acquisition, knowledge production, knowledge warehousing, knowledge distribution, and knowledge application. They are enabled or hindered by the factors and approaches of environment, technology, organization and people. Furthermore, in order to improve KM quality and sustainability, interactive communication for knowledge transparency and organizational learning for sustainable competency are of significance for 3PL business practices.

6 Case study: the practical perspective

6.1 Introduction

The growing importance of logistics, as well as the increasing dynamic complexity of markets, technologies, and customer needs, has brought great challenges to logistics. 3PL have played an important role in managing logistics processes within supply chain management. In order to provide professional logistics services, knowledge in business processes is crucial.

This chapter takes a leading 3PL provider in Germany as a case study to demonstrate why, to what and how KM has been applied in business processes. The theoretical analysis and proposed framework introduced in previous chapters will be applied to this case. The objective of this chapter is to make the ideas, model, and approaches of KIBPM more specific and feasible, as well as to evaluate whether or not the proposed framework and approaches meet the needs of KM development in 3PL enterprises. A further discussion in chapter 7 will focus on the findings (e.g. enablers, approaches and impacts) of KM application in the company.

6.2 Method

Research on KIBPM involves multiple variables, and some of them (e.g. learning culture, business process, interpersonal relationship, motivation) are complex and difficult to quantify. Therefore, a case study with quality analysis suits the empirical research for such topic.

The method for this case study is a combination of interviews and web research based on literature as well as my individual observations. The research on KM drivers and approaches used materials longitudinally, while the analysis of knowledge resource and demand used cross-section data. This logistics company has applied KM for the past eight years, so the time span of the data sources is 2005-2012. The face to face interviews are based on questionnaires sent in advance. We organized meetings and exchanged emails to discuss questions on KM practice at a leading 3PL service provider. The interviews were conducted in May, July, August and December. Figure 6-1 illustrates the procedure.

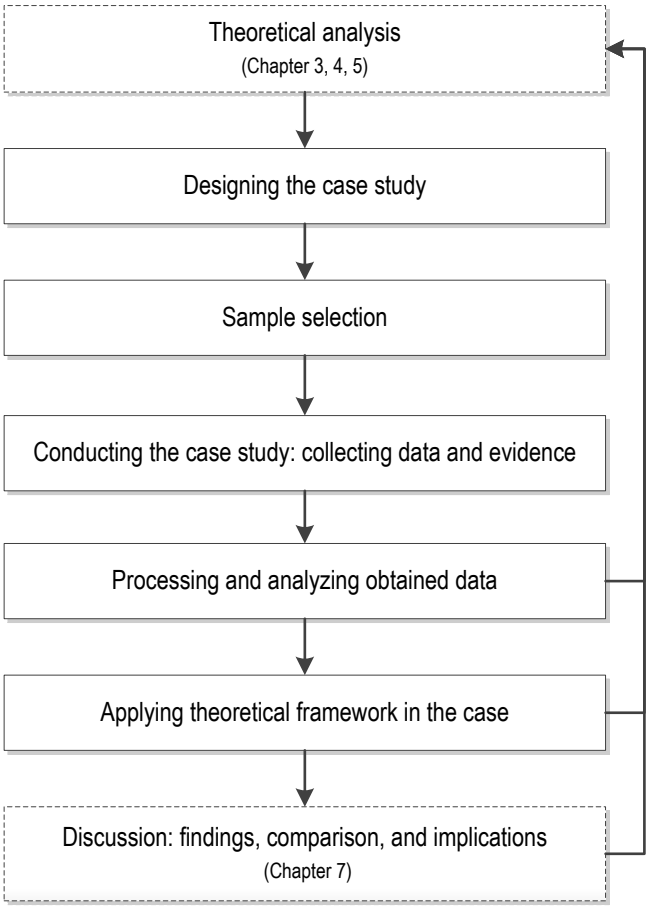

Figure 6-1 The procedure of the case study

The standard of sample selection for the case study is representativeness. The object of the case study in this study is an excellent 3PL service provider that has applied KM for several years. It is one of Europe's leading service providers in the areas of transport and contract logistics. The service, especially contract logistics, is process oriented and knowledge intensive. Moreover, both the top management and frontline employees have been involved in the KM activities, which has generated fruitful results. In addition, their KM practice has been integrated in the business process, and combined technology, organization and people.

6.3 Company background[6]

This logistics company is a modern logistics service provider with a long tradition. It was founded in 1853 in Bremen, Germany, and currently has 1300 employees. Today it is one of Europe's leading service providers in the areas of transport and contract logistics. Since 1996, it has been wholly owned by the Kuehne + Nagel Group. In 2009, it ranked number 58 among the top 100 logistics enterprises in Germany [Klaus et al. (2010)].

The logistics company is an excellent 3PL service provider, designing customized solutions, managing complex tasks and insisting on high standards of precision and quality. It serves customers from such industries as aerospace, automotive, mechanical engineering, steel, renewable energy, chemical, industrial, and paper. Their main services are contract logistics and transport logistics.

The contract logistics business contains project management and operation. The company has successfully managed many in-house logistics projects (e.g. a spare-parts warehouse in Lohmar), stand-alone-logistics (e.g. a service centre in Cologne), and transport-logistics (e.g. a service centre in Neuwied). This logistics company offers its customers a wide range of services with modern equipment and years of experience as a freight forwarder. The transport logistics business includes ocean freight, airfreight, overland transport, inland shipping, rail transport, and intermodal transport. Besides, these services this logistics company has also offered some 4PL services since 2007, such as consulting, VAS and special projects.

The headquarters of this logistics company is in Bremen. It controls and develops all the freight forwarding and logistics activities of the group. This logistics company has about 30 branches in Germany, including in Hamburg, Cologne, and Mannheim. In addition, the International Freight Forwarder Beijing Representative Office is responsible for these businesses, among others: advice in affreightment business, acquisition of imports and exports, personal supervision on site for transport, assistance in customs formalities.

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[6] The information sources for section 6.3, figure 6-2, and figure 6-4 are from this logistics company. For further information please contact Prof. Dr. Hans-Dietrich Haasis and the author.

6.4 KM practice[7]

6.4.1 Drivers of KM in business processes

This logistics company has practiced KM for more than 7 years beginning in 2005 when they started some initiatives to manage knowledge in the organization. There are several factors that drove this logistics company to start KM.

First, in the era of the knowledge economy, knowledge has been a strategic resource alongside land, labor, and capital. In order to keep sustainable competitive advantage in a dynamic market, logistics service providers need to better meet customer demands through the utilization of this latest strategic resource.

Second, the company is growing larger due to business development. Twenty years ago there were only several employees. Usually they worked in the same office on the same project, meaning that it was easier for them to exchange ideas and learn from each other. Nowadays, when many branches are located in different cities, it has become more difficult to meet and talk frequently. The employees work on different projects and have different experience. Knowledge sharing is thus important to provide better service to customers.

Third, with development and growth of business, the company has become larger and there are now many more employees, especially as new people join this logistics company. They know little about the management of old projects. It is difficult to learn from more experience people in the company since some have left due to retirement or changing jobs, and others are too busy or too far away to share knowledge with new people. Therefore, it is necessary to create knowledge, and store knowledge in organization memory, so that people can learn good practices or past mistakes. There is a saying in this logistics company: each mistake only once.

Moreover, logistics service, especially contract logistics, is process oriented, so KM must consider the process: plan, design, implement and review. This can provide the required knowledge in time, which will highly improve business efficiency and effectiveness.

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[7] The content of section 6.4.1, 6.4.3, and 6.4.4 is a part of [Zhang (2013)].

6.4.2 Knowledge and KM in business strategy formulation

Business processes at this logistics company include contract logistics, transport logistics, VAS and consultancy. Figure 6-2 describes the logistics service and customer industry.

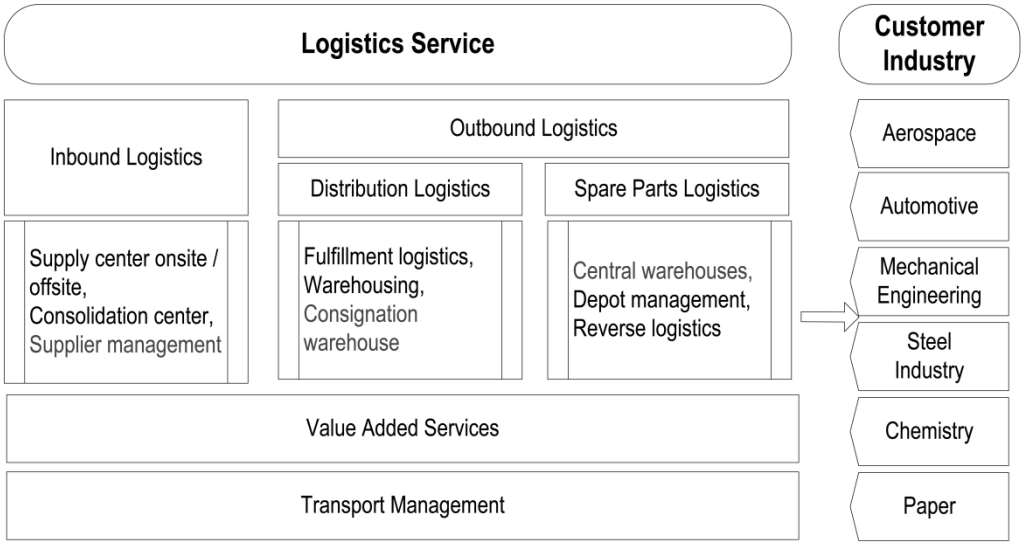

Figure 6-2 Logistics service and customer industry

In order to achieve and maintain competitive advantage, companies must select proper strategies. According to Porter's generic strategies, product differentiation and product cost are the most important competencies. In the broad market scope, the strategy can be cost leadership or differentiation, and in the narrow market scope the segmentation strategy is critical. Another consideration is the strategy of individualization vs. that of standardization. The choice of strategy depends on multiple factors and knowledge about the market, the strength of competitors and one's own company, the features of each specific industry and business process, and negotiations with shipper and buyer.

The market for 3PL logistics services (contract logistics) can be divided into "consumer contract logistics and distribution", and "industrial contract logistics" [Klaus et al. (2011)]. "Consumer contract logistics and distribution" has sub-segments including: staple goods ("dry" or "ambient" goods.); fresh goods ("perishables"), such as vegetables, dairy and meat products, and deep-frozen goods; "fast moving consumer goods" for everyday use, which require "continuous replenishment"; and "slow moving consumer goods" such as durable goods of all kinds, and one-off weekly or irregularly offered "special purchase" goods [Klaus et al. (2011)]. For this last segment, it is easy to standardize the service and serve more than one customer.

In “industrial contract logistics” (i.e. “business-to-business” logistics services), the focus is on the procurement and distribution of production materials and components in the various stages of the industrial process [Klaus et al. (2011)]. The customers come from different industries, requiring 3PL service providers to master the specific needs of each particular one. In the automotive industry, for example, the high level of innovation has made production more complex. Just in time (JIT), just in sequence (JIS), consignment stores, consolidation of different component suppliers, and spare parts management are crucial to guarantee punctual delivery and unloading. In the air and space industry, the many orders for various aircraft models from suppliers, manufacturers and service providers call for professional, innovative and customized logistics solutions. The mechanical engineering industry deals with mainly individual pieces and small serial production. For this segment, it is quite difficult to use the standardization strategy. They must instead design individualized services for each specific customer, which require special warehouses, routes, and equipment.

In the logistics company which is the subject of this case study, the main businesses of contract logistics and transport have different business strategies. For daily transport, cost leadership and standard service with prompt response and delivery, high quality and security have increased customer value and organizational competency. For intermodal transport, the differentiation strategy and customization with feasible and effective solutions is the proper strategy. For the contract logistics of the warehousing business, within which the market and industry are relatively narrow, they adopt the segmentation strategy and individualized service for specific customers.

Eighty percent of the contract logistics in this logistics company involve the steel industry., The broad range of products from rolled or forged bars to flat products (e.g. coils of various alloys), creates a tremendous challenge. Through working with other steel companies, this logistics company is familiar with the various requirements. Whether handling the storage of standard pipes and specialty cartons, or the handling or delivery in product-specific packaging, they will find the appropriate solution for customer requirements. The use of the right equipment (such as cranes in the warehouse and customized carriers), efficient delivery times, reliability, flexibility and individuality are crucial.

However, there is a critical problem in contract logistics for the steel industry. Most steel

plants close in summer (August) for maintenance, which means that there are fewer orders during this period. How to minimize cost and loss by making better use of the warehouse and equipment is a practical issue. One option is to suggest to employees in this logistics company that they take their holiday during this period. However, this is not a realistic solution, as employees may have different plans. Another option is to look for new markets (e.g. beverages such as water or beer), to complement the summer market. This is a strategic decision making process that requires new knowledge of customer needs, market share, transport equipment and special warehousing.

To develop a strategy, the managers of this logistics company come together and discuss a three-year- plan, as happened, for example, in 2010, when the 31 leaders held a meeting to discuss the right course for the next three years. They consent to a common vision and objectives for profits, people, orders, customers, and so on. Then they discuss ways to achieve the objective, such as investment in education of human resources for better output, new IT system for BPM and KM, visiting A level customers. The targets will be broken up as different processes, and then further divided into sub-processes and specific activities, down to delegation to responsible persons. Afterwards, a standard report in each quarter of the year needs to be submitted for evaluation and adjustment.

Business strategy is also a coordination of all processes in this logistics company. Logistics resource planning and other business units (e.g. warehousing) always support business development by planning for the next half year according to customer needs. In July or August they review the performance of the target process over the past half year and plan for the next six to twelve months. The plan is flexible so as to be adaptable to the dynamics of the market and customer needs. Logistics optimization involves both external and internal projects, trucks configuration, for example. Performance evaluation makes the key indexes and measurements to assess the revenue (e.g. cost of renting a truck 300 Euro/day, annual profit and return on investment) and working days per month (e.g. 23 days in Aug. and 15 days in Dec.). Moreover, the implementation of business strategy needs the support of all functions: process standard establishment and logistics optimization, truck requirements and assignment, logistics systems application ("Optimist", continuous improvement process), personnel and financial controlling, customer service, certification of quality, security, and sustainability.

Partner relationship management is another important part of business strategy.

Transparency is critical for effective knowledge sharing to provide more efficient service at a lower cost. This logistics company has almost 30 branches in Germany, and more than 200 sub-contractors, from whom they select the best five or six as key partners. When there was no centralized controlling in the company, it was quite normal for different branches to use the same partner without being aware of it. This increased the cost in time spent on communication and contracting. Moreover, the pricing and contract conditions with the same partner might be different. This company solved this problem through centralized management with intranet and documentation for all branches.

6.4.3 Knowledge in contract logistics

Contract logistics is the most important service at the logistics company considered in this chapter, though transport, consultancy, and value added service are also core business processes. The other management processes and support processes support the BPM and KM. This logistics company possesses more than 20 years experience in these segments of logistics. They serve the entire value chain, whether in-house or greenfield projects.

The business process of contract logistics is essentially a knowledge intensive project. The service includes inbound logistics (procurement and production logistics), and outbound logistics (distribution logistics and spare parts logistics). It combines the logistics know-how of various industries, customer tailored services, specially designed products for each individual supply chain section, a variety of best-practice solutions, and continuous improvement.

According to the definition and classification of process knowledge in chapter 3, the process knowledge in contract logistics includes procedure knowledge, profession knowledge and perception knowledge.

- *Procedure knowledge*

Procedure knowledge is about the overall phases, steps, tasks, and activities involved in managing a project. The main phases in contract logistics are planning, operation, and review, which together make up a continuous KM process. The key processes are tender, CTI (Customer Transmission Integration), operation, and review. Figure 6-3 describes the key activities in each phase of contract logistics.

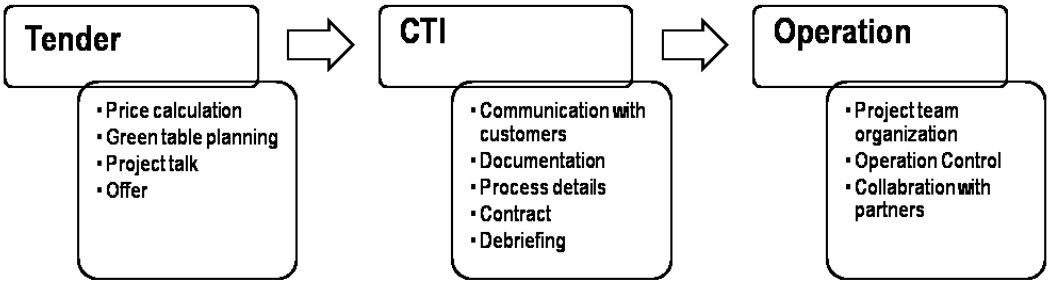

Figure 6-3 Process of contract logistics

First, the tender center needs to offer a price to obtain a project. They are competing with many other logistics service providers. This is the most difficult step. The tender center needs to calculate the basic price, time and steps to manage the project. When building a spare parts distribution center, for example, they allocate all the resources of manpower, capital, and location, and estimate the cost (Euro/m^2) for warehouse renting in the desired location. In addition, they were under time pressure to produce such a professional plan.

Next, in the process of CTI, the main task is documentation. Based on the previous calculations, they organize a project team with qualified employees from different departments. After obtaining the project, they communicate with customers to establish contracts. They need to discuss the price and process in detail to write a feasible plan.

In the operation process, they implement the planned project in the real world. They organize the project team in a mixed and flexible structure. Usually, there is one team leader, and the members come from different units with different functions. The project team in this operation phase is the same as that in the tender phase.

The final phase is the project review. They evaluate the project performance and check good and bad experiences during the business process. This phase is a critical way to review the past project and support guidelines for future projects, and is key to realizing the company mantra of “each mistake only once”..

- *Profession knowledge*

Profession knowledge covers various aspects, among them: business service expertise and experience, customer requirements, market and industry, logistics, sub-contractors, and logistics performance. Contract logistics services require professional planning, development and implementation of integrated logistics solutions. These solutions need

knowledge and expertise in the fields of project experience, resources, techniques, IT, and construction[8], which develop and implement what customers need to make their production and distribution flows sustainable and profitable. Figure 6-4 describes the profession knowledge in contract logistics at the logistics company considered in this chapter.

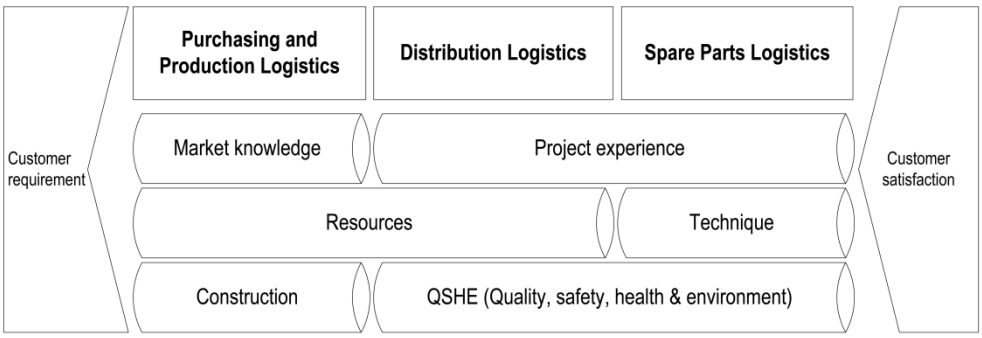

Figure 6-4 Profession knowledge in contract logistics

Customer knowledge: Customer knowledge includes customer requirements and knowledge of the specific industry. This logistics company variously serves commercial sectors/industries (e.g. automobile-manufacturing and –supply), and steel, chemical, aerospace, and heavy-engineering firms. Within the different supply chain segments, each industry has its own specific logistics requirements. Logisticians must be familiar with all relevant logistics disciplines and have extensive knowledge of the industry, so that they can offer the best business solutions tailored to customer requirements.

Logistics knowledge: The specific knowledge of logistics consists of procurement and production logistics, distribution logistics, and spare parts logistics. Production supply manages the reception, storage, picking up, deployment and delivery of goods to production. The offers are as varied as the manufacturing processes, and include such diverse functions as engine factory production lines or the cell production of an aircraft manufacturer. Solutions for a “just in time” or “just-in-sequence delivery” are necessary for inbound logistics.

Besides the classic contract logistics (i.e. transport, storage, picking up and handling), a variety of additional services are required (e.g. the storage of dangerous, heavy or small

[8] Information source: the logistics company under discussion.

products, or the development of product-specific carriers). Moreover, knowledge about logistic service includes a wide range of value added services, such as "kit-building", labeling, cutting work, custom packaging concepts, and color filling, among others. Furthermore, the global disposition of transport, (including document preparation and customs clearance), returns and reverse logistics, recycling and waste management activities are some examples of logistics knowledge.

In the actual distribution center itself, the factors of flexibility, speed and quality are the top priority. Additionally, optimal choice of location, flexible operations, prompt reaction, efficient network optimization and cross-industry innovative impulses are crucial to create value. In spare parts supply, flexibility and speed, adapting to ever-changing needs, continuous availability, efficiency and reliability, inventory visibility, time-critical delivery, seasonal peaks and easy access to various modes of transport are also important knowledge requirements.

1) Market knowledge

A good project plan and its implementation also need updated market knowledge. When the tender center calculates the price of renting a warehouse, they should know the latest prices and compare them with different offers. Moreover, every industry has its unique requirements and specifications. More knowledge of the industry will generate better solutions tailored to the particular industry of the customer. In order to make customers successful with their solutions, logisticians therefore need to acquire industry specific knowledge to serve their customers professionally in their respective segments.

2) Project experience

A seamless, transparent planning and competent multi-phase implementation of the proposed solution are extremely important. A professional start and end to the operation, effective application of planning and project management tools, and continuous improvement are also essential. Furthermore, logistics solutions are also designed to be adapted to the dynamic customer requirements, such as restructuring, expansions, software modifications and integration of VAS. The methods used must make the logistics processes of diverse customers efficient not only to plan, optimize and evaluate, but also to run smoothly in business.

During the implementation, experts examine the areas of "reengineering" and "operational excellence" continuously and systematically in all processes to identify process problems and to develop a low wastage, but safe and flexible, logistics process. Collaboration with customers to define the processes and responsibilities from startup, as well as to design the plan and put it into operation, is also necessary.

3) Resources

Resources in contract logistics include physical assets, human resources, capital, time, collaboration, and so on. The assets (e.g. one's own warehouse or a truck) are the foundations for managing a project. Human resources may be employees within the company or people from a company to which work has been outsourced. Especially with regard to projects for new customers, the key point lies in personnel allocation. Differently qualified employees need to be coordinated and incorporated in a very short time to quickly create a strong team so that smooth operation and optimum results are ensured. Sub-contractors are important partners of 3PL in supporting some parts of business processes, such as construction or transport. Knowledge about the collaboration plan and progress contributes to the fulfillment of the project.

4) Techniques

Customer demands are diversified and dynamic. They can be highly complex and automatic, fast and flexible or small and specific. Logistics engineers should understand "materials handling and storage technology" as well as related areas. They should also work in close cooperation with other departments to find solutions tailored to customers at all times. The success of logistics solutions depends significantly on the implemented IT infrastructure. Knowledge of advanced warehouse management systems, management of all enterprise resource planning (ERP) and subsystems, use of the latest IT security standards (ISO 27001, IT contingency plans, safety audits), and development of innovative solutions (Radio-frequency identification (RFID)) are all necessary supports for logistics service.

5) Construction

Identifying the right property and location, searching for existing properties, creating

functional building specifications, construction assessment and calculations, considering individual needs and coordinating closely with all involved planning areas will pave the way for a smooth project implementation. Further on, the time availability, plan flexibility, technical equipment, and the legal requirements are also of crucial importance.

6) Quality, safety, health and environment (QSHE)

The issues of quality, safety, health and environment always come first in the overall process of planning and operations. This ensures the sustainability and continuous improvement of business processes and customer satisfaction.

- *Perception knowledge*

Perception knowledge comes from experience in business processes. It will enrich both procedure knowledge and profession knowledge. Some ideas or methods contribute to optimizing the processes or activities, improved CTI procedures for example, while other knowledge supplements or updates market development or logistics service.

6.4.4 KM in contract logistics

For everyday work of the case study firm (e.g. transport), knowledge during the process is shared and transferred by electronic exchange such as emails. Reports are also generated to reflect the progress and share knowledge in the intranet with different branches. Seventy percent of the business has no contract. The other 30% consists of orders that need special equipments (e.g. trucks that can transport liquids such as aluminum at temperatures as high as 750-800 ℃) and have 3-5 year contracts. This case study focuses on contract logistics, an example of which would be undertaking the building of a distribution center for a customer. Value added service and consultancy are a part of contract logistics in this logistics company, as the requirements of VAS and consultancy are discussed and defined in the contracting process. Contract logistics service is organized as a project that is planned and implemented by a project team.

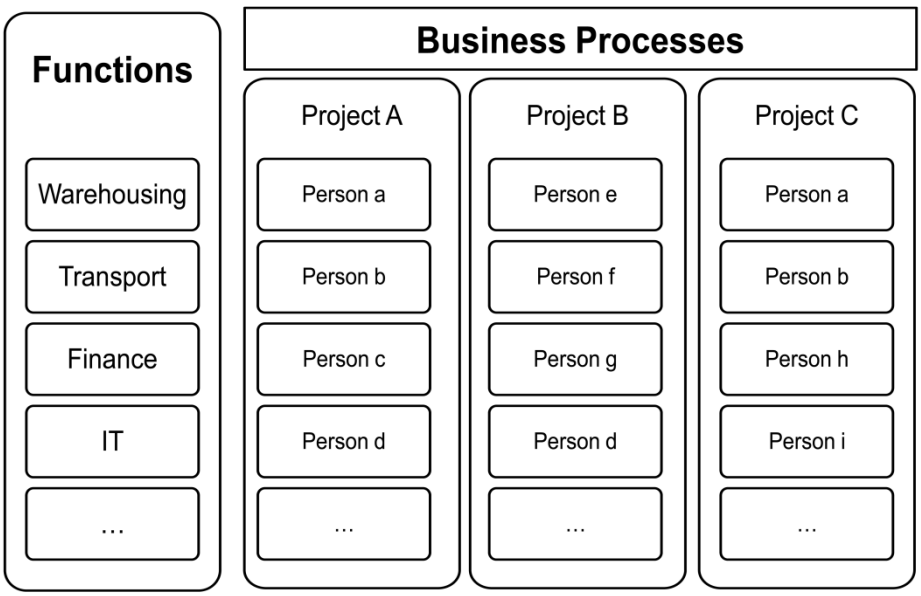

Figure 6-5 Mixed structure of project team in contract logistics

Professional logistics planning with innovative ideas and experience from many successful implementations of logistics solutions is crucial to the success of the project. In order to guarantee customer-specific concepts and continuous care with efficient, flexible and feasible solutions for long-term success and satisfaction, each project has a tailor-made team of specialists. Figure 6-5 shows the mixed structure of project teams.

Knowledge management is involved throughout the whole process of project management, from planning to operation. Figure 6-8 illustrates some important activities and approaches of KM in different phases of contract logistics at this logistics company.

- *Tender phase*

In order to calculate a competitive price, the tender center needs to know the calculation methods for different projects, thus they must learn from the past, as well as from the market and industry. Moreover, they should be familiar with the tools that support the calculation. The GCT (global calculation tool), for example, covers the resources of people, figures, processes, and ideas, among others, within the excel system.

The required knowledge is produced through brainstorming discussions, as well as via professional tools, such as GCT. Such knowledge is stored in documents that must clarify operation procedures, basic prices, exact time and steps, human resource allocation, and other factors.

After generating the initial plan, there will be a special meeting to discuss it: project talk. The project team explains their plan, and the other employees challenge it. They may ask such critical questions as “Why do you provide this price but not another?” or “How do you know the cost of renting such a warehouse?” They exchange their ideas and improve the plan. This project talk is a process of knowledge distribution. During the meeting, the project team presents the plan and distributes knowledge to other people. Then the participants challenge the plan by asking critical questions. Through this process, knowledge is transferred to the project team members, which will stimulate valuable knowledge for improving the plan. During the exchange, the presentation and challenge both also contribute to knowledge acquisition and knowledge production. After this project talk, the project team applies the new knowledge in the updated plan.

- *CTI phase*

After the project team has successfully obtained the project from the customer, they actively meet and talk with the customer to directly acquire more important information or knowledge. During the meeting and other communications, they produce further and more detailed knowledge about the customer’s needs.

Moreover, they document the knowledge in the contract with the customer. The contract provides detailed and specific knowledge about the project, price calculation for example. Additionally, t also describe the process, activities and content of communication with the customer in the Lotus Notes. The description clearly shows how the process is going. When it is going well, the process is in the green, otherwise it is in the red.

When the contract is refined, they have further discussions with the customer to review the details. The exchange between them is knowledge distribution. Knowledge from interactions with the customer will be applied in the final contract. A practical application is the check list, which will instruct future CTI processes.

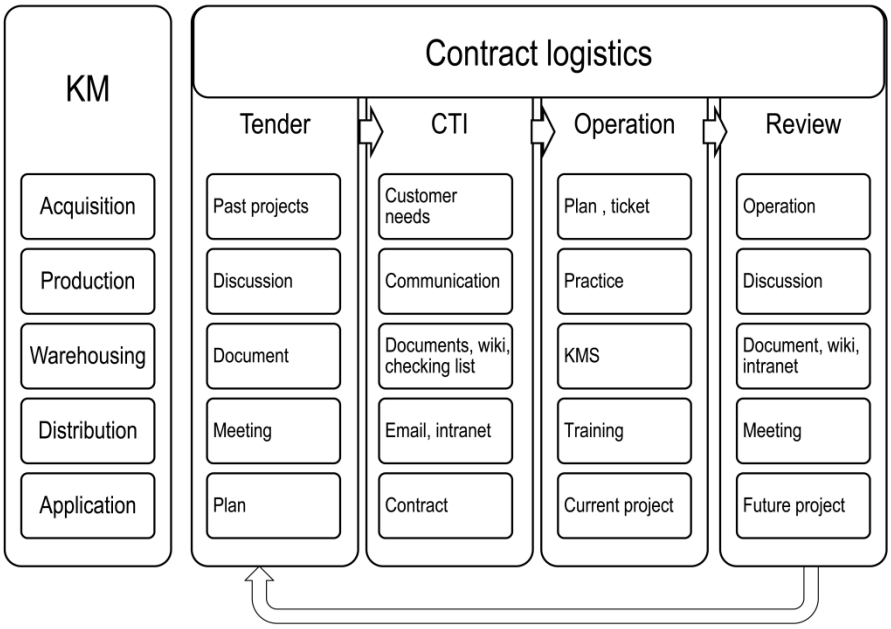

Figure 6-6 Approaches of KM in contract logistics process

- *Operation phase*

In the operation phase, the project team acquires knowledge from the well organized plan and applies it in the real world, simultaneously also acquiring knowledge from the current practice. The knowledge from plan and practice can generate new ideas for better operation, while knowledge from operation processes can produce dos and don’ts for future projects. Since the project team at this operation step is the same as that at the planning stage, it is easier for them to produce new knowledge based on their teamwork.

Regarding knowledge warehousing in contract logistics process, there are some supporting systems for storing the ongoing process and finished documents. The OCS (operation control system) stores very specific knowledge in the operation process, such as the unloading of a truck, showing every step and its result. The DOR (documentation requirement system) is also for knowledge warehousing.

In order to distribute the right knowledge to the right people, the team uses emails, intranet, and reports to share and transfer the progress. As it is a continuous improvement process, they also conduct training of new people. Knowledge from the operation process will thus be applied for improvement in current and future projects.

- *Review phase*

After these three phases, the project team holds a review of the whole business process, in which they discuss both improvements achieved and lessons learnt. This step is another process of KM. Knowledge is acquired from the operation of contract logistics, produced through discussion, stored in documents, wikis, or intranets, distributed by meetings and forums, and will be applied in future projects.

6.5 KIBPM application

6.5.1 Application background

The drivers of KM in this logistics company are the dynamics of the competitive environment and enterprise development. The objective is to provide better service to meet customer demands. KM at this logistics company has implemented many practical approaches and many of them are process oriented and integrated into daily work, especially in the contract logistics of warehousing management, the most knowledge intensive business process. In 3PL, intermodal transport and dispatch processes are also knowledge intensive. Application of KM has directly or indirectly brought such benefits as better service in less time, lower cost, higher quality, and more value added, as well as process standardization and improvement. Some questions remain unaddressed, however.

First, KM in this logistics company has up to now focused on more explicit knowledge management. Their KM approaches rely more on systems, which are good at acquiring and storing data and information. There has not been a systematic approach that combines people, organization and technology. KM in practice has tried to obtain knowledge from frontline employees, such as truck drivers, but they still need to motivate some long-serving employees with rich experiences to share their valuable knowledge.

Second, KM application has not become organizational learning, which is more critical for KM improvement and development. Organizational learning needs an open culture, simple structure, efficient communication, etc. It is essential to transform individual learning into organizational learning, which is the capacity to maintain or improve performance based on experience. This is the direction for improving KM performance.

Third, “who is responsible for KM application and evaluation” is another question.

Whether a special knowledge manager, the business manager, personnel manager, or project manager, the problem is that there is no single specific person or department responsible for KM planning, implementation, and evaluation, before or after organizing the project team. This situation will lead to an overlook of effective design, updating, measurement, and protection of organizational knowledge.

6.5.2 Framework application

Based on the previous theoretical and practical analysis, as well as the case study of KM practice in this logistics company, this work puts forward the adapted KIBPM framework in Figure 6-7 and Figure 6-8.

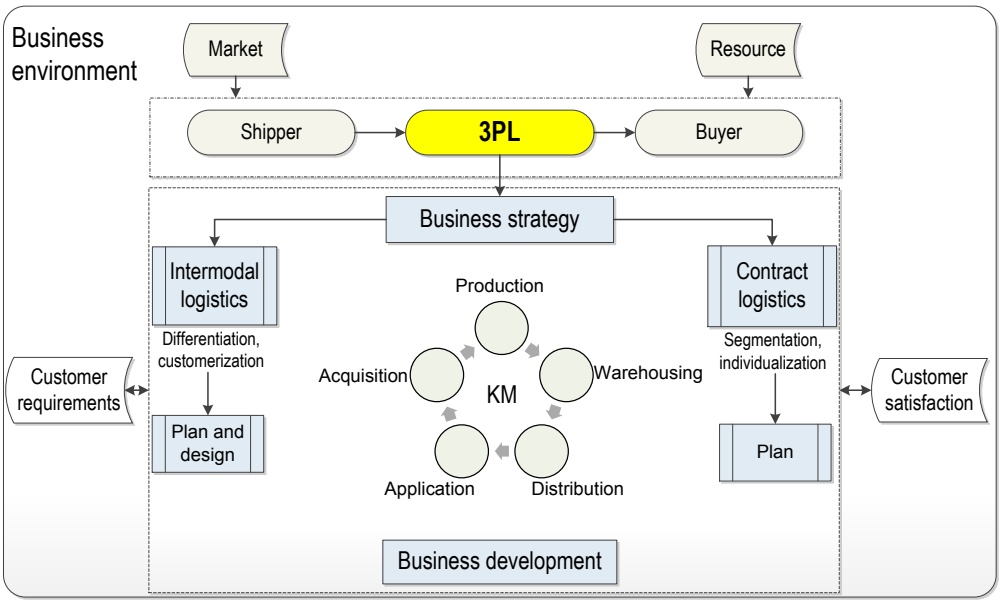

Figure 6-7 KIBPM application at the strategic level

The current KM practice in this logistics company is uses several systems, such as Lutos Notes and Optimist, to support business operation. KM has significantly improved work effectiveness and efficiency. However, there are still great potential and challenges in applying KIBPM. How to better integrate KM in core business processes and process networks at the strategic and operational levels is a practical issue. Moreover, more tacit knowledge compartmentalized in employees' minds need to be shared and collected. In addition, the awareness and practice of organizational learning is critical for the company to keep sustainable competitive advantage.

The next step of KM application in this logistics company needs to strengthen KIBPM application in the core business processes of contract logistics and intermodal transport. First, integrating KM in business processes can share the existing BPM tools, which make it possible to manage most of the explicit knowledge in business processes. Second, motivating logisticians to share, transfer and store their valuable tacit knowledge in the organization will make the knowledge available in future similar process, and contribute to improving work efficiency. Third, improving communication platforms will enable KMS to connect the necessary business processes, process networks and branches. Finally, cultivating a learning culture will allow the organization to obtain continuous development and improvement.

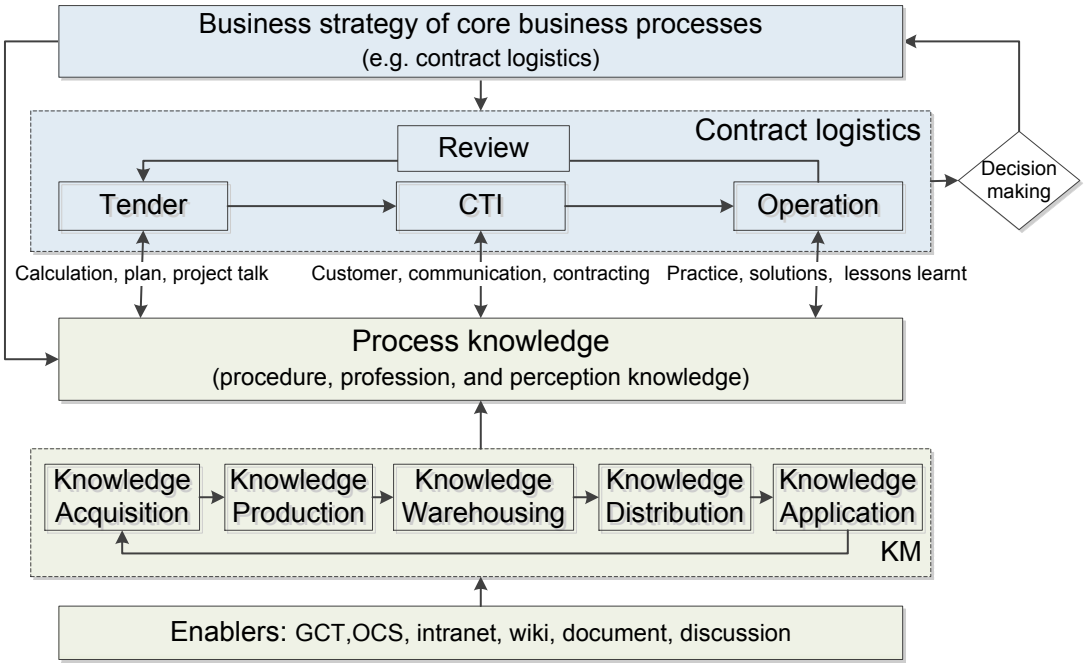

Figure 6-8 KIBPM application at the operational level

6.5.3 Measures for improvement

In order to improve the performance of KM application in this logistics company for long-term development, future efforts need to address the following aspects.

First, taking full advantage of the current BPM tools, KIBPM can share the existing Lotus Notes, wiki, Optimist and tools for a continuous improvement process, which provide an efficient way to produce, distribute, acquire, and reuse all kinds of process knowledge. Taking contract logistics as an example, the GCT, CTI, OCS, and DOR systems, as well

as successful case studies, are also very good KM tools. In addition, the project manager or another person on the project can take charge of the KM audit, updating, and evaluation during the business process. In this way, KM is a real time work responsibility in the business process, but not an additional project for the employees or an extra investment for the company.

Second, establishing effective incentive measures for knowledge sharing and transfer will make logisticians more willing to exchange and store their tacit knowledge produced during the working process. In this logistics company, the idea card is a good way to motivate knowledge sharing and problem solving, while at the same time increasing the employees' sense of responsibility and achievement. The incentive measure can use an evaluation system that regularly comments on the knowledge shared by the users, such as by grading individual contributions. This grade can be gathered quarterly, and the final result announced at the end of the year, and the best performer will get rewarded with a bonus or promotion. In this way more individual knowledge will be transferred into the organizational knowledge base.

Third, communication platforms based on existing BPM systems and knowledge demand in the business processes should be improved. According to the knowledge demand in critical points of the business process, the communication platform should classify the needed knowledge and connect it with relative business processes, process networks and branches. Some possible techniques are cluster analysis, knowledge mapping, grid technology, and the expert system. In intermodal logistics, for example, customer knowledge has been accessed through online tickets, not only via the traditional telephone call. Besides these technology tools, formal and informal meetings during work are indispensable for enhancing communication between employees.

Fourth, organizational learning should be promoted with an open and trusting culture. Learning is even more important than KM itself. It is a continuous process of thinking, doing, and improving that helps individual and the company gain competency. Through the integration of KM and BPM, the employees are able to quickly document and store real time knowledge in business processes, as well as to distribute and apply the knowledge in their work. Through motivation, they are encouraged to share their tacit knowledge, findings and solutions for improving logistics services. Through KMS such as

wiki, Notes, intranet, and face to face meetings, they should actively propose personal ideas about specific problems. When the company creates a learning culture and environment, and the employees share the learning awareness as well, KM will be improved and developed in the long run, and the company will also obtain continuous development and growth.

Finally, inter-organizational KM is also significant in the dynamic environment and party logistics networks. Market changes, logistics technology, customer needs, competitor in and out, policy and regulations are the key knowledge for companies to learn in order to better adapt to the current situation, grasp opportunities and avoid threats. At the same time, they must communicate and cooperate with partners in the logistics network, which also stresses the necessity of knowledge sharing, transfer, and application. Moreover, the enablers of KM are typically technology, organization and people, both internal and external to the logistics enterprises. Knowledge acquired from the external source (e.g. public industry reports, online forums, libraries, latest logistics systems) is worth learning and applying in business processes.

6.6 Summary

This chapter has studied KIBPM from the practical perspective in two parts. First, it documented a case of why, to what and how KM has been applied in the business processes of a leading 3PL provider in Germany. This logistics company has practiced KM since 2005. The forces driving implementation of KM are the dynamics of the competitive environment and enterprise development. The enablers for KM at this logistics company are: professional systems, organizational culture, and people involvement. KM has been integrated into business processes of logistics strategy formulation and contract logistics to achieve and maintain competitive advantage. KM has brought this logistics company the benefits of better service, more efficiency, higher quality, and process standardization. However, there are some great challenges in managing knowledge, especially motivating the sharing of tacit knowledge and ensuring the sustainability of the KM life circle in core business processes.

Second, the theoretical analysis and proposed framework in previous chapters have been applied to this case. In order to improve KIBPM in this logistics company for long-term development, some measures need to be adopted: 1) combining BPM and KM tools, e.g.

Lotus Notes, wiki, Optimist and PDCA; 2) strengthening incentive measures for knowledge sharing and transfer, e.g. idea cards, tickets, rewards, promotions; 3) improving communication platforms based on existing BPM systems and knowledge demand in business processes; 4) encouraging organizational learning with an open culture of trust; 5) enhancing inter-organizational communication and cooperation with partners in party logistics networks and external knowledge sources.

7 Discussion, conclusion & outlook

7.1 Findings

7.1.1 Findings from the literature

The concept of knowledge has been defined by different disciplines, among them philosophy, computer science, and economics and management. According to different bases, knowledge can be classified in different ways. At the most basic level, knowledge can be divided into explicit and tacit varieties. Further on, there are two categories of tacit knowledge: tacit knowledge that it is possible to transfer (codable knowledge), and tacit knowledge that it is impossible to transfer under current conditions (non-codable knowledge). Explicit and tacit knowledge are complementary and can be comparatively viewed as the components of an iceberg, with explicit knowledge representing the small visible portion, and tacit knowledge the larger, unseen subsurface portion. The nature and characteristics of knowledge are manifold. It is usually embedded in individual minds or organization processes, and is diversified and ambiguous. It has the feature of wave-particle duality, being a dynamic process of learning, accumulation, communication and sharing, but also a relatively stable product of information and knowledge elements.

Process knowledge is an essential part of organizational knowledge, which can generate value in the business process and bring great value to the organization. It is contextual, experiential, value laden and insightful information about a process, including also explicit and tacit knowledge, at the individual, group, organizational and inter-organizational levels. In particular, it can be knowledge about the process (process template knowledge, generic process knowledge), knowledge within the process (process instance knowledge, project instance knowledge), or knowledge derived from the process (process-related knowledge, task support knowledge) [Remus (2002), Zhang & Wang (2010), Jung et al. (2007), Han et al. (2008)].

KM has become more and more important, and several KM schools have arisen: technology, behavior, composite, strategy, knowledge capital, process, and supply-demand among others. The current leading theory in KM studies comes from the perspective of intellectual capital as well as dynamic capabilities. It supports the provision of the right knowledge to the right people at the right time in the right place with the right context. KIBPM is a method that integrates knowledge and KM in business processes. It

analyzes the production, sharing and application of knowledge from the start to the end of business processes. It captures knowledge produced in the business processes, provides it when needed and contributes to service efficiency and value creation.

3PL has been defined from different perspectives, such as service, relationship, responsibility, performance, and position in the supply chain. 3PL is usually associated with the offering of multiple services, including basic service and VAS. Typical services are transport, warehousing, inventory, VAS, information services and design, and reengineering of the chain.

Core business processes are those business processes that provide a superior customer benefit compared with competitors and create the most value for the organization (e.g. warehousing management process). Knowledge intensive business processes are those that contain a high density of knowledge, which affects decision making or output significantly. They have the characteristics of high importance, long-term duration, complex operation, basis in experience, and networks. The typical business process networks in 3PL include project cooperation, intermodal integration, and geographic collaboration. Project cooperation links the business, management and support processes. Intermodal integration combines different modes of transport and storage. Geographic collaboration collects the efforts and knowledge from various branches. Cooperative projects in these networks are typically dynamical with respect to the diversified members, geographical distribution, and quick response to market demands.

From the strategic perspective, KM can support the choice of business competitive strategy, as well as of business process planning, design and development. This will point to the right direction and objective, thus ensuring to do the right things. From the operational perspective, the objective of implementing KIBPM in 3PL is to do the things right, to support business process execution, control, optimization and improvement.

Knowledge sharing is the foundation of KM, and the basis of organizational learning. In knowledge intensive core business processes of 3PL, knowledge sharing and transfer are critical for improving business process performance and organizational competence. Knowledge sharing is critical not only in business processes, such as transport, warehousing and consultancy, but also in business process networks, such as project management, intermodal transport, and collaboration between branches.

However, it is still a great challenge to motivate knowledge sharing within organizations. For knowledge that has a low degree of contribution and low, such as the loading and unloading process of trucks, KMS can support and realize knowledge sharing and transfer. For knowledge that has a low contribution degree but a high implicity degree, such as personal report writing skills, sharing depends on the knowledge owners' own initiative. For knowledge with a high contribution degree and a low implicity degree, such as better route design for intermodal transport or lower warehouse renting prices, external motivation for knowledge sharing should be adopted by organizations in order to improve business efficiency and performance. For knowledge with high contribution and implicity degrees, such as. innovtion of core technique for system development, it is up to knowledge owners to share their knowledge.

In general, the enablers of KM are the environment, technology, organizations and people (ETOP) both internal and external the organization implementing KM. The main activities of PKM implementation represent a continuous process of knowledge acquisition, production, warehousing, distribution and application. Various KM approaches have been discussed in the literature and applied in practice, with the goal of enabling the ETOP factors and overcoming obstacles and barriers. For example, regarding the people enabler , approaches of knowledge acquisition include subscription, action learning, checklists, coaching, a community of practice, debriefing, forums, portals, training, workshops, knowledge distribution approaches include action learning, an experts directory, interviews, and teamwork. Knowledge application approaches include checklists, coaching, debriefing, an experts directory, manuals, models, and teamwork.

KM is a way to actively enable knowledge flow in the business process and support organizational goals. In order to improve KM continually and maintain sustainable competency of the organization, KM should consider and pay attention to transparency and organizational learning. A very common and typical issue in KM is transparency during knowledge exchange. The basic approach of improving transparency of KM is communication with interactive feedback. Moreover, 3PL enterprises need to evolve learning technologies to help employees to master new knowledge at a fast pace in order to achieve growth in the industry. Furthermore, transforming individual learning into organizational learning is essential.

7.1.2 Findings from the case study

There is no clear concept and classification of knowledge in practice. Usually it includes data and information (explicit knowledge) as well as experience, skills and methods (tacit knowledge). Regarding process knowledge, it includes procedure knowledge for business process instruction, instance knowledge during the business process, and new knowledge created from the business process.

The 3PL firm examined is a company that carries out logistics activities on behalf of shippers. Their activities include management and execution of warehousing and transportation, inventory management, tracking and tracing, secondary assembly and installation of products, and even supply chain management. The network is a typical characteristic of 3PL owing to its intermediary role between shipper, buyer, and sub-contractors. 3PL service providers need external collaboration with all the parties in the network. As supporting intermediaries between shippers and buyers within the supply chain, 3PL providers need to understand the influence of the other connected actors, such as the suppliers' supplier and the customers 'customer or supplier.

The drivers of KM in this particular logistics company are the dynamics of the competitive environment and enterprise development. The objective of KM is to provide better service to meet customer demands. The enablers for KM are: collaboration and competition within the industry, business process dynamics and networks, professional systems (e.g. GCT, OCS, DOR), organizational culture, and employees' involvement. KM activities include knowledge acquisition, knowledge production, knowledge warehousing, knowledge distribution, and knowledge application. KM at this logistics company has implemented many practical approaches. Some of them are process oriented and integrated into daily work. :, The approaches of the main enablers, technology, organization, and people, can be classified into the activities shown in Table 7-1.

A very general approach is centralized documentation. All necessary knowledge is stored in boxes and binders, especially knowledge from the very beginning of KM implementation, when there was no email and internet. Another one is checklists. Before a delivery offer is made to the customer, a checklist helps review if all the needed materials have been prepared (e.g. calculation, process description, insurance, contract, etc.).

Table 7-1 KM approaches at the logistics company

	Technology	**Organization**	**People**
Knowledge acquisition	checklist Lotus Notes wiki ticket intranet	company magazine Intranet QSHE-Work process/ instruction	meeting idea card questionnaire
Knowledge production	CIP	project management	meeting
Knowledge warehousing	centralized documentation Lotus Notes wiki ticket	documentation video	project report
Knowledge distribution	check list email	company magazine	meeting
Knowledge application	check list	QSHE-Work process/ instruction	collaboration

Meetings are important for KM. This logistics company has many branches located in different places. Phone conferences or intranet communication alone is not enough, so the managers have meetings six times a year. This means that, about every eight weeks, leaders talk to managers and workers in other branches. this logistics company also has agents abroad; they meet face to face 2-3 times a year. Face to face conversations are very important for acquiring and meeting customer needs.

A specific tool for KM in process management is CIP (continuous improvement process), the four steps of which are: P(plan), D(do), C(check), and A(Act). It supports process optimization and the management of quality and cost.

A successful method to acquire and apply knowledge is the idea card. The firm has planned this program for 2 years. The objective is to acquire knowledge from the employees in different levels and locations. There are options in the headline: cost, quality, and service. Under this are four parts: what are your ideas? Why do you propose this idea? What could be improved with this idea? What is the result? The small cards are distributed in many possible places that are convenient for employees, such as kitchens, meeting rooms, and trucks. Two hundred truck drivers have the cards at hand. Whenever they have new ideas or requirements, find new problems or solutions, or suggestions to improve work, they can quickly take the card and write down their ideas. The managers collect the cards and stick them in a white board. They review the ideas once a month and select the most

important ones to put into action. Within a year and a half, they received more than 1100 ideas from 1700 workers, most of them from the front line. Good ideas are discussed and realized. At the annual celebration of the enterprise, they make a ranking of "best ideas" and reward the contributor. In 2011, the idea “Who has driven where” successfully produced a system that contributes to the efficiency of selecting experienced partners.

A new method is the ticket, which was first applied in internal work. When a problem arises (e.g. a printer is out of order) it will soon be reported to email@company A.de. The message will be assigned an IP and the answer will be given with the same IP No. (ticket number). The tickets explain different problems and solution, which can help others solve the same problem quickly. After the ticket worked successfully inside the company, they applied it in customer claims. It is, for example, used to track the progress of transport.

Knowledge transfer is the premise for a professional and effective project management. A central information supply is the premise to standardization. They also use Lotus Notes, wiki, intranet and email to support KM between customers, different locations, and different steps of the business process. These tools have been widely used in daily work. Lotus Notes contains an info system, which covers a contract database, discussion database, seminar reports, LISA – Logistics-Information system, trucker database, and a training database. Wiki is an available page collection in the internet/intranet which can be read and edited. It is a gateway of the KM field. Examples are: FAQ, Knowledgebase, specification of enhancements, customer requirement specification, and portal.

To anchor the concept of continuous improvement throughout the company and all its employees, the CIP program Optimist has been developed. Tailor-made tools include but are not limited to5S, a decentralized and highly efficient idea management tool, and the DMAIC methodology based on Six Sigma (Define, Measure, Analyze, Improve and Control). Thus, all processes are aligned continuously in terms of quality and efficiency.

After implementing these approaches, KM has brought the logistics company some benefits directly or indirectly: better service, more value added, less time, lower cost, higher quality, and process standards. However, there are still some great challenges to managing knowledge, especially tacit knowledge in the business process. First, tacit knowledge sharing depends strongly on organizational culture and incentive measures. It is easier for people to share tacit knowledge (e.g. valuable experience from project operation)

when the culture is open and friendly. Organizational learning is important to enhance knowledge management. Both new employees and old ones are more willing to share knowledge in such an environment.

Incentive measures contain two aspects. On the one hand, measures to encourage knowledge sharing and transfer, such as idea cards and rewards, can positively motivate KM. On the other hand, punishments for those who hide or conserve important knowledge can support KM at some expense.

In addition, structure can also influence KM. If the organizational structure has too many levels and a complicated hierarchy, it will make knowledge flow more slowly or indirectly. A purely functional structure can hinder KM as well, as it is static and not flexible. Therefore, a mixed structure combining process and functions is more efficient and effective at supporting business and knowledge flow.

Last but not least, there is a life cycle for KM, not only for product or service development. At the initialization stage there is rapid growth which quickly comes to a peak, but may then decline if it is not well managed. Organizations should pay attention to this, analyze the causes and take prompt action to control the situation, allowing it to move forward and improve steadily.

7.2 Comparison

7.2.1 Differences between theory and practice

Comparing the findings from theory and practice, we can see some differences of concepts, orientations, and approaches of KM application in 3PL. First, the concept of knowledge in theory is more broad and meaningful than its perception in practice. The initial understanding of knowledge in practice is relatively similar to that of information, a part of explicit knowledge. Equally, the concept of KM is generally understood as information management with all kinds of systems. When talking about the tacit knowledge in people's minds, it is more difficult to share than what is discussed in literature. The biggest challenge is the culture of the organization, which will enable or hinder knowledge sharing between old and new employees, and from upper to lower management. Therefore, the actual understanding and acceptance of knowledge and KM still has a long journey ahead of it into practice.

Second, knowledge and KM in practice is more dynamic and places more emphasis on the network in 3PL and business processes. Dynamics come from the external environment, advanced technology, customer needs and logistics plans, as well as internal business process operation, knowledge demands and supply, and characteristics of knowledge. The network of party logistics, the business process network, intermodality and geographically dispersed branches require high collaboration for KM in 3PL.

Third, 3PL enterprises also provide additional services that theoretically belong to 4PL (e.g. consultancy, integrated logistics solutions), not limiting themselves to the traditional transport, warehousing and VAS functions. Moreover, they can even offer better solutions, since they have the rich and similar experience required to offer customers feasible and innovative service. Furthermore, such services are more knowledge intensive and need effective KM to maintain the competency.

Fourth, KIBPM in practice should consider both business process strategy and operation, though theory focuses more on the operation perspective. The strategic perspective combines market dynamics and business development as well business change. Adapting to the environment changes, 3PL enterprises must choose their business strategy, e.g. blue sea strategy, cost leadership strategy, differentiation strategy or segmentation strategy. They need to establish their market, for example “consumer contract logistics and distribution” or “industrial contract logistics”. More specifically, they should find the proper market position. Moreover, they must even adjust and redesign the existing business to obtain more competitive advantage.

7.2.2 Similarities between theory and practice

There are also some aspects in common between theory and practice, namely, the importance of knowledge and KM for 3PL, the necessity of integrating KM in the business process, and the main enablers and approaches.

First, knowledge has become a strategic resource and capital in 3PL. Knowledge flow is increasingly independent in the value chain. Therefore, KM has been more and more essential for 3PL enterprises to improve logistic service and performance as well as to enhance competency and competitive advantage.

Second, 3PL enterprises need to apply KM and integrate KM into business processes. Companies have realized that functional orientation leads to rigidity and separation of cost centers, while process orientation leads to customer orientation in supply chains. The logistics service is business process oriented, which makes KIBPM more feasible and effective. KIBPM can support business process design, execution, evaluation and improvement. A typical example is the KM in project management in 3PL, which requires feasible plans, effective communication, efficient implementation and scientific measurement, and collaboration with partners and customers.

Third, the problems and challenges to applying KIBPM are similar. Technology is the most frequently mentioned factor as enabler and method. Culture is the most difficult factor, which needs more time and more effort to cultivate. People are another critical factor to utilizing KM successful, requiring both internal and external motivation.

Fourth, the approaches of KIBPM contain a socio-technical character. People in industry strongly agree that while developing and implementing KM databases, tools and techniques have played important roles in KM, and thst non-technological design (people, organization and managerial) will contribute to more dramatic improvements in KM.

Finally, the benefits of applying KIBPM in 3PL enterprises include the following aspects: enhanced ability to adapt to the external environment, rational allocation of resources, daily work fulfillment, project completion, logistics service improvement (value creation, flexibility and innovation), cost reduction (time, finance), organization learning and sustainable competitive advantage (talent/expert retention).

7.3 Implications

According to the analysis and discussion of findings from theory and practice, we learn that KM is crucial for 3PL, and that it is both necessary and feasible to integrate KM in the business processes of 3PL enterprises. However, there is currently a distance between theory and practice. On the one hand, KM and KIBPM have been studied in academia for a long time, and they are expected to produce considerable contributions to organizations. However, not every application of KM in practice performed well, and some large projects or systems investments have failed. In fact, KM has not been applied on a large scale in logistics and 3PL enterprises, especially SMEs. On the other hand, the reality in

business is changing dynamically, and many new phenomena are arising, which should also be considered by research. In both of these cases, practitioners need to learn the current development of KM as realized in theory and the practical experiences of others. Meanwhile, researchers also need to look into practices from industry in order to determine the existing problems and possible solutions.

7.3.1 Research implications

First, the most often mentioned enablers of KM are: technology, organization, people, and process, while another enabler—the environment—should also have attention drawn to it, as it is the essential background for KM. Organizational culture is a kind of internal environment that will motivate or hinder knowledge sharing. Customer needs, market changes, industry trends, and logistics networks are important external environments that produce necessary knowledge for organizations to learn. Therefore, KM in 3PL enterprises or any other organizations should consider the environmental factors and their effects on decision making for sustainable growth.

Second, as business processes involve both strategic planning and operational execution, KIBPM should also consider both of these levels. KM in operational business processes ensures that things are done right, while KM in strategic design for business processes guarantees that the right things are done. The strategic plan itself needs KM, and simultaneously points out the direction and route for operational activities. Hence, research on KIBPM must focus on this vertical process from strategic design through plan realization, to performance evaluation.

Third, KM research should also consider the horizontal relations with other organizations that are interacting with each other. Taking 3PL as an example, communication as knowledge sharing and transfer between 3PL service providers and shippers, partners, and customers is critical to fulfilling an order or accomplishing a project. Additionally, business processes do not stand alone, but cooperate with other management and support processes, which also involve KM activities. Thus, the logistics networks and process networks bring more opportunities and challenges for KM.

Lastly, there is a marked resemblance between KM activities and logistics management, the objects of which, however, are different. They both have the requirements of specific

time, quality, quantity, cost, reliability, flexibility, security, sharing, and transferring of objects. They supply different users/customers. They include similar activities of acquisition, production, warehousing, distribution and application. They can also share the concept of inbound and outbound logistics. Therefore, the flow of knowledge and KM in logistics can be visualized in the movement of materials and processes of logistics management. The role of KIBPM is especially vivid in the process of planning, implementing, operating and reviewing.

7.3.2 Managerial implications

First, the premise of KIBPM is a comprehensive analysis of business processes. KM investment should focus on the most knowledge intensive core business processes. It will be neither efficient nor effective to implement KM activities in all business processes. The selection of core business process should consider if it connects closely to enterprises' core strategic goals, and if it reflects the organizational core competency.

Second, implementation of KM should start with a good understanding of knowledge demand and an objective auditing of the existing knowledge base. Knowledge demand is inspired by external (e.g. technology, market, competitor, customer preference, politics, economy) or internal (e.g. finance, personnel, knowledge or material assets) environmental factors. Different enterprises, business processes and employees have different knowledge demands, so identification of the potential knowledge demand is the first task after defining the core business processes. In addition, a knowledge audit is aimed at finding the gap between knowledge demand and knowledge supply.

Third, effective application of KM needs the support of top management and IT systems. The full support of top management makes possible decision making for KM at the strategic level, which will motivate more employee involvement, and ensure the right direction of KM implementation. Good IT systems are indispensable tools that highly improve KM efficiency.

Last but not least, motivation of knowledge sharing and transfer is of significant importance for applying KIBPM. Figure 7-1 illustrates a motivation model of knowledge sharing and management. The enablers of technology, organization, and people are the basis, which will enhance or hinder knowledge sharing and management. Furthermore,

motivation of knowledge sharing has different levels. First, the employees know that knowledge should be shared and managed. Second, there are some opportunities and systems that make knowledge sharing possible, such as meetings or intranet. Third, organizations establish the culture and rule that knowledge should be shared. Finally, some incentive measures make employees willing to share knowledge.

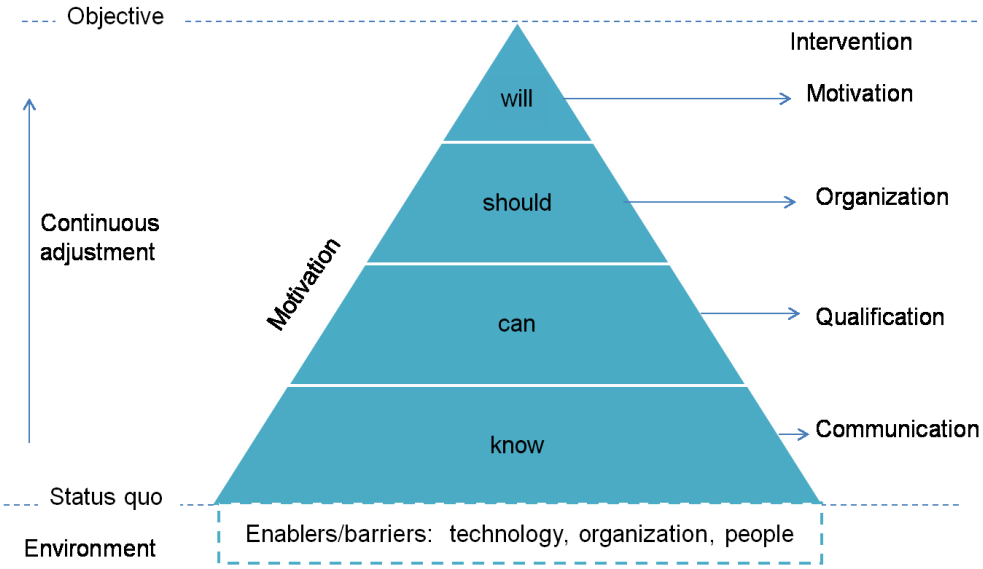

Figure 7-1 Motivation model of KM

Source: [Kohl (2009)]

7.4 Conclusion

The objective of this work is to apply KIBPM in 3PL enterprises from both the theoretical and practical perspectives. From the theoretical perspective, it studies the application issues and approaches, and proposes a framework from the strategic and operational perspectives, based on literature review and theoretical analysis. In particular, it highlights the dynamics and networks of KM context and tacit knowledge sharing in 3PL. From the empirical perspective, a case study in a leading 3PL provider demonstrates the KM drivers, practices and approaches, and validates the KM framework.

The dynamics of market, technology, and customer needs have brought great challenges to logistics and supply chains. To survive in such a competitive environment, most enterprises recognize the importance of knowledge assets to attaining the enterprise performance goal. Logistics processes need to cope with the increasing diversity of logistics problems in external and internal networks, which requires the implementation of KM methods, techniques and systems by logistics service providers.

However, a large number of companies have launched KM projects, only to fail in many cases. One problem is that KM activities often lack context (e.g. of the business process). The integration of KM in business processes is meant to improve KM effectiveness and efficiency. KIBPM has the application potential to improve process optimization and service innovation in 3PL. It links the exact context and knowledge, and combines business processes, people, and knowledge. Process knowledge is essential for BPM including planning, implementing and controlling, establishing standards and communicating best practices within the organization. Knowledge is acquired and created within the strategic and operative business processes and shared with customers and partners in the logistics network, as well as other business processes and geographic networks. Process orientation enables KM to grasp organizational realities (context), trace knowledge flow along with the value chain, aid navigation of existing information systems, and particularly facilitates easy access to and application of the knowledge resource for daily work [Gai & Dang (2010)].

From the strategic perspective, KM can support the choice of business competitive strategy, as well as business process planning, design, and development. This will point to the right direction and objective, thus ensuring 3PL enterprises do the right things. In today's hyper-competitive market, customer needs, market opportunities, information technology, old and new businesses, and relationships with partners are changing considerably. Prompt adaption to these environmental dynamics is increasingly important, and methods of doing so include: keeping collaborative networks with customers, shippers, and partners; adjusting competitive strategies to suit specific businesses; and planning efficient business processes. From the operational perspective, the objective of implementing KIBPM in 3PL is to do things right, that is, to support business process execution, control, optimization and improvement.

The implementation of KIBPM should not cover all business processes, but firstly focus on the knowledge intensive core business processes, which are of higher importance for the production and application of knowledge. The core business processes provide a superior customer benefit compared with competitors and have a higher demand of KM. Evaluation of the core business processes includes analysis from the perspectives of external environment, internal organization, and knowledge characteristics in the business process. The classic business processes in 3PL are: warehousing management, transport

management, value-added service (VAS), and consultancy. Knowledge intensive business processes are those that contain high density knowledge. In 3PL, warehousing management/operation, intermodal transport, and dispatch processes are the most knowledge intensive business processes. These processes do not operate separately, but interact with each other. The typical business process networks in 3PL include project cooperation, intermodal integration, and geographic collaboration.

Knowledge resources in the core business processes of 3PL including knowledge at both the strategic (e.g. business strategy choice, intermodal transport plan) and operational levels (e.g. project management, intermodal transport execution). Strategic knowledge sources include knowledge about the market, industry, existing and potential customers, competitors, policy and regulations, products, services and technology, as well as the selection criteria of the shippers. These selection criteria include expertise knowledge, network customization, experience in the specific industry and handling of specific product types, sub-contracting practices, and others.

Operational knowledge can be classified as procedure knowledge, profession knowledge, and perception knowledge. Procedure knowledge is process related knowledge, including the overall phases, steps, tasks, and activities required to manage a project. Profession knowledge is domain related knowledge in business processes. It covers various aspects, among them: business service expertise and experience, customer requirement, market and industry, logistics, sub-contractors, and logistics performance. Perception knowledge is results related knowledge. It comes from experience in business processes. It will enrich both procedure knowledge and profession knowledge.

The main enablers of KM are environment, technology, organization and people. The core activities of KM are knowledge acquisition, knowledge production, knowledge warehousing, knowledge distribution, and knowledge application. KM at the strategic level is achieved by the decision makers' sense of the external environment, and analysis of opportunities and threats. The main approaches of dynamic KM are ICS (Wissensbilanz), knowledge cross docking center, environment scans, competitive intelligence, and business intelligence. KM at the operational level is a systematic method of KM foundation (knowledge sharing and transfer), KM implementation (enablers, approaches, activities) and KM improvement (communication and organizational

learning). Examples of the approaches at this level are FAQs, search engines, groupware, intranet, wikis/blogs, knowledge maps, grid technology, checklists, best practices, action learning, coaching, debriefing, discussion forums, experts directories, manuals, idea management, and teamwork.

The potential benefits of applying KIBPM in 3PL include: enhanced ability to adapt to the external environment, rational allocation of resources, daily work fulfillment, project completion, logistics service improvement (value creation, flexibility and innovation), cost reduction (time, finance), value creation, and organization learning and sustainable competitive advantage (talent/expert retention). Direct and indirect KM benefits found in the case study include better service, more value added, less time needed, lower cost, higher quality, and process standardization.

In conclusion, logistics services provided by 3PL are process oriented and knowledge intensive, and it is necessary to apply KIBPM in 3PL enterprises. The dynamics from outside and inside logistics enterprises drives organizations to identify their knowledge, manage that knowledge in business processes, and adapt to new changes. KM can be enhanced through the dynamic capabilities of a recursive flow of integration, learning, and reconfiguration. The service quality and reliability of 3PL enterprises depend not only on themselves, but also depend on that of their partners, which will influence the choices and decisions of shippers. The integrated services of 3PL are always collaborative processes, with networks of project cooperation, intermodal integration, and geographic collaboration. Moreover, the application of KIBPM in 3PL involves both operation and strategy. The main enablers are not only technology, but also organizations and people internal and external to 3PL. KM is not a series of short term efforts, but a long term commitment. Further on, communication and learning is critical to improving KM and long term performance and competency.

7.5 Outlook

With all the analysis from different aspects in this thesis, the application of KIBPM in 3PL is expected to contribute to BPM at the strategic level (strategy, planning, and development) as well as at the operational level (execution, controlling, optimization and improvement). However, as this work is an initial exploration, it leaves several issues unresolved for future research.

First, the object of future study can be 3PL service providers for a specific industry/ product, or other types of LSPs. This work explored the application of KIBPM in 3PL enterprise, and studied the practice of KM in a 3PL company, which serves the market of "Industrial Contract Logistics", for customers from such industries as aerospace, automotive, mechanical engineering, steel, and chemistry. Further research can focus one or some of these industries, in order to study the specific knowledge and KM approaches for specific industries. Similarly, future research can also explore the KIBPM application in another market: "consumer contract logistics and distribution" (e.g. fast food), which must require quite different knowledge and KM. From another perspective, logistics services provided by 3PL enterprises include inbound logistics and outbound logistics, such as procurement and production logistics, distribution logistics, and spare parts logistics. Hence another direction is to study KIBPM in one of these logistics services, or even just one business process and its networks (e.g. intermodal transport or warehousing management). Moreover, it is also very interesting to compare knowledge integration in different business processes of 3PL companies, and compare the application in 3PL companies in different countries. In addition, a potential direction of future research is applying KIBPM in 4PL service, which is even more knowledge intensive.

Second, future research may focus on one specific aspect of process knowledge. This work classifies process knowledge into three types: procedure knowledge, profession knowledge, and perception knowledge. Profession knowledge covers various aspects, among them: customer knowledge, partner knowledge, quality, security, and sustainability. Orientation on any one of these mentioned aspects will be a good topic for future research. In business processes, customer knowledge is critical throughout the whole process, since a logistics service is to learn and meet customer requirements. Partner knowledge will directly influence the quality, cost, and efficiency of logistics service. Quality management and sustainability also require knowledge support and KM in business process and key points. In addition, risk / security management is a growing challenge for 3PL service providers. Risk in contracting, transport, warehousing construction, and so on, are critical issues for 3PL service providers to consider and prevent, so that they can better satisfy customers and improve logistics performance.

Third, future research may also study one specific aspect of KM. KM has different phases: planning, implementation, and evaluation. More precisely, KM planning includes KM

strategy, audit, and design, while KM implementation includes such core activities as knowledge acquisition, production, warehousing, distribution, and application. Finally KM evaluation includes measurement method, establishment of key indexes, and validation, among other elements. Furthermore, each specific aspect has various research perspectives, such as technology (IT, KMS design and development), organization (culture, structure, leadership, incentives, process), and people (human resources, motivation). In addition, a very interesting topic is knowledge sharing and transfer, and a more practical direction is knowledge application.

Furthermore, the research methodology can expand the number of case studies and combine them with a quantitative approach. While descriptive case studies have the advantage of reflecting on problems in the business environment with all relevant facts, opinions and expectancies with recordings [Kern & Boppert (2010)], they also have the disadvantage in identifying a causal relationship between different variables and suffer from the subjective biases of their sources (data, information, document) authors. Therefore, future research may extend the case study approach to further study the application of KM or KIBPM in 3PL. One possible direction is to conduct more case studies in different 3PL companies, compare the differences and similarities, and thus generate deeper findings. Another direction is to test the proposed framework through explanatory case studies, evaluate the frameworks suitability, and improve it. One more possible direction is multi-method research. This contains elements of both the qualitative and quantitative approaches, which can complement each other, inspire the research process, validate the research results, and facilitate interpretation [Hurmerinta-Peltomäki & Nummela (2004)].

Finally, organizational learning is a promising direction for future study. KM is a way to enable knowledge flow in business process actively and support organizational goals. In order to improve KM continually and maintain the sustainable competency of the organization, KM research should consider and pay more attention to organizational learning. Learning is the means of acquiring and applying knowledge, leading to change in behavior and performance.

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Appendices

Interview Questionnaire with Fraunhofer IPK

Interviewer: Hongyan Zhang

Organization: University of Bremen

Interviewee: _____

Organization: _____

Work Responsibility: _____

Experience in KM / logistics research: _____

Email: _____

Phone: _____

Introduction

The objective of this interview is to further learn the model and methods of PKM projects (ProWiss, GPO-WM) in Fraunhofer IPK, and find out the potential to integrate PKM into the 3rd / 4th party logistics enterprises.

Questions

1. How do you define these **concepts** :

   - Knowledge (tacit, explicit)
   - Knowledge management (KM)
   - Process-oriented KM (PKM)

2. Could you please introduce the motivation, application and effects of **ProWis**?

3. ProWis homepage describes the **process model, analysis/implementation methods, and case studies** of PKM in small & middle sized enterprises. It seems that they considered the **strategic, management and operative level** of organization process?

4. According to St. Gallen Management Model, organizations contain **management process, business process, and support process**. Is the **business process** in ProWis defined similarly?

5. Could you please explain the 3 **KM analysis tools: WM-Fitness-Check, WM-Audit, GPO-WM-analysis?**

6. In WM-Fitness-Check, the **knowledge fields** include specialized knowledge, customer knowledge, product knowledge, and market knowledge. Are they just some examples, or are they classified according to some standard? What about the supplier knowledge, employee knowledge, and competitor knowledge?

7. The key **enablers** of KM are **technology, people and organization (TOM model).** What is your opinion of **people** perspective?

8. How to **motivate people to share and transfer knowledge** in business process and involve knowledge management in the organization?
9. What do you think of the integration of **PKM into logistics: 3PL, 4PL** on the strategic, management and operational levels?
10. How do you understand **knowledge** in business processes of the 3rd/4th logistics enterprises?
    - tacit knowledge

- knowledge in intra- & inter-company communication
- knowledge in intermodal transportation
- supplier, employee, customer and competitor knowledge….

11. How can the software tool **MO ² GO** model business process of logistics enterprises?

12. From your expertise and experience, could you please suggest some possible **methods of PKM in logistics?** Could you please provide some relative **examples or cases** ?

13. Do you think if PKM can achieve the following **improvements** in logistics:
    a) Increase in **profitability**
    b) Increase in **market share**
    c) Increase in **knowledge sharing and learning**
    d) Improvement of business **process**
    e) Improvement of **service innovation, value creation, and flexibility**
    f) Reduction of time and financial **cost**
    g) **Retention** of experts and retirees **knowledge**
    h) Increase in sustainable **competitive advantage**
    i) Other

14. Could you please give me some suggestions on my **dissertation**?

15. Could you please recommend or share some **articles and books**? e.g.
    - Orth, R./ Mertins, K. (2006): Strategisches und operatives Wissensmanagement – Ein ganzheitlicher Ansatz. In: VDI Wissensforum IWB GmbH (Hrsg.), VDI-Berichte Nr. 1964 - Ingenieurwissen effektiv managen. Düsseldorf: VDI-Verlag, S. 3-24.
    - Orth, R.; Voigt, S. (2012): Prozessorientiertes Wissensmanagement in kleinen und mittleren Unternehmen. In: gfwm THEMEN.
    - Mertins, K.; Seidel, H. (Hrsg.): Wissensmanagement im Mittelstand. Grundlagen - Lösungen - Praxisbeispiele, 306 S. ISBN: 978-3-540-69362-8

Thanks so much for your time and support!

Interview Questionnaire with 3PL Enterprise

Interviewer: Hongyan Zhang

Organization: University of Bremen

Interviewee: _____

Organization/service: _____

Position/title: _____

Work Responsibility: _____

Experience in logistics/KM: _____

Email: _____

Phone: _____

Introduction

The objective of this interview is to learn the **perception and implementation** of knowledge management (KM)/ process-oriented KM (PKM) by the 3rd party logistics service providers.

The key questions are:

- How do people **understand Knowledge and Knowledge Management (KM)** in logistics?
- What **practices** have been used to support **KM**? Are these practices **effective**?
- What are the **potentials and problems** to integrate KM into **business processes** during daily work? Which aspects should be improved to fulfill the potentials of PKM?

Questions

1. What is the understanding of the **concepts** in logistics?

   - 3PL
   - 4PL
   - Information
   - **Knowledge**
   - **Knowledge Management (KM)**
   - Process-Oriented KM (PKM)

2. What challenges have the dynamics of market, technology, customer needs etc. brought to logistics services? Which factors drive the logistics service providers start KM?

3. What are the most important **processes** in the 3rd party logistics services? (i.e. business/ management/ support processes, e.g. logistics, forwarding, consultancy, **value-added service**; 4PL service)

4. What are the most important **knowledge resources** in business processes?
   - tacit / explicit knowledge
   - knowledge in intra- & inter-company communication
   - knowledge in intermodal transportation
   - supplier, employee, customer and competitor knowledge

5. What **KM strategy/projects** has your organization launched? How long?

6. What **activities / approaches** are used to **manage (share, create, store, transfer, apply & retain) knowledge**? (e.g. KM systems, wiki, groupware, FAQ, sharing best practices, knowledge community, workshops, training or other incentive measures)

   - Subscriptions
   - Action Learning
   - Best practice approach
   - Checklist
   - Idea Management
   - Learning History
   - Model
   - Organizational instructions

- Coaching
- Communities of Practice
- Database-based systems
- Debriefing
- Discussion forum
- Enterprise Information Portal
- Experts directory
- FAQ
- Interview techniques
- Groupware systems
- Manual
- Process Wizard
- Skills training
- Interfaces Workshops
- Search Engine
- Teamwork
- Enterprise newspaper
- Visualization technique
- Wikis / Blogs
- Knowledge map
- Knowledge Manager
- Knowledge dictionary

7. What is the **main objective** of integrating knowledge management practices in the organization? How about the **results**? Which approaches are more **effective**?

   a) Improving **knowledge sharing and transfer**
   b) Enhancing organization **learning**
   c) Improving business **process**
   d) Enhancing **service innovation**
   e) Adding service **value**
   f) Promoting **flexibility** of logistics service
   g) Reducing time and financial **cost**
   h) Increase in **profitability**
   i) Increase in **market share**
   j) **Retaining knowledge** of experts and retirees
   k) Keeping sustainable **competitive advantage**
   l) Other

8. Have KM practices integrated in **business processes** during daily work? Why?

9. What are the **potentials and problems** to integrate KM initiatives into **business processes**?

10. What are the most important **enablers** (e.g. technology, organization, people, culture, structure, management,) for KM in logistics? How to incentive **people** to share and transfer their knowledge?

Thanks very much for your time and support!

Further Questions

1. Could you please describe the **typical processes of 3PL** with **St. Gallen management** model or any other frameworks?

Core business processes	**Management processes**	**Support processes**
Contract logistics		
Transport logistics		
Value added services		
Consultancy		

General process:

Customer requirement→communication and analysis →solutions → application → review / feedback

Plan—Do—Check—Act

Detailed procedure of each business process

Contract logistics	Transport logistics	Value added services	Consultancy
1 Tender 2 Plan 3 Implementation /operation 4 Review/evaluation			

2. Regarding **knowledge resources in business processes**, besides **employee knowledge** from work experience etc., what about the knowledge about **customer, partners (e.g. supplier, sub-contractor), and competitor**? How do companies deal with such knowledge? Perhaps the ticket method is one example to handle knowledge about customer claims?

- **Process knowledge:**
- Procedure: phases, steps
- Profession: customer needs, project requirements,
- Lessons learnt: dos, don’ts, better solutions, mistakes to avoid

3. For the **intermodal transport,** I think the **Tender Center** needs much special knowledge to plan the best way, and the operation requires very good communication and exchange of knowledge/information to deliver the goods to the right place at the right time. Do you have very special practices of KM in these cases?

4 Dynamics and enablers

Table Enablers of KM

Enabler	**External**	**Internal**
Technology	ERP, Oracle	GCT, OCS, DOR
Organization	Competition	Culture, learning
People	Communication	Share

5 Regarding the **KM approaches,** do you also use interviews, questionnaires, expert systems, video, knowledge map/dictionary etc.? Do you have a checklist of the KM approaches you have applied in business processes? **Who is responsible for KM** plan, implementation and evaluation, the business manager, knowledge manager, human resource manager, or other, or flexible?

6

	Technology	**Organization**	**People**
Knowledge acquisition	checklist Lotus Notes Wiki Ticket Intranet	Company Magazine Intranet	meeting idea card
Knowledge production	CIP		meeting
Knowledge warehousing	centralized documentation Lotus Notes Wiki Ticket		
Knowledge distribution	checklist email		meeting
Knowledge application	checklist		

7 What are the **benefits, problems or difficulties** of KM in logistics?