

**Knowledge Management in the Shipping Industry:  
The Effects of Human Mobility on the Organisational  
Knowledge Base and Effective Knowledge Transfer Practices  
– A Perspective from China**

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## DECLARATION OF ORIGINALITY

This thesis contains no material which has been accepted for a degree or diploma by the University of any other institution, except by way of background information and duly acknowledged in the thesis, and to the best of the candidate's knowledge and belief no material previously published or written by another person except where due acknowledgement is made in the text of the thesis.

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## ABSTRACT

The severe shortage of skilled and qualified personnel in the shipping industry has been addressed in various ways. This thesis looks into the issue from a new perspective where high mobility in the shipping industry is seen as a vehicle of knowledge flows that can be used for knowledge transfer. The rationality of this approach is that knowledge has been considered the most important asset that an organisation can possibly use as a leverage to gain competitive advantage, and the fact that knowledge management practices have been successfully applied into industries such as the pharmaceutical, oil and gas industries where skill shortages have been a major obstacle for development. It is argued that while an organisation cannot stop personnel leaving, it is possible, by utilising effective knowledge management practices, to retain part of the knowledge held by such personnel.

As there is a dearth of research on knowledge management in the shipping industry, the objective of this thesis is to explore the appropriate application of knowledge management practices to the industry. This is achieved by (i) identifying the components of an organisational knowledge base (OKB); (ii) examining the effects of human mobility on the OKB; and (iii) investigating management practices for effective knowledge transfer in the shipping industry. A conceptual framework is established to address these three research questions.

In order to empirically validate the research models, a sample of Chinese shipping companies (ship owners, manning companies, ship managers) was selected for a mail survey. The mail survey generated a 60 per cent response rate in which 166 valid questionnaires were returned. A wide range of statistical techniques such as reliability, *t*-test, ANOVA, Pearson's correlation, factor analysis (PCA), and multiple regression, was employed to analyse the data collected from the mail survey.

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The study made a number of findings. First, an OKB consists of fourteen knowledge components with four dimensions, and the perceived importance of these components vary according to business sectors, fleet sizes, and respondents' total work experience. Secondly, all personnel movements except those of ratings are considered critical to the OKB. Such perceived effects can be predicted by two of the three factors regarding current workforce stability (*total preferred workforce, total stability and optimism*). Finally, effective knowledge transfer practices are comprised of fourteen elements from three main management domains, that is, culture, leadership, and technology. A multiple regression analysis finds that current management practices (a four-factor solution) do not explain perceived effective knowledge transfer practices. It is found, however, that some elements are affected by the establishment of a knowledge management department or the designation of a chief knowledge officer, and that there are correlations between information communication technology related practices and the current/preferred means of communication.

It is suggested that through the identification of the composition of an OKB, an organisation should provide a supportive culture, strong leadership, and relevant resources to manage its knowledge asset through effective knowledge transfer, given the impacts that high human mobility has on the OKB.

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## LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BBS	Bulletin Board System
BIMCO	The Baltic and International Maritime Council
CI	Confidence Interval of the difference
CKO	Chief Knowledge Officer
CoP	Communities of Practice
DWT	Dead Weight Tonnage
EDI	Electronic Data Interchange
EKT	Effective Knowledge Transfer
HR	Human Resource
IC	Intellectual Capital
ICT	Information Communication Technology
IGO	Individual-Group-Organisational
IT	Information Technology
KMO	Kaiser-Meyer-Olkin
KMD	Knowledge Management Department
KT	Knowledge Transfer
MNC	Multinational Corporation
MEI	Maritime Education Institution
MOB	Mobility
NIH	Not-Invented-Here
OADI-SMM	Observe, Assess, Design, Implement – Shared Mental Model
OKB	Organisational Knowledge Base
PCA	Principal Components Analysis
SCA	Sustained Competitive Advantage
SECI	Socialisation, Externalisation, Combination, Internalisation
RBV	Resource-based View
R&D	Research and Development
OM	Organisational Memory

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SM	Ship Manager
SO	Ship Owner
SRQ	Subsidiary Research Question
SPSS	Statistical Package for Social Science

## CHAPTER 1: INTRODUCTION

### 1.1 Research background

Nearly a century ago, Marshall, in his book: *Principles of Economics*, explicitly pointed out the importance of knowledge within economic affairs by stating: “Capital consists in a great part of knowledge and organisation...knowledge is our most powerful engine of production” (Marshall 1920, IV.I.2). Economic prosperity rests upon knowledge and its useful application (Teece 1981). Drucker (1993) comments that we have entered a knowledge society in which knowledge is not just another resource alongside traditional resources such as land, labour and capital, but the only meaningful resource today. The importance of knowledge-related resources to organisational success ranks highest among all intangible resources an organisation possesses (Hall 1992). Knowledge is thus considered the ultimate replacement of other resources (Toffler 1990; Quinn 1992) therefore the key or even the only resource (Drucker 1993) to a firm’s sustained competitive advantage (SCA).

While the critical importance of knowledge was recognised nearly a century ago, the development of theories has been a long race. In the course of the development of theories regarding knowledge management, two distinct lines of thinking appeared in the literature. One is the scientific line, for example: Porter (1980, 1985), Simon (1945, 1973) and the other is the humanistic line represented by Mayo (1933), Weick (1979) and Pfeffer (1981). Attempts have been made to synthesise these two camps, for example: Argyris and Schön (1978), Drucker (1993), Nonaka and Takeuchi (1995), and Senge (1990), bringing more camps of theories into management and organisation theories such as organisational learning (Argyris & Schön, 1978), the learning organisation (Senge, 1990), the resource-based approach (Prahalad & Hamel 1990; Stalk, Evans & Shulman 1992), and Drucker’s (1993) knowledge worker and the knowledge society.

Knowledge management has come a long way from the resource-based view (Barney

1991; Prahalad & Hamel 1990; Teece *et al.* 1997; Wernerfeld 1984), organisational learning (Hedlund 1994; Wenger 1998), to a knowledge-based view of strategy (Grant 1996; Nonaka 1994; Spender 1996). Despite continuous debates on theories, a wide range of strategies and tools has been designed and implemented to manage knowledge assets of organisations in various industries. In comparison with other industries, the shipping industry appears to have lagged behind in embracing these new management practices. This is evidenced by a dearth of research on the application of knowledge management practices in the context of the shipping industry.

The need for the exploration of a new approach such as knowledge management in the shipping industry arose from the severe skill shortages being faced by the industry as a result of high personnel mobility in the industry. A comprehensive study conducted by the Baltic and International Maritime Council, in conjunction with the International Shipping Federation showed an imbalance of supply and demand of seafarers (BIMCO 2000; 2005) as a result of on-going outflow of its highly experienced personnel to other shore-based industries and low intakes to refill its skill base. It is projected that by 2010, the shipping industry will be faced with a shortage of 46,000 skilled and qualified personnel worldwide (BIMCO 2005). Because these highly qualified personnel are the main source to fill up onshore positions in many sectors of the shipping industry for example, management positions in shipping companies, and professional ship managers including technical, operational, legal, financial, and commercial management of shipping activities, the shortage will impact the shipping industry's ability to meet ever increasing demands on maritime transport, which will in turn affect the wellbeing of international trade and world economy. The skill shortage will also be a threat to safe shipping practices, with impacts on costs of trading, the marine environment, and the wider economic stability that the global community has come to expect.

Due to the shipping industry's unique characteristics, personnel movement across industries has been very high (Moreby 1975) and in most cases, such movement is in

a one-way direction with the shipping industry constantly losing its expertise to other industries (for example: Gardner & Pettit 1999; Kong & Ruan 2001). The problem is compounded by the difficulty in attracting personnel into the industry for various reasons (Dinwoodie, 2000; Leggate 2004; Moreby 1975; Sambracos & Tsiaparikou 2001). Conventional teaching from human resource management cannot effectively solve the problem of high turnover in the shipping industry due to, not only high costs involved in retaining leaving personnel, but also the initial motives of leaving being irrelevant to retention incentives (Abassi & Hollman 2000). The battle to retain expertise and skills has continued for years with little success. It is against this background that this research was initiated as an attempt to address the effects of high mobility of personnel in the shipping industry from a new perspective.

The underlying rationale is to regard the high personnel mobility as an opportunity rather than a problem because the movement of personnel is widely recognised as a mechanism for distributing tacit knowledge and skills across space and time (Almeida & Kogut 1999; Cooper 2001; Gruenfeld, Martorana & Fan 2000). As personnel are knowledge carriers (Grant 1996; Polanyi 1962; Von Krogh & Roos 1995), when they move they bring their knowledge into the new workplace. While inflow mobility may bring in new knowledge that the organisation previously did not have, outflow mobility may be translated into a loss of certain knowledge if the knowledge of the person leaving is not known to the others in the organisation. The impact of personnel mobility, to a great extent, depends on whether there are mechanisms in place to manage these knowledge flows for the best interest of the organisation.

The attempt to apply knowledge management principles to the shipping industry brings with it three important tasks. The first task is the identification of knowledge assets in a shipping organisation. The significance of this process is three-fold:

- Any management practices is pointless if their purpose is not clear.
- The identification of knowledge assets provides measurable items to examine the effects of high personnel mobility on the organisation.

- For management practices to be effective, their design and implementation must be relevant to what is being managed.

While there is abundant research on knowledge related constructs (for example: Aaker 1989; Amit & Schoemaker 1993; Grant 1991; Hall, 1992, 1993, 1994; Hamel & Heene 1994; Itami & Roehl 1987; Lyles & Schwenk 1992; Prahalad & Hamel 1990; Rumelt 1994; Teece 1998; Walsh & Ungson 1991; Winter 1987; Zander & Kogut 1995) and knowledge measurement approaches (for example: Brooking 1996; Edvinsson & Malone 1997; Marr & Schiuma 2001; Roos *et al.* 1997; Sveiby 1997), there is a lack of definition of concepts to capture the wholeness of organisational knowledge (that is, both individual and organisational, explicit as well as tacit) in particular in the shipping industry.

The second task is to examine the effects of high personnel mobility seen from the point of view of each shipping organisation. Mobility is a more neutral description of turnover in that turnover traditionally has been seen as an important organisational problem that is costly and dysfunctional to the organisation. The differentiation of dysfunctional and functional turnover, rather than the traditional categorisation of voluntary and involuntary turnover, clarifies that turnover incurs negative as well as positive effects (Abelson & Baysinger 1984; Dalton & Todor 1979; Muchinsky & Tuttle 1979; Staw 1980). The belief that personnel are knowledge carriers (Grant 1996a; Polanyi 1962; von Krogh & Roos 1995) reveals that personnel mobility (Graversen 2003; Langberg & Graversen 2001) in fact creates knowledge flows. For a given organisation in a particular industry, knowledge flows at different levels and in different directions (for example: Almeida, Song & Grant 2002; Bolton 1994; Eisenhardt & Santos 2002; Hauknes & Ekeland 2002; Tomlinson 1999; Winter & Szulanski 2001). The effects of these complex knowledge flows are yet to be examined in the context of the shipping industry, although general discussions of the effects of turnover on organisations have been provided in the literature.

If there are effects on organisational knowledge assets as a result of knowledge flows



brought about by personnel mobility, then how can these knowledge flows be managed in a way that organisational knowledge assets can be increased over time becomes an important question. This brings to us the third task, which is to find an appropriate set of management practices to effectively manage knowledge flows. The knowledge management process includes a range of activities such as knowledge creation or acquisition, distribution or dissemination, interpretation, and application (Hubber 1991). Depending on the priority of knowledge management application, these activities have been emphasised differently in the literature. For example, while Nonaka and Takeuchi (1995) emphasise the creation of knowledge, Almeida and Grant (1998) argue that the major source of value creation from knowledge management is likely to be in knowledge application. Due to the nature of the problem faced by the shipping industry (the high knowledge attrition caused by high personnel mobility), the main management task is knowledge retention if a high level of personnel movement is inevitable. It is identified that the most effective way of knowledge retention is through knowledge transfer (Abou-Zeid 2002; Almeida & Grant 1998; Govindarajan 2000).

Research in different contexts has identified knowledge-related and partner-specific factors that might affect the effective transfer of knowledge (Gupta & Govindarajan, 2000; Simonin, 1999; Szulanski, 1996). Knowledge-related factors include the value of knowledge being transferred (Gupta & Govindarajan, 2000), tacitness and complexity (Simonin, 1999) and causal ambiguity (Szulanski, 1996). Partner-specific factors mainly concern the recipient's absorptive capacity (Gupta & Govindarajan, 2000; Szulanski, 1996) or prior knowledge (Simonin, 1999), the relationship between source and recipient (Szulanski, 1996), the cultural and organisational distance (Simonin, 1999), and the motivation of source and recipient (Gupta & Govindarajan, 2000; Simonin, 1999; Szulanski, 1996). Research on these variables lays a firm foundation for the examination of barriers and facilitators of knowledge transfer in the context of the shipping industry, which in turn helps the identification of effective knowledge transfer practices for shipping organisations.

## 1.2 Research questions

The discussion of the three tasks elaborated above provokes the following three fundamental research questions in this study:

**Research question one:** How is an organisational knowledge base described in the shipping industry?

To answer the first requestion, two hypotheses are proposed:

**Hypothesis 1:** *Organisational knowledge base is a construct of 14 identified components associated with four groups of knowledge: individual explicit, individual tacit, organisational explicit and organisational tacit.*

**Hypothesis 2:** *The perceived importance of knowledge components in an organisational knowledge base (OKB) varies according to the observer's business sector, fleet size, and work experience.*

**Research question two:** How are the effects of human mobility on the organisational knowledge base perceived in the shipping industry?

The second research question is divided into two subsidiary questions (SRQ) with the first being answered through three hypotheses:

**SRO2.1:** *What are the effects of human mobility on the OKB?*

**Hypothesis 2a:** *There is a positive relationship between the inflow of personnel and the OKB.*

**Hypothesis 2b:** *There is a negative relationship between the outflow of personnel and the OKB.*

**Hypothesis 3:** *The effects of mobility on the OKB differ with different movement patterns.*

**SRO2.2:** *How well can perceived effects of human mobility on the OKB be*

*predicted by the current workforce stability?*

**Research question three:** What are the effective knowledge transfer practices in the context of the shipping industry?

To investigate the third research question, a hypothesis and a subsidiary research question are proposed as follows:

**Hypothesis 4:** *Effective knowledge transfer practices in the shipping industry consist of 14 factors involving 3 groups of management practices: organisational culture (6), leadership (3), and technology (5).*

**SRO3.2:** *Can perceived effectiveness of knowledge transfer practices be predicted by existing management practices in a shipping organisation?*

### **1.3 Research objectives**

The research background outlined earlier revealed some gaps in the literature and in management practices. The main objectives of this research are, therefore, to identify the knowledge components of the OKB in a shipping organisation, to determine the effects of personnel mobility on the OKB, and to identify the effective knowledge transfer practices in the context of the shipping industry. The research will focus on the perceptions of shipping organisations (including ship owners and ship managers) in China as listed in the World Ship Directory 2007-2008 (Lloyd's Register 2007). More specifically, the research sets out to achieve following objectives:

- To propose a conceptual model of the OKB in the shipping industry with associated dimensions and components;
- To empirically explore the perceived importance of knowledge components as identified in the conceptual model from the perspective of shipping organisations in China;
- To investigate whether the perceived importance of knowledge components varies according to demographic variables;

- To establish the projected relationships between the high level of personnel mobility in the shipping industry and the OKB;
- To empirically validate respondents' attitudes toward the projected relationships between mobility and the OKB in the context of China;
- To investigate whether such attitudes toward the projected relationships between mobility and the OKB can be explained by current workforce stability of respective shipping organisations;
- To suggest a conceptual model of effective knowledge transfer for the shipping industry with identified management practices;
- To explore the perceived effectiveness of these knowledge transfer practices in the context of the shipping industry in China;
- To examine whether the differences of perceptions of effectiveness can be predicted by current management practices of the respective shipping organisations.

## **1.4 Outline of the thesis**

The thesis follows a conventional structure with the current chapter establishing the purpose of the research and explaining the three primary research questions and their subsidiary research questions and hypotheses.

Chapter Two reviews the concept of knowledge and organisational knowledge assets for the first research question. It begins with a review of the literature on the dimensions of knowledge, followed by a discussion of different measurement approaches with regard to knowledge assets. The concept of organisational knowledge base is then proposed with the identification of knowledge components. Finally the shipping specific knowledge components are identified and examined under the concept of the OKB.

Chapter Three covers a review of the literature for the second and the third research questions. It begins with the discussion of the effects of human mobility on the OKB,

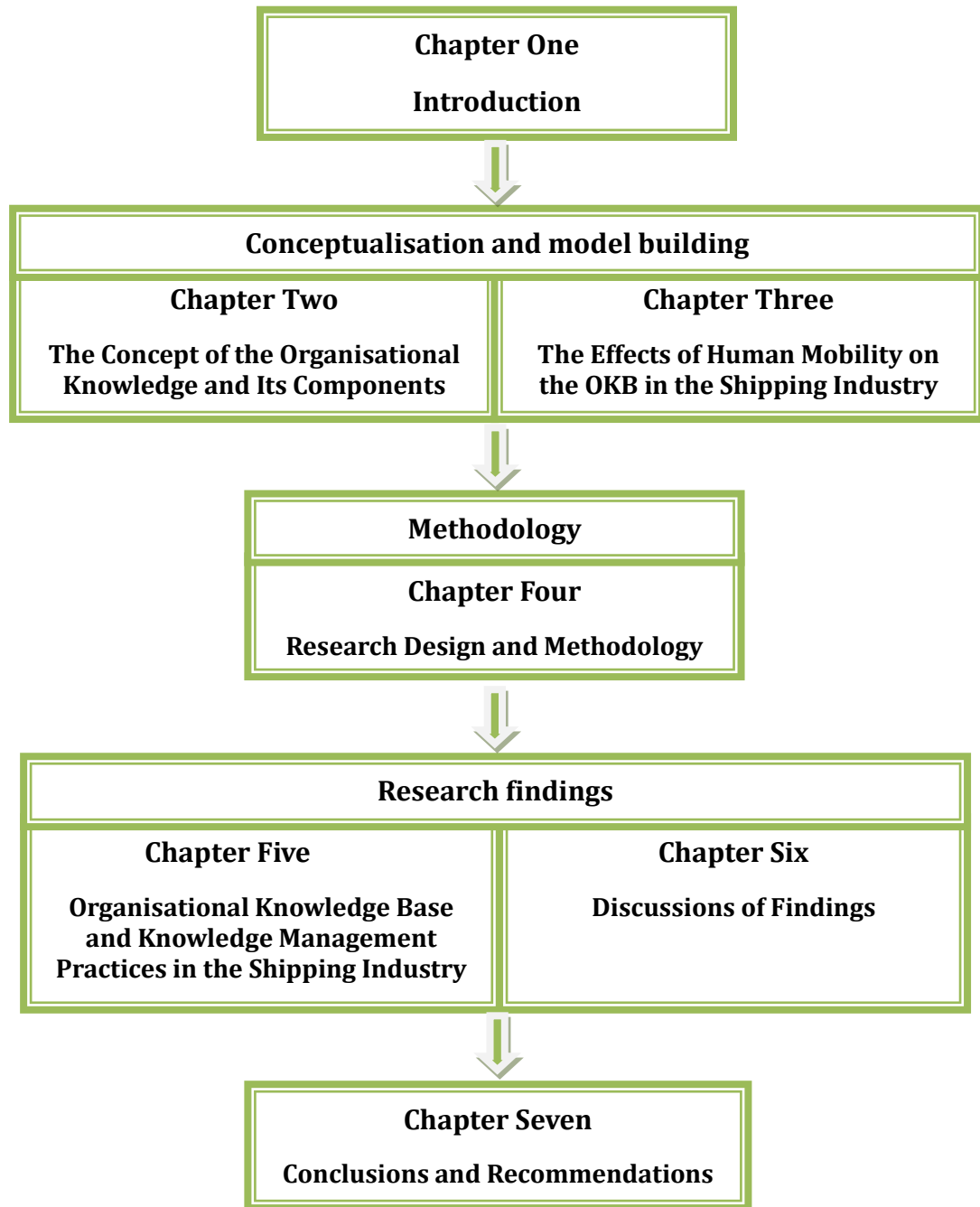
linking turnover with mobility and then with knowledge flows. This section concludes with the establishment of perceived effects of human mobility on the OKB in the context of the shipping industry. The chapter then moves on to a review of the literature on knowledge transfer including individual learning and organisational learning, and the knowledge management process, followed by the identification of barriers and facilitators of knowledge transfer. Based on the effective knowledge transfer practices identified through the literature review, a knowledge transfer model is proposed. This model is then used for the investigation of knowledge transfer practices in the context of the shipping industry.

Chapter Four presents the research design and methodology used in this study. It begins with the development of the research framework in which all conceptual models are summarised. The unit of analysis, target population, sampling design, and sample size are discussed next, followed by the explanation of methods of data collection including the design of the survey instrument and the administration process. The final section covers the discussion of data editing, coding and entering, and methods of data analyses.

Chapter Five analyses the collected data and reports on the profiles of respondents. It begins with the analyses of demographic variables followed by three sections of data analyses for the three research questions. Each section of data analyses provides detailed discussion of statistical techniques being used and the process of the data analyses. Findings are presented along with hypotheses and subsidiary research questions. Chapter Six discusses the findings from Chapter Five. The discussions of findings are linked back to the review of the literature conducted in Chapter Two and Three wherever appropriate.

Chapter Seven draws conclusions on the three research questions and makes recommendations for future research. The chapter begins with a revisit of the purpose of the study followed by a summary of results. The contribution and limitations of the research are then discussed. It concludes with recommendations for future research.

Figure 1.1 The structure of this thesis



Source: Author

## **CHAPTER 2: THE CONCEPT OF ORGANISATIONAL KNOWLEDGE BASE AND ITS COMPONENTS**

### **2.1 Introduction**

The main objective of this chapter is to provide an overview of the concept of organisational knowledge, on which the concept of organisational knowledge base (OKB) is presented. The chapter begins with an overview of the concept of knowledge, its distinction between data and information through which a definition of knowledge is given and adopted as the understanding of knowledge. The conceptualisation of the OKB is achieved through the review of literature on the classification of knowledge and other knowledge-related constructs such as intangible assets, core competency/capabilities, absorptive capacity and organisational memory.

Another main task of this chapter is to identify the components of knowledge in the cells of the OKB matrix. By reviewing measurement models on intellectual capital, components of knowledge in each category are examined and discussed and then reorganised and restructured into a table to illustrate the composition of the OKB. The final sections of this chapter endeavour to apply the concept of OKB in the shipping industry and identify its relevant components for the empirical test. The identification of knowledge components of the OKB lays the foundation for examining the effects of human mobility in the shipping industry. Based on the OKB, these knowledge management practices can be identified and applied into the shipping industry to mitigate the problem of severe skill shortages the industry has been facing (Chapter three).

## 2.2 The multidimensional concept of knowledge

### 2.2.1 The distinction of data, information and knowledge

There has been a long history of confusion and debate in both academia and the practitioner with regard to the relationship between data, information and knowledge. In fact, confusion between knowledge and information has resulted in enormous expenditure in information technology ventures that have yielded only marginal results (Sveiby 1997; Davenport & Prusak 1998). The intuitive idea that knowledge is something more than information has led literature in knowledge management to make distinctions between data, information and knowledge, for example, Boisot (1995), Choo (1998), Davenport and Prusak (1998), Hayek (1952) and Nonaka and Takeuchi (1995). However, despite the efforts of distinction and definition, many researchers use the terms casually and interchangeably. It is argued that equating information and knowledge oversimplifies and even confounds the already contentious division among biologists, cognitive psychologists, sociologists, and organisational researchers regarding data, information and knowledge (Miller 1978). Thus, a brief discussion of the distinction between data, information and knowledge is given to clarify the author's stand as to how knowledge is understood. A definition of knowledge is provided at the end of this section as adopted in this thesis.

The distinction of data, information and knowledge tends to be related to the ability of their independency from their owner. Data is seen as syntactic and invariant with a potential meaning to someone who can interpret them (Hirschheim *et al.* 1995; Setzer 2001). Information is created through a process of meaning attribution or interpretation of data by individuals (Hirschheim *et al.* 1995). Unlike information, knowledge is embedded in people, and its creation occurs in the process of social interaction (Sveiby 1997). Knowledge resides in individuals and is based at least partially on personal experience (Leonard & Sensiper 1998). Therefore, information is a personal, variable, esoteric and ephemeral concept, dependent on the receiver's point of interest and knowledge base, which is private and only available to the individual (Boahene & Ditsa 2003). Knowledge may be personal or collective, it is

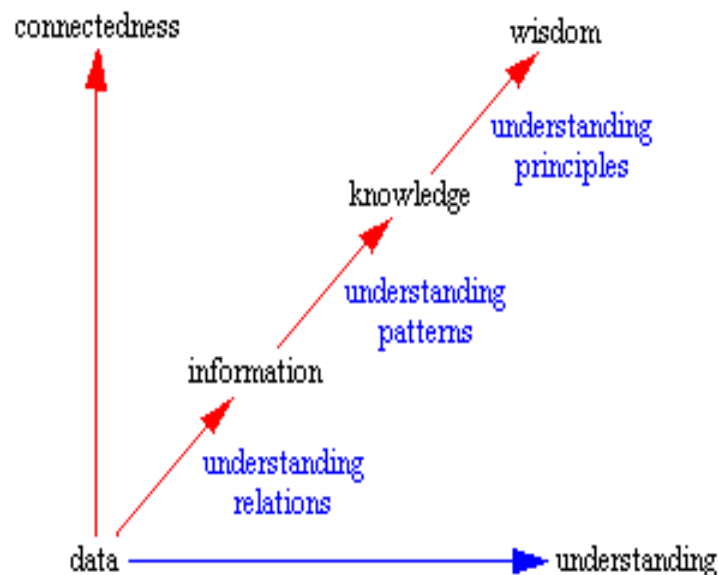


however more stable than information (Boahene & Ditsa 2003). Although related to both, knowledge is neither data nor information and the differences between these terms are often a matter of degree (Davenport & Prusak 1998).

### 2.2.2 The relationship between data, information and knowledge

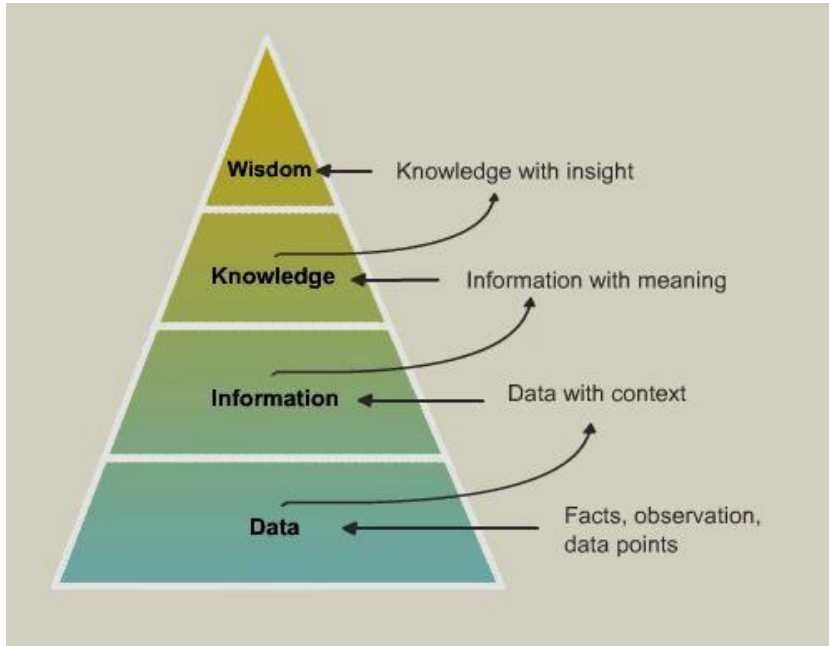
The relationship between data, information and knowledge is widely recognised in the literature and is popularly referred to as a hierarchy (Ackoff 1989; Alavi & Leidner 2001; Knight & Howes 2002; Stenmark 2001; Tuomi 1999). The hierarchy where data sit at the base, and followed by information and then knowledge is referred to as the knowledge hierarchy (figure 2.1). Information is data endowed with relevance and purpose and the conversion from data to information requires relevant knowledge (Drucker 1988). Information tends to be relatively static in time and linear in nature, while knowledge is dynamic and has completeness in it (Bellinger 1997). Information can become knowledge only when the patterns and their implications are realised and understood. The process of transition from data to information, to knowledge or finally to wisdom is illustrated through a pyramid-shaped diagram (figure 2.2).

**Figure 2.1 DIKW Hierarchy**



Source: Bellinger, Castro & Mills (1997)

**Figure 2.2 The Knowledge Hierarchy**



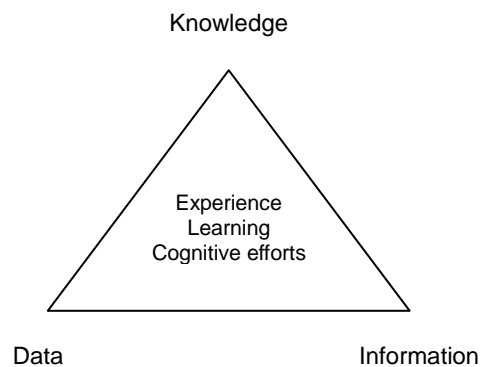
Source: Knight & Howes (2003)

The underlying view of this knowledge hierarchy intends to reveal that the value of the various forms of data-information-knowledge increases through learning or understanding (Bender & Fish 2000; Choo *et al.* 2000; Knight & Howes 2002). It considers the construction of knowledge as somewhat similar to using letters as atoms for building words that are subsequently combined to meaningful sentences and then context. However, knowledge emerges through inter-personal validation (Earl 1994). A broad knowledge base is needed to understand, interpret and integrate the information at hand (Leonard-Barton 1995; Kogut & Zander 1992). Thus, there is suggestion of a reversed knowledge hierarchy (Alavi & Leidner 2001; Stenmark 2001; Tuomi 1999), contending that the presumption of a hierarchy from data to information to knowledge with each varying along some dimension such as context, usefulness, or interpretability, rarely survives scrupulous evaluation. The key to effectively distinguish between information and knowledge is not found in the content, structure, accuracy or utility of the information or knowledge, rather in whether the information is processed in the mind of the individual.

Central to this argument is the belief that knowledge is embedded in a knower and is shaped by one's needs as well as one's initial stock of knowledge (Fahey & Prusak 1998; Tuomi 1999). Data can emerge only if a meaning structure, or semantics, is first fixed and then used to represent information. Information is achieved when the meaning is articulated within a linguistic and conceptual context. Information is converted to knowledge once it is processed in the mind of individuals and knowledge becomes information once it is articulated and presented in symbolic forms (Alavi & Leidner 2001). The transformation process involves individual and collective cognitive efforts.

From a more neutral perspective, Stenmark (2001) argues that information and knowledge are interwoven and interrelated in more complicated ways than the knowledge hierarchy or reversed hierarchy has suggested. In some way, knowledge is a prerequisite to make sense of data and information (Drucker 1988). At the same time, new knowledge is developed and constructed through available data and information. Data and information are considered two opposite ends on a continuum and what one conceives as information might be data to another (Stenmark 2001). Therefore, instead of considering the relationship between data, information and knowledge as hierarchy, where one is superior to another, a triangle (figure 2.3) is suggested to illustrate the interwoven and interrelated relationship among these three (Ancori *et al.* 2000; Boahene & Ditsa 2003).

**Figure 2.3 The triangular relationship of data, information and knowledge**



Source: Developed by the author based on Ancori *et al.* (2000) and Boahene & Ditsa (2003)

The definition provided by Bell (1999) with regard to the distinction of data, information and knowledge can be a summary for the above discussion. For Bell, data is an ordered sequence of given items or events. Information is a context-based arrangement of items whereby relations between them are shown. Knowledge, however, is the judgement of the significance of events and items, which comes from a particular context and/or theory. What differentiates knowledge from information therefore is that knowledge presupposes values and beliefs, and is closely connected with action.

The definition of knowledge suggested by Davenport and Prusak (1998, p5) is adopted as what knowledge means in the context of this thesis. Knowledge is:

A fluid mix of framed experience, value, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms.

Tsoukas and Vladimirou (2001) comment that Davenport and Prusak pack into knowledge too many things in this definition, it is believed that this definition captures three important characteristics of knowledge: 1) the distinction and relationship between knowledge and information which has been discussed in this section; 2) the ontological dimension of knowledge, that is, knowledge as existing both in individuals and organisations and 3) the epistemological dimension of knowledge, that is, tacit and explicit knowledge. The ontological and epistemological dimensions of knowledge are explained in the following section.

### **2.2.3 The classification of knowledge**

Knowledge has been classified into different categories from different perspectives. Epistemologically, knowledge can be either explicit or tacit (Lubit 2001; Nonaka

1994; Nonaka & Takeuchi 1995; Polanyi 1966; Spender 1996; Zack 1999). Ontologically, knowledge can exist in an individual, a group or an organisation (Nonaka 1994; Nonaka & Takeuchi 1995). Some have classified knowledge according to its level of embedment (Argyris & Schön 1978; Cooper 1992; Fiol & Lyles 1985; Levitt & March 1988; Nelson & Winter 1982; Prahalad & Hamel 1990; Senge 1990; Zuboff 1988), or its causal-effect relationship (Anderson 1983; Singley & Anderson 1989; Quinn *et al.* 1996). The level of embedment includes such subcategories as embodied, encoded, embrained and embedded knowledge. Embodied (Blackler 1995; Collins 1993; Zuboff 1988) and embedded (Astley & Zammuto 1992; Badaracco 1991; Brown & Duguid 1991) knowledge emphasises more the process of knowledge development and construction. Knowledge is generated and shared in different language systems, organisational culture and work groups. Encoded knowledge (Blackler 1995; Collins 1993; Zuboff 1988) on the other hand, remains in the organisation even if all employees have gone. Knowledge is retained in databases, product categories, rules and regulations, and operation manuals. Embrained knowledge (Argyris & Schön 1978; Blackler 1995; Collins 1993; Fiol & Lyles 1985; Prahalad & Bettis 1986) depends on the cognitive abilities which allow the recognition of underlying patterns and assumptions. Thus embodied and embrained knowledge reflect the tacitness of knowledge, whereas encoded knowledge represents the explicit characteristics of knowledge. Moreover, declarative (Anderson 1983; Singley & Anderson 1989; Quinn *et al.* 1996) and procedural (Bohn 1994; Zander & Kogut 1995) knowledge, captures the explicit side on the one hand and encompasses the tacit nature of knowledge on the other. A summary of classification can be found in table 2.1.

From the above discussed classification of knowledge, it is fair to conclude that the epistemological and ontological classification of knowledge has well captured the full dimensions of knowledge, though there may be many other possible ways of classifying it. This classification is then adopted in this thesis as a basis to conceptualise the organisational knowledge base in the later sections. The classification of knowledge has been an important part of literature in knowledge

management as it allows management to identify relevant barriers and enablers in knowledge creation and transfer process, which will be discussed in the next chapter. The epistemological and ontological dimensions of knowledge are further discussed in the following sections.

**Table 2.1 The classification of knowledge**

Type of classification	Dimension of classification	Contributing authors
Epistemological	Tacit and explicit knowledge	Lubit, 2001; Nonaka, 1994; Nonaka & Takeuchi, 1995; Polanyi, 1966; Spender, 1996; Zack, 1999
Ontological	Individual, group, organisation knowledge	Nonaka, 1994; Nonaka & Takeuchi, 1995
Level of embedment	Embrained, embodied, encultured, embedded, and encoded knowledge	Argyris & Schön 1978; Cooper, 1992; Fiol & Lyles, 1985; Levitt & March, 1988; Nelson & Winter, 1982; Prahalad & Hamel, 1990; Senge, 1990; Zuboff, 1988
Cause-effect relationship	Declarative, procedural knowledge	Anderson, 1983; Bohn, 1994; Singley & Anderson, 1989; Quinn <i>et al.</i> , 1996; Zander & Kogut, 1995

Source: Author

### **2.2.3.1 The epistemological dimension**

Epistemological classification distinguishes between tacit and explicit dimensions of knowledge. According to Polanyi (1966), tacit knowledge is deeply rooted in action and specific context and is subjective, situational and intimately tied to the knower's experience (Kidd 1998). It is difficult to express, formalise or share in an explicit way. Tacit knowledge involves both cognitive elements which include mental models, schemata, paradigms and beliefs, and technical elements which include know-how, crafts and skills (Nonaka 1993). The acquisition of tacit knowledge usually involves (unconscious or semi-conscious) actions (Leonard-Barton & Sensiper 1998; Zack 1999), which reflect the effortlessness of tacit knowledge (Polanyi 1966). Tacit knowledge is further classified into four categories (Lubit 2001): a) skills or know-how, b) mental models, c) ways of approaching problems and d) organisational routines. Under the theory of resource-based view (RBV), tacit knowledge is

intangible and difficult to imitate, and therefore a source of competitive advantage to an organisation (Barney 1991).

Explicit knowledge refers to knowledge that is structured and independent of the knower (Kidd 1998) therefore, capable of articulating in formal, systematic language. It is captured in records of the past such as libraries, archives and databases, and is assessed on a sequential basis. In organisations, explicit knowledge is stored in databanks, standard operating procedures, and manuals as objective knowledge (Spender 1996).

### 2.2.3.2 The relationship between explicit and tacit knowledge

Explicit and tacit knowledge are not totally separate but mutually complementary entities (Nonaka 1993). In fact, “All knowledge is either tacit or rooted in tacit knowledge; a wholly explicit knowledge is unthinkable” (Polanyi 1996b, p. 7). Knowledge is created through four patterns of interaction between tacit and explicit knowledge: socialisation, externalisation, combination and internalisation – SECI model (Nonaka & Takeuchi 1995) (figure 2.4).

**Figure 2.4 Four modes of knowledge conversion**

		Tacit knowledge	To	Explicit knowledge
Tacit knowledge	From	<b>Socialisation</b>		<b>Externalisation</b>
	Explicit knowledge	<b>Internalisation</b>		<b>Combination</b>

Source: Nonaka & Takeuchi (1995)

Through socialisation, an individual is able to acquire tacit knowledge directly from others without using language but through observation, imitation and practice. The key to acquire tacit knowledge is shared experience. Externalisation is the knowledge creation process in which tacit knowledge becomes explicit, taking the shape of

metaphors, analogies, concepts or models. Externalisation holds the key to knowledge creation, because it creates new, explicit concepts from tacit knowledge. Combination involves combining different bodies of explicit knowledge into a knowledge system. Reconfiguration of existing information in the knowledge system through sorting, combing and categorising of explicit knowledge can lead to new knowledge. Internalisation is a process of embodying explicit knowledge into tacit knowledge. It is closely related to learning by doing.

When experience through socialisation, externalisation, combination and internalisation is initialised into an individual's tacit knowledge base, in the form of shared mental models, they become valuable assets. For organisational knowledge creation to take place, however, the tacit knowledge accumulated at the individual level needs to be socialised with other organisational members, thereby starting a new spiral of knowledge creation.

### **2.2.3.3 The ontological dimension**

Ontological dimension classifies knowledge into individual, group and organisational knowledge. Knowledge can be viewed as existing in individuals, groups or organisations (Nonaka 1994). Knowledge is created by individuals, and organisational knowledge creation is considered as a process in which individual knowledge is amplified, and integrated into organisational knowledge. The process is referred to as the spiral of organisational knowledge creation (Nonaka & Takeuchi 1995), where organisational knowledge creation happens through the amplification of the patterns of knowledge conversion throughout the organisation, starting from the individual rising to the inter organisational level. The ontological classification of knowledge coincides the distinction between individual and organisational learning (Kim 1993), defining different levels of social interaction, that is, individual, group and organisational.



#### **2.2.3.4 The relationship between individual and organisational knowledge**

The character of knowledge has been debated for a long time. While some insist on the personal character of knowledge (Polanyi 1962; Von Krogh & Roos 1995), others claim that all knowledge is, in a fundamental way, collective (Wittgenstein 1958). Other statements suggest that knowledge is the individual capacity to draw distinctions, within a domain of action, based on an appreciation of context or theory (Baumard 1999; Nonaka & Takeuchi 1995; Tsoukas & Vladimirou 2001), that is, knowledge can be personal as well as collective. That organisations provide concrete settings, sets of abstract rules for individual action illustrates how knowledge, in the organised context, becomes organisational (Tsoukas & Vladimirou 2001).

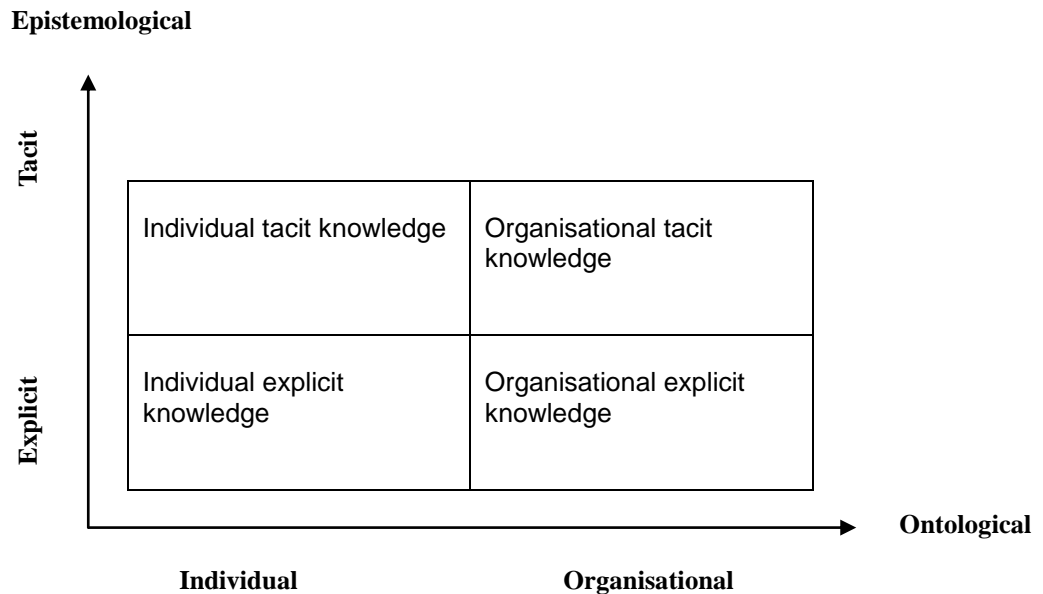
The development of organisational knowledge is not achieved by aggregating individual knowledge, but rather by synthesising through social interaction between individuals and is mediated through multiple levels (Probst, Büchel & Raub 1998). At the individual level, interpretation of the environment leads to the revision of individual knowledge structures. At the group level, individual knowledge structures are synthesised to create shared beliefs or a shared mental model (Nonaka & Takeuchi 1995). At the organisational level, the routinisation of shared beliefs leads to organisational knowledge. These are social processes which are composed of the interaction of individuals and not of their isolated behaviour.

In Nonaka and Takeuchi's knowledge creation model (1995), the ontological dimension consists of four different levels of knowledge creation: individual, group, organisation and inter-organisation. Organisational knowledge is created in the process that organisationally amplifies the knowledge created by individuals and crystallises it as part of the knowledge network of the organisation. This process takes place within an expanding "community of interaction" which crosses intra- and inter-organisational levels and boundaries (Nonaka & Takeuchi 1995). The amplification of knowledge is achieved through the four modes of knowledge conversion (SECI), which creates a spiral effect as it progresses from individual to the inter-organisational level. By using concepts of 'scaling' and 'self-similarity',

von Krogh and Roos (1995) illustrate the conversion between individual and organisational knowledge, an approach similar to Nonaka and Takeuchi's (1995) ontological dimension. Organisational learning occurs in such processes of exchange, evaluation and integration of knowledge out of which organisational knowledge emerges (Duncan & Weiss 1979). Organisational knowledge, therefore, resides in both the individual organisational members and in relationships among organisational members (von Krogh & Roos 1995).

Drawn from the organisational knowledge matrix of Nonaka and Takeuchi (1995) and Spender (1996), and Cook and Brown's (1999) four forms of knowledge, a matrix is developed to illustrate the concept of the organisational knowledge base (see figure 2.5). Organisational knowledge is the knowledge that belongs to the organisational, but independent of its individual members. The organisational knowledge base, however, includes both the organisational knowledge and the individual knowledge of its employees.

**Figure 2.5 A matrix of organisational knowledge base**



Source: Adapted from Nonaka & Takeuchi (1995), Spender (1996), Cook & Brown (1999)

## **2.3 Conceptualising the organisational knowledge base**

The last section briefly mentions the concept of organisational knowledge base. The reasons for this thesis to use this concept lie in the fact that theoretically, organisational knowledge only stands for one end of the knowledge continuum if an ontological classification of knowledge is acknowledged. Practically, organisations only have ownership on knowledge that belongs to them, be they corporate culture, routines, operation processes or databases, written rules and manuals, which are independent to their employees, that is, even if individuals leave, organisational knowledge would still remain. Personal knowledge however goes with individuals when they walk out of the door. Organisations cannot retain personal know-how if the individual does not prepare to share it. An organisational knowledge base contains both organisational and personal knowledge which can be used by the organisation as resources to generate competitive advantage.

The concept of the OKB provides a better understanding of what to manage and how to manage knowledge in an organisational context. As personal knowledge is temporal to an organisation, it can be an organisational resource only when used. The extent to which personal knowledge is made available to the organisation and to other employees within that organisation is a vital factor in deciding whether organisational knowledge is increased over time. The issue is how fast and effectively an organisation is able to learn. To make personal knowledge available not only helps the organisation make best use of its resources to create competitive advantage in the present but also, through externalisation and routinisation, personal knowledge becomes part of the organisational knowledge and stored for future use. Furthermore, OKB does not remain static; rather it reflects the dynamic nature of organisational knowledge. OKB can be enriched, upgraded and refreshed through internal and external personnel flows.

The term organisational knowledge base was used by Scarbrough (1996). Similar concepts, such as knowledge repository (Penrose 1959), knowledge stocks

(Narasimha 2000; SubbaNarasimha, Ahmad & Mallya 2003) and knowledge inventory (Levinthal & March 1993; Miller 2002; Powell 2003) have been used in the literature, though the components of it vary. Nevertheless, no literature so far has specifically dealt with this concept. While there is no intention in this thesis to create a new concept, the distinction between OKB and organisational knowledge and the adoption of the OKB concept is a significant step towards measurement of knowledge in an organisation as will be illustrated in the following sections. Most importantly, the concept of OKB is firmly built upon the epistemological and ontological dimension of knowledge as discussed in earlier sections.

The following sections will provide a brief overview of knowledge-related constructs and how they relate to OKB. Then a generic OKB is presented after the review of existing methods on the measurement of knowledge. The last section of this chapter endeavours to apply the concept of OKB in the shipping industry and brings out the operational attributes and indicators of OKB in shipping-related companies for empirical testing.

### **2.3.1 Organisational Knowledge base and related constructs**

#### **2.3.1.1 Knowledge-related constructs**

Venzin *et al.* (1998, p. 54) provide a list of knowledge-related constructs which can be further grouped into four main categories (table 2.2): assets, competences or capabilities, organisational memory, and absorptive capability. Constructs in assets are further divided into invisible assets and intellectual capital (Itami & Roehl 1987; Skandia 1994), intangible resources (Hall 1992, 1993, 1994), and strategic assets (Amit & Schoemaker 1993; Winter 1987). Organisational resources, such as trade names, customer relations, organisational culture, employee know-how and other capabilities which are difficult to imitate or transfer, unique and appropriate, are capable of generating a competitive advantage for the organisation. Competences and capabilities are the combination of abilities and technology, based on explicit and tacit knowledge, and have the ability to integrate new knowledge into the

organisation. Constructs in this category include core competences (Hamel & Heene 1994; Prahalad & Hamel 1990; Rumelt 1994; Teece 1998), core capabilities (Grant 1991; Stalk *et al.* 1992; Zander & Kogut 1995), skills (Aaker 1989; Klein *et al.* 1991) and architectural competence (Henderson & Cockburn 1994). Another organisational knowledge-related construct is organisational memory which refers to the organisational capacity for storing organisational knowledge (Lyles & Schwenk 1992; Walsh & Ungson 1991). In addition, absorptive capacity is also regarded as an organisational knowledge-related construct. Absorptive capacity is a firm's capacity to develop new knowledge in interaction with its environment.

Constructs in the asset category emphasises tacit knowledge. At an organisational level, there are culture, external relationships (such as supplier and customer relations), trade name and internal management styles. Personal tacit knowledge in this category includes employee know-how and capabilities. The explicit dimension of knowledge in this category, however, is insufficiently explained with the exception of Teece (1998) who notes that the firm's knowledge base includes its technical competences as well as its knowledge of customer needs and supplier capabilities. These competences reflect both individual skills and experiences as well as ways of doing things inside firms. According to Teece (1998), the organisational knowledge base may include knowledge embedded in business routines and processes, codified knowledge such as blueprints, formulas and manuals, intellectual property such as patents, trade secrets and trademarks, and individual skills and experiences.

**Table 2.2 Knowledge-related constructs**

Categories	Construct	References	Explanation
<b>Assets</b>	Invisible assets, intellectual capital	Itami & Roehl (1987); Skandia (1994)	Resources based on information (i.e. customer trust, trade name, distribution control, organisational culture, capacity of management)
	Intangible resources	Hall (1992; 1993; 1994)	Intangible assets which can belong to a legal person are distinguished from capabilities which are not easily transferable (ie. The know-how of the employees, suppliers and customers, and the culture of the organisation)
	Strategic assets	Amit & Schoemaker (1993); Winter (1987)	Combination of resources and capabilities which are difficult to imitate or transfer, rare, appropriate and specialised to generate competitive advantage in the organisation
<b>Competences or capabilities</b>	Core competences	Prahalad & Hamel (1990); Hamel & Heene (1994); Rumelt (1994)	Combination of abilities and technology which is based on explicit and tacit knowledge and characterised by durable stability cross-product influence. Core competences create value for the customer, are unique among competitors, allow of access to new markets, are not easily imitable or transferable and are synergetically linked to other competences
	Core capabilities	Zander & Kogut (1995); Amit & Schoemaker (1993); Stalk <i>et al.</i> (1992); Grant (1991)	Capacity of an organisation to use resources it is based on organisational principles which structure, coordinate and communicate knowledge
	Skills	Aaker (1989); Klein <i>et al.</i> (1991)	'Capability' and 'competences' are often used synonymously and refer to social systems. 'skills' describe the individual capabilities on which competences are based
	Architectural competence	Henderson & Cockburn (1994)	Ability to integrate new knowledge into the organisation
<b>Memory</b>	Organisational memory	Walsh & Ungson (1991); Pautzke (1989); Lyles & Schwenk (1992)	Capacity for storing organisational knowledge (in knowledge structure)
<b>Absorptive capacity</b>	Absorptive capacity	Cohen & Levinthal (1990)	A firm's capacity to develop new knowledge in interaction with its environment

Source: adapted from Venzin *et al.* (1998, p. 54)

The competences and capabilities category, which contains both tacit and explicit knowledge, focuses more on the ability and capacity of organisations to use resources in order to create knowledge rather than the knowledge itself. As Zander and Kogut (1995) suggest, organisational knowledge consists of the competence of individuals and of the organising principles by which relationships among individuals, groups, and members of an industrial network are structured and coordinated. These principles of coordination of individual and functional competence generate the capabilities of an organisation. Absorptive capacity emphasises the importance of prior knowledge (Cohen & Levinthal 1990; Liyanage & Barnard 2003) in exploiting and assimilating new knowledge. While acknowledging that prior knowledge exists at both individual and organisational level, absorptive capacity does not explicitly explain what consists of prior knowledge, that is, if prior knowledge is tacit or explicit or both. However, it should be noticed that Cohen and Levinthal's primary objective is to explore the crucial rules that prior knowledge plays in the ability of a firm to recognise the value of new, external knowledge, assimilate it, and apply it to commercial ends. Prior knowledge is then treated as an aggregated concept which contains both tacit and explicit knowledge, be they individuals or organisations.

#### **2.3.1.2 Organisational memory and knowledge base**

Organisational memory (OM) refers to the "stored information from an organisation's history that can be brought to bear on present decisions" (Walsh & Ungson 1991, p.61). Although the concept of memory is primarily associated with individuals, researchers suggest that memory could also pertain to groups or organisations (Nelson & Winter 1982; Walsh & Ungson 1991). An organisation exists independent of particular individuals and may preserve knowledge of the past even when key organisational members leave. On the other hand, through sharing, the organisational interpretation system in part transcends the individual level. Individuals in an organisation retain information based on their own direct experiences and observations (Argyris & Schön 1978; Nystrom & Starbuck 1984; Sandelands & Stablein 1987). This information can be stored in their own memory in terms of briefs (Walsh 1988), assumptions and values (Brief & Dwney 1983; Beyer 1981).

The interpretations of the past can also be embedded in organisational systems and artefacts. Effective organisational structures embed personal information and experiences from individuals into the policies, procedures, rules, job descriptions and decision-making protocols of the organisation and its operation. Thus, the collective memory no longer resides solely in employees but rather in the organisation (Wexler 2002). Therefore, OM is both an individual and organisational level construct (Anand, Mantz & Glick 1998; Walsh & Ungson 1991).

According to Cyert and March (1963), Nelson and Winter (1982), standard operating procedures or routines are the memory of an organisation. Organisational routines constitute the most important form of storage of the specific operational knowledge of the organisation. Organisations remember by doing (Nelson & Winter 1982) and loss of memory is due to personnel turnover. Knowledge possessed by organisations thus can be partly reflected in organisational routines. Moreover, organisational memory is also retained and stored in individual, organisational culture, transformations, organisational structure and ecology, which are referred to as five storage bins (Walsh & Ungson 1991), or in a multi-layered organisational memory system, with the highest level being systemic and the lower two levels being group and individual (Anand, Mantz & Glick 1998).

Some argue that organisational memory is stretched by communities of practice (Fox 2000; Wenger 1998; Wenger & Snyder 2000; Lave & Wenger 1991) to peripheral activities of the focal organisation, where knowledge and experiences operate in networks of functioning groups or teams. Some authors, such as Carlsson (2002), even go a step further by suggesting that knowledge exists, and is created through, different types of networks, which are defined as a set of nodes (persons, organisations) linked by a set of social relationships (friendship, transfer of funds, overlapping membership) of a specified type (Laumann *et al.* 1978). These relationships and networks, when triggered, can stimulate the transfer of existing knowledge and the creation of new knowledge. Therefore, the part of networks or the community of practice to which organisation members belong, is the shared memory



of the organisation. Communities of practice contribute to the organisational memory from two aspects. One is the knowledge itself – the personal experiences, experts, insights and skills, which dwell among the members and in the process of interaction between them. The other is the knowledge of relationships established in the process of interaction in the communities of practice, that is, tacit knowledge also resides in individuals and their social relationships (Aadne *et al.* 1996; Choo 1998; Baumard 1999).

In summary, by stating that organisational memory is both an individual and organisational level construct (Anand, Mantz & Glick 1998; Walsh & Ungson 1991), it is clear that the concept of OM has well captured the ontological dimension of knowledge. Secondly, the five bins as storage facilities proposed by Walsh & Ungson (1991) have distinct functions in storing knowledge. As will be explained later, not all of the bins have the capacity to store both tacit and explicit knowledge. Some of them can only store either tacit or explicit knowledge. This distinction captures the epistemological dimension of knowledge. Thus, among the knowledge-related constructs discussed previously, OM is the best one for this thesis to conceptualise the organisational knowledge base. Besides, Walsh and Ungson's five-bin knowledge storage sheds light on the possible solution of knowledge measurement. The next section will give a brief description of the five-bin system based on which a matrix is given to illustrate the composition of OKB.

**Five storage bins** Walsh and Ungson (1991) state that organisational memory is stored in a five-bin structure with each bin having distinct storage functions. These five bins are:

- individuals,
- culture,
- transformations,
- structures,
- and ecology.

According to Walsh and Ungson (1991, p. 63), '*individuals* in an organisation retain

information based on their own direct experiences and observations'. This information can be retained in their own memory stores (Cowan 1988), belief structures (Walsh 1988; Walsh, Henderson & Deighton 1988), assumptions (Brief & Downey 1983), and values (Beyer 1981). In addition, individuals and organisations keep records and files as a memory aid, which help to constitute an organisation's memory (Huber 1991; Yates 1990). *Culture* is a learned way of perceiving, thinking, and feeling about problems that is transmitted to members in the organisation (Schein 1984). It embodies past experience that can be useful for dealing with the future and is therefore one of OM's retention facilities (Walsh & Ungson 1991). Information carried in culture is stored in language (Donellon 1986), shared frameworks (Duncan & Weiss 1979; Shrivastava & Schneider 1984), symbols (Dandridge 1983; Pfeffer 1981) and stories (Martin, Feldman, Hatch & Sitkin 1983; Wilkins 1983). OM is also preserved in the many *transformations* that occur throughout the organisation, such as operating procedures (Weick 1979), rules (March & Sevon 1984) and formalised systems (Walsh & Dewar 1987). Organisational *structures*, defined as stable role definitions, have implications for individual role behaviour that link with the environment (Walsh & Ungson 1991). Individual roles provide a repository in which organisational information can be stored. Finally, *ecology* is the actual physical structure or workplace ecology of an organisation which encodes and thus reveals a great amount of information about the organisation (Walsh & Ungson 1991).

Each of the five bins varies in its capacity to retain decision information (table 2.3) (Walsh & Ungson 1991). Among them, only individuals and culture (as an aggregation of individuals' shared briefs) have the capacity to reflect information about the who, what, when, where and how of a decision stimulus and response. Transformations, structures and ecology might not retain information about a decision stimulus but they inhabit an organisation's response to such a stimulus (Walsh & Ungson 1991).

**Table 2.3 Property of decision information retained in organisational memory**

	Who	What	When	Where	Why	How
Individuals	S/R	S/R	S/R	S/R	S/R	S/R
Culture	S/R	S/R	S/R	S/R	S/R	S/R
Transformations	R	R	R	R		R
Structures	R	R				
Ecology				R		R

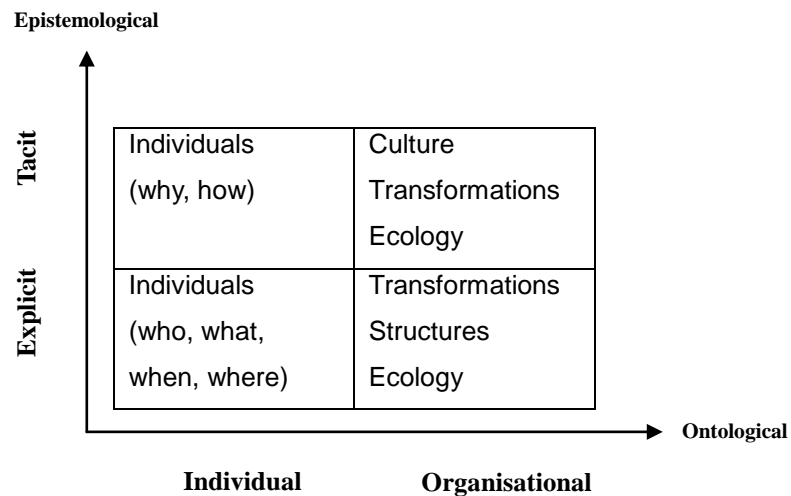
Note: S = Decision Stimulus

R = Organisational Response

Source: Walsh & Ungson (1991)

Walsh and Ungson's (1991) discussion on the different functions that each of the five bins has in storing organisational memory coincides with the previously explained OKB structure where OKB can be illustrated by a matrix. In fact, the five-bin storage system can be a useful input in identifying the composition of OKB. As shown in figure 2.6, five bins are put into different cells according to their capacity to carry and store OM. However, it should be noted that firstly, storage capacity of bins may vary over time or in different contexts. Secondly, the boundaries of the cells in the matrix are an illustration of how bins can fit in rather than an absolute definition of where they belong. This is because 1) explicit and tacit knowledge are two ends of a knowledge continuum and 2) knowledge can exist in groups, teams, even communities of practice apart from individuals and organisations. These two points apply to all OKB matrices in this thesis.

**Figure 2.6 Five bins in an OKB matrix**



Source: Author

As noted by Walsh and Ungson (1991), the five bins are only retention facilities of organisational memory not the memory itself. This poses a measurement problem and indeed 'any attempt to directly measure or assess organisational memory is doomed to be partial and incomplete' (Walsh & Ungson 1991, p. 81), as there is a lack of measurable items. Until the contents in each bin are discovered, OM cannot be measured. The literature sheds light on the measurement of organisational intangible assets which can help to identify the contents of OKB in each cell. After that, a full picture of the OKB can be visible and measurement becomes possible.

### **2.3.2 Measurement approaches on knowledge assets**

The aims of measuring knowledge assets are two-fold: 1) to evaluate the real value of an organisation to the external market and 2) to identify the knowledge components of an organisation in order to manage them (Marr, Shiuma & Neely 2004). While the former is born for clear accounting purposes, aiming to give stakeholders a more comprehensive picture of the traditional monetary value of the organisation, the latter is more concerned with knowledge management activities in order to continuously improve organisational performance. Regardless of what the purposes are in the measurement process, little has done about the assessment of organisational knowledge assets, though management literature has provided plentiful insights into knowledge management practices (Marr *et al.* 2004).

The attempt to operationalise knowledge assets has led to the development of new concepts. Of these, a popular one is intellectual capital (IC) which has been explored by many scholars such as Roos *et al.* (1997), Stewart (1997) and Teece (2000). It is believed that IC provides a better understanding of knowledge assets and is less abstract and more operative in conceptualising knowledge than the overall evaluation of knowledge assets to an organisation (Marr *et al.* 2004). IC has been referred to as the human resource (Boudreau & Ramstad 1997; Liebowitz & Wright 1999), information technology (Davenport & Prusak 1998), intangible assets (Bontis *et al.* 1999; Brooking 1996; Hall 1992; Sveiby 1997), or knowledge (Chase 1997;

Edvinsson & Sullivan 1996; Marr & Schiuma 2001; Marr *et al.* 2004). The concept of IC has brought models that address the measurement of knowledge assets. An overview of these models can be found in Marr *et al.* (2004), Marr and Spender (2004) and Malhotra (2002). Table 2.4 gives an overview of approaches (*Skandia Navigator, IC-Index, Intangible Assets Monitor, Knowledge Asset Map and IC Audit Model*) that have been employed to measure knowledge assets.

Among these models, Skandia Navigator, IC-Index and Intangible Assets Monitor split IC into human-related capital and structural capital (refer to table 2.4). In Skandia Navigator (Edvinsson & Malone 1997), structural capital has been further divided into customer capital (external) and organisational capital (internal) with the latter being further broken down into process capital and innovation capital. IC-Index (Roos *et al.* 1997) however, considers relationship capital (external), organisational capital (internal) and renewal and development value (internal) as components of structural capital. Sveiby (1997) concisely divided structural assets into internal and external structure. If reorganised, these three models in fact share the same measurement structure, that is, IC is divided into human capital and structure capital. Structure capital is further subdivided into internal and external structural capital.

**Table 2.4 Measurement approaches on knowledge assets**

<b>Skandia Navigator (Edvinsson &amp; Malone, 1997)</b>	Human Capital - Individual capabilities - Skills - Experiences		Structural Capital	
			Customer Capital (customer relations)	Organisational Capital - Process capital - Innovation capital
<b>IC-Index (Roos et al, 1997)</b>	Human Capital - Competence (skills and education) - Attitude - Intellectual agility (innovation ability)		Structural Capital	
			Relationship capital (relationships with customers, suppliers, allies and stakeholders)	Organisational Capital (databases, process manuals, culture and management styles)  Renewal and development value (employee training, reengineering and restructuring efforts, R & D)
<b>Intangible Asset Monitor (Sveiby, 1997)</b>	Competence of employees - Indicators of growth (years in profession, education level, training, turnover) - Indicators of efficiency (proportion of professionals, leverage efforts) - Indicators of stability (average age, seniority, turnover rate)		Structural Assets	
			External structure (relationships with customers and suppliers, image and brand names)	Internal structure (Investment in internal structure, corporate culture, system and process building)
<b>Knowledge Asset Map (Marr &amp; Schiuma, 2001; Schiuma &amp; Marr, 2001)</b>	Stakeholder resources		Structural resources	
	Stakeholder relationships - Customer relationships (loyalty, brand image) - Other external relationships (licensing agreements, partnering agreements, financial relations, contracts, and distribution arrangements)	Human resources - Skills and competence (know-how, technical expertise, problem solving capability, education, creativity) - Commitment and loyalty - Motivation	Physical infrastructure - Structural layout - IT (databases, servers and intranets)	Virtual infrastructure - Culture (corporate culture, values, management philosophies) - Practices and routines (process manuals, databases, tacit rules, management styles) - Intellectual property (patents, copyrights, trademarks, brands, registered design, trade secrets)
<b>IC Audit Model (Brooking, 1996)</b>	Market assets (brands, contracts, customers, distribution channels, licensing agreements and franchise contracts)	Human-centred assets (expertise, problem solving capability, creativity and managerial skills)	Infrastructure assets (Technologies, methodologies and processes)	Intellectual property (patents, copyrights, trade secrets, trademarks and design rights)

Source: Author

**Table 2.5 Restructured measurement approaches on knowledge assets**

<div>Categories</div> <div>Models</div>	Human Capital	Structural Capital	
		Internal Structure	External Structure
<b>Skandia Navigator (Edvinsson &amp; Malone, 1997)</b>	Human Capital <ul style="list-style-type: none"> <li>- Individual capabilities</li> <li>- Skills</li> <li>- Experiences</li> </ul>	<ul style="list-style-type: none"> <li>- Process capital (procedures, routines)</li> <li>- Innovation capital</li> </ul>	<ul style="list-style-type: none"> <li>- Customer relations</li> </ul>
<b>IC-Index (Roos et al, 1997)</b>	<ul style="list-style-type: none"> <li>- Competence (skills and education)</li> <li>- Attitude</li> <li>- Intellectual agility (innovation ability)</li> </ul>	<ul style="list-style-type: none"> <li>- Culture and management styles</li> <li>- Databases and process manuals</li> </ul>	<ul style="list-style-type: none"> <li>- Relationships with customers, suppliers, allies and stakeholders</li> </ul>
<b>Intangible Asset Monitor (Sveiby, 1997)</b>	Competence of employees <ul style="list-style-type: none"> <li>- Indicators of growth (years in profession, education level, training, turnover)</li> <li>- Indicators of efficiency (proportion of professionals, leverage efforts)</li> <li>- Indicators of stability (average age, seniority, turnover rate)</li> </ul>	<ul style="list-style-type: none"> <li>- Corporate culture</li> <li>- Internal structure</li> <li>- System and process</li> </ul>	<ul style="list-style-type: none"> <li>- Relationships with customers and suppliers</li> <li>- Image and brand names</li> </ul>
<b>Knowledge Asset Map (Marr &amp; Schiuma, 2001; Schiuma &amp; Marr, 2001)</b>	<ul style="list-style-type: none"> <li>- Skills and competence (know-how, technical expertise, problem solving capability, education, creativity)</li> <li>- Commitment and loyalty</li> <li>- Motivation</li> </ul>	<ul style="list-style-type: none"> <li>- Structural layout</li> <li>- Culture</li> <li>- Practices and routines (process manuals, tacit rules)</li> <li>- IT (databases, servers and intranets)</li> </ul>	<ul style="list-style-type: none"> <li>- Customer relationships (loyalty, brand image)</li> <li>- Other external relationships (licensing agreements, partnering agreements, financial relations, contracts, and distribution arrangements)</li> </ul>
<b>IC Audit Model (Brooking, 1996)</b>	<ul style="list-style-type: none"> <li>- Expertise</li> <li>- Problem solving capability</li> <li>- Creativity</li> <li>- Managerial skills</li> </ul>	<ul style="list-style-type: none"> <li>- Processes and methodologies</li> <li>- Technologies,</li> </ul>	<ul style="list-style-type: none"> <li>- Customer relationships</li> <li>- Other external relationships (contracts, distribution channels, licensing agreements and franchise contracts)</li> <li>- Brands</li> </ul>

Source: Author

The knowledge Asset Map (Marr & Schiuma 2001; Schiuma & Marr 2001) and IC Audit (Brooking 1996) each has four subcategories (refer to table 2.4). The Knowledge Asset Map sees stakeholder resources and structural resources as the sum of organisational resources. Stakeholder resources are divided into stakeholder relationships (external) and human resources. Structural resources are split into physical (internal) and virtual infrastructure (internal). Virtual infrastructure includes culture, routines and practices and intellectual property. IC Audit (Brooking 1996) interprets IC as containing four components: market assets (external), human-centred assets, intellectual property assets (internal) and infrastructure assets (internal). A close look at the contents of each category in these two models finds that 1) stakeholder relationship in the Knowledge Asset Map corresponds to the market assets in the IC Audit and 2) the total components in physical and virtual infrastructure coincides with those in intellectual property assets and infrastructure assets, though some of the components have been put into different categories. Therefore, the components that have been measured in these two models also can be summed up into human capital and structural capital with the latter being subdivided into internal and external structural capital.

A revised measurement structure is provided in table 2.5 where IC consists of human capital and structural capital. Structural capital is further subdivided into internal and external structural capital. Although different names are used in each model, components of human capital in general include skills/expertise, education/training, experience and personal attitudes (motivation, commitment and loyalty). These elements coincide with four factors suggested by Hudson (1993) who argues that human capital is the combination of genetic inheritance, education, experience and attitudes about life and business. Internal structural capitals are mechanisms and structures of an organisation that support and facilitate employees in their quest for an optimum intellectual performance and therefore the overall business performance (Bontis 1999). It contains two groups. One is organisational culture and tacit rules (some use routines as a component. See next paragraph for discussion). The other is called infrastructure assets including technologies, information systems (databases, intranet, and servers) and process manuals. The intellectual property (patents, copyrights, trademarks register design etc.) is not included in the structural capital for the reasons



discussed below. External structural capital consists of customer and supplier relationships, image and other external relationships (licensing agreements, contracts, partnering agreements etc.). Table 2.6 is a generalised structure of measurement approach.

**Table 2.6 A generalised measurement structure**

Human Capital	Structural Capital	
	Internal	External
<ul style="list-style-type: none"><li>- Skills/expertises</li><li>- Experience</li><li>- Education/training</li><li>- Attitudes</li></ul>	<p>Group one:</p> <ul style="list-style-type: none"><li>- Culture</li><li>- Tacit rules</li></ul> <p>Group two:</p> <ul style="list-style-type: none"><li>- Technologies and information systems (databases, intranets etc.)</li><li>- Process manuals</li><li>- Intellectual property</li></ul>	<ul style="list-style-type: none"><li>- Customer and supplier relationships</li><li>- Image</li><li>- Other external relationship (licensing agreements, contracts, partnering agreements etc.)</li></ul>

Source: Author

### **Explaining routines**

Among these models, some (Edvinsson & Malone 1997; Marr & Schiuma 2001) regard routines as a component of internal structural capital. It is argued that organisations maintain their structure and coherence through tacit knowledge embedded in organisational routines that no single person understands completely (Nelson & Sidney 1982). Even if some individuals leave the organisation, a shared net of expectations created through organisational routines and accepted standards remains (Cook & Yanow 1993). Routines are developed through the coevolution of three mechanisms: tacit accumulation of past experience, knowledge articulation, and knowledge codification processes (Zollo & Winter 2002). These processes are responsible for the evolution of two sets of organisational activities: operating routines and dynamic capabilities. Operating routines reflect experiential wisdom in that they are the outcome of trial and error learning and the selection and retention of past behaviours (Gavetti & Levinthal 2000, p113). Dynamic capabilities, arising from learning, constitute the firm's systematic methods for modifying operating routines (Zollo & Winter 2002, p.340). However, once the firm is viewed as a body of practices or routines, identifying and measuring knowledge becomes difficult, so researchers become

dependent upon surveys, which presuppose the respondents' knowledge of these practices and routines and can thereby reveal their movement within the firm and between firms (Spender & Grant 1996). The statement that 'organisational routines are the organisation's genetic material, some explicit in bureaucratic rules, some implicit in the organisation's culture' (Kodama 1992 p.134) provides a better understanding and easier measurement of organisational routines.

### **Explaining intellectual property**

It is noticed that the Knowledge Asset Map and the IC Audit Model have included intellectual property (patents, copyright, trademarks register design etc.) in their structural capital. Among these, the patent-based approach in particular, has been used as a means for capturing the dimensions of organisational knowledge (Ahuja & Katila 2001). A patent, as a unique and novel element of knowledge, when owned by a firm, represents the knowledge that the firm has created (Jaffe, Trajtenber & Henderson 1993). The number of cited and obtained patents then can be the measurement of the size of the knowledge base (Ahuja & Katila 2001). Arguably, using patent data to measure organisational knowledge bases corresponds closely to the conceptual abstraction of a firm's knowledge base as a set of knowledge elements (Grant 1996a) and is believed to have three major strengths. Firstly, by using information on individual elements of knowledge, the approach makes possible a more precise assessment of a firm's knowledge base. The approach also enables a continuous, highly informative and detailed measurement of difficult constructs. Finally, it permits quantification of knowledge bases from publicly available data, in a longitudinal context (Ahuja & Katila 2001).

Patents might be very satisfactory indicators of knowledge creation in terms of being documented knowledge whose novelty has been verified by a meticulous, legalistic research process. They are, nevertheless, a very partial measure of the production of organisational knowledge and patenting is itself a strategic choice (Spender & Grant 1996). Industries vary widely in their propensities to patent (Griliches 1990). The relevance of a patent-based approach is likely to be limited to industries in which patents are themselves meaningful indicators of innovation (Ahuja & Katila 2001). Furthermore, at the firm level, success at patenting does

not necessarily correspond to success in translating patents into competitive advantage. Therefore, the sheer quantity of patents may mean little on its own (Spend & Grant 1996). Bontis (1999) clearly states that intellectual capital does not include intellectual property. They are ‘considered mutually exclusive but the former can be considered an output of the latter’ (Bontis 1999, p. 444). However, for the purpose of empirical study and the fact that intellectual property also includes, apart from patents, copyrights, trademarks, registered designs and brands, this component will also be included in the organisational knowledge base.

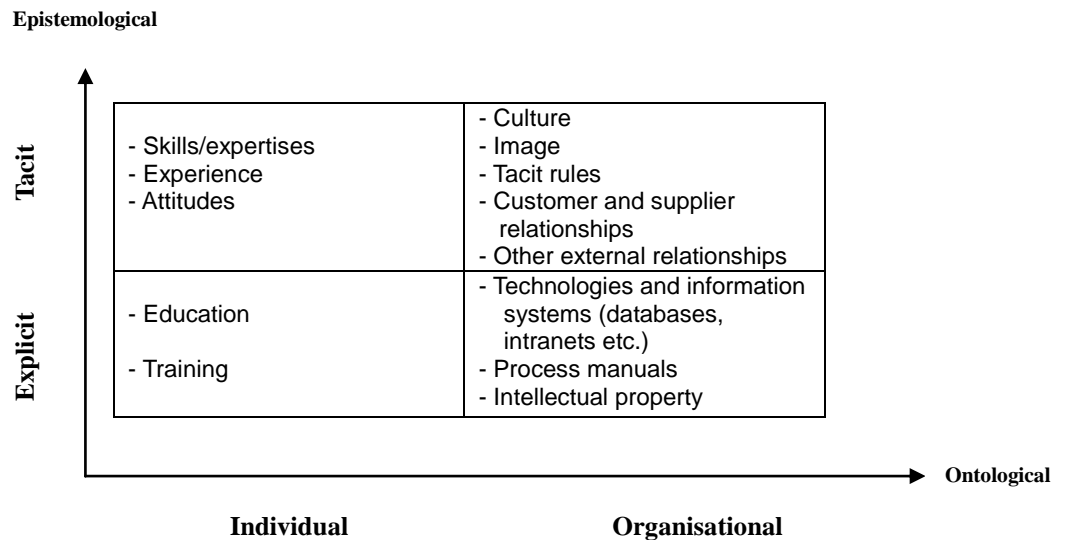
### **2.3.3 Components in the organisational knowledge base**

An earlier discussion of measurement methods on organisational knowledge assets presents a picture of structures and components that have been included in different measurement models. The reorganisation of the measurement structure and the rationalisation of inclusion of components in each category further clarifies the structure of the organisational knowledge base. However, the classification of knowledge in the OKB from these measurement models have been ontological in nature that is, OKB is divided into human and structural capital (organisational level). The epistemological dimension of knowledge is not specified, although some components clearly show their nature of tacitness or explicitness. For example, culture is hard to articulate and is, therefore, tacit while process manuals are explicit. It is useful for the purpose of assessment of the OKB that both ontological and epistemological dimensions of knowledge are reflected in the measurement process. In addition, the classification of these two dimensions has strong implications for management to adopt different approaches in managing organisational knowledge assets (see chapter three). The following section will illustrate how the components of these measurement models can fit into the OKB Matrix discussed earlier.

The earlier discussion has argued that OKB can be expressed in a two-dimension matrix. A later discussion of organisational memory and its five-bin storage system concludes that according to their carrying functions, the five bins can be put into different cells of the matrix (figure 2.6). However, it should be noted that

the five bins are only storage facilities not the knowledge components. It is possible that, after the discussion of components assessed in the knowledge asset measurement models, the knowledge components in these bins can be revealed. Combining the generalised measurement structure of table 2.6 and the five-bin knowledge storage in the OKB Matrix expressed in figure 2.6, a new matrix can be obtained to illustrate the components of OKB (figure 2.7).

**Figure 2.7 Knowledge components in an OKB Matrix**



Source: Author

In the OKB Matrix, personal knowledge contains two parts. One is personal tacit knowledge which includes personal experience, skills/expertise and attitudes. The other is personal explicit knowledge, that is, the education and training, either formal or informal that an individual has had. On the other part of the ontological axis lies organisational knowledge. Organisational tacit knowledge includes its culture, image, tacit rules, customer and supplier relationships and other external relationship such as contracts, licensing agreements and partnering agreements. The information technology infrastructure which includes such elements as databases, intranets and servers, together with process manuals, are the explicit knowledge of the organisation. In summary, the OKB is comprised of four elements:

- individual explicit knowledge,
- individual tacit knowledge,
- organisational explicit knowledge,

- and organisational tacit knowledge, which an organisation can use as resources to create competitive advantage.

### **2.3.3.1 The dynamics of the organisational knowledge base**

Strategic advantage nonetheless is not a result of the sheer size of an organisational knowledge base encompassing different knowledge elements, but the result of interactions between these elements to produce an evolving knowledge base (Shepherd & Johnson 1999). A dynamic and evolving knowledge base is the one that continually analyses itself through validation in terms of its relevance to the firm, and subsequently embeds in organisational practices and principles through integration. An evolving knowledge base is also encompassed by the strategic intent of the organisation where constant learning takes place. Only through continuous learning, can an OKB be enriched.

An organisation's ability to assimilate and adopt new forms of knowledge depends on its absorptive capacity (Cohen & Levinthal 1990). This capacity is based on the level of prior knowledge available within the organisation and also on the way knowledge is distributed. However, although prior knowledge assists in the creation of new knowledge, it may also be a deterrent to integrate new knowledge because of mismatches between prior and new knowledge (Bontis 1999; Liyanage & Barnard 2003). In addition, knowledge may become obsolete over time because of changing technology and social norms. This highlights the need to understand the knowledge base of organisations as both an inhibitor and an enabler of business-process oriented change (Scarbrough 1996). To reduce the deterrent effect of existing knowledge, the knowledge base needs to be continually validated (monitoring, testing and refining of knowledge) (Scarbrough 1996). Continuous construction and deconstruction of knowledge components are necessary to the accumulation of new knowledge in an organisation (Dasgupta & David 1994). This cumulative process contributes to destroying conditions of the existing knowledge structures and to the further improvement of the OKB (Tushman & Anderson 1986).

### 2.3.3.2 Assessment of the OKB

The conceptual construction of the OKB leads to another related issue – the assessment and measurement of the OKB. Using Bonits (1999) concept of intellectual capital, a method is developed to assess knowledge components in the OKB. As indicated in table 2.7, individual knowledge can be assessed by its volume. Organisational explicit knowledge, along with tacit knowledge, culture and image, is assessed by efficiency, while relationships (customer and supplier relationships and other external relationships) are assessed by longevity. Whereas explicit knowledge is, as self evidenced, codified knowledge and therefore easier to assess, tacit knowledge on the other hand, has medium to the highest level of codification difficulty and is, therefore, harder to assess. The following section will discuss the components of the OKB and their implications for assessment.

**Table 2.7 Assessment of components in the OKB**

	Individual Knowledge		Organisational Knowledge	
Components	Explicit <ul style="list-style-type: none"><li>- Education</li><li>- Training</li></ul>	Tacit <ul style="list-style-type: none"><li>- Skills/expertis</li><li>- Experience</li><li>- Attitudes</li></ul>	Explicit <ul style="list-style-type: none"><li>- Technologies and information systems</li><li>- Process manuals</li><li>- Intellectual property</li></ul>	Tacit <ul style="list-style-type: none"><li>- Culture</li><li>- Image</li><li>- Customer and supplier relationships</li><li>- Other external relationships</li></ul>
Parameter	Volume		Efficiency	Efficiency/longevity
Codification difficulty	Low	High	Low	Medium to highest

Source: Author

**Education and training** Formal education is believed to be the first measurable step in a human's acquisition of knowledge (Graversen 2004; Wong & Radcliffe 2000), though the knowledge acquired through education in most cases, is explicit in nature. Therefore, university degrees and qualification certificates possessed, various training courses, workshops and executive education undertaken, by an individual are indicators of personal knowledge (Powell 2002). In addition, the level of formal education is highly correlated with the ability to acquire tacit knowledge through life experience or workplace experience (Graversen 2004).

**Experience** Leonard and Sensiper (1998) argue that tacit knowing embodied in cognitive skills is learned through experience and resides in the unconscious or semiconscious. In fact, personal knowing has a 'bearing on experience' (Polanyi 1962, p. 49). To a great extent, know-how, intuitions, and flashes of inspiration are the product of experience and the tacit insights that experience provides (Brown & Duguid 1998). Experience at work creates its own knowledge. Diverse portfolios of skills and knowledge gained from prior work experience, when exposed to work practices and products, contribute to the individual's current job performance. In addition, social connections, which are associated with prior work experience, further enhance the individual performance. The length of service of an individual is believed to be the most important attribute of individual experience (Graversen *et al.* 2003; Leonard & Sensiper 1998).

**Skills/expertise** Skills/expertise are developed from workplaces but based on explicit knowledge acquired through formal education. A combination of education and experience to a great extent can indicate the skills or expertise possessed by an individual. From the intellectual capital measurement models discussed earlier, skills and expertise can be reflected in the individual problem-solving capability and the ability to innovate in the workplace.

**Attitudes** Attitude is the psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour (Eagly & Chiken 1993) and affecting the ways individuals react to their environment. Work attitudes have a close relationship with job performance (Shristastava 1983) and influence employees' learning motivation and their willingness to share knowledge (Brown & Collard 1999). Employee attitudes are considered an indicator of the future success of an organisation (Hurst 1995). Work attitudes as measured through four work attitude indicators which are reported by Rode and Near (2005, p.85):

- Overall satisfaction with the job
- Pride in working for the organisation
- Sharing similar values with the organisation and
- Planning to leave the organisation (reverse scored)

**Culture** Culture is defined as ‘a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems’ (Schein 1992, p. 12). Culture can be understood from five elements: language (jargon, metaphors, myths, slogans, heroes and heroines (Deal 1985), tangible artefacts and symbols (company logos) (Westbrook 1993), norms (Allen 1985; Schein 1992), espoused values, and beliefs and underlying assumptions (Schein 1992). In knowledge management literature, culture has been treated as both an element of knowledge itself and an important factor influencing effective knowledge management practices.

## **2.4 OKB in the shipping industry**

The general conceptualisation of the organisational knowledge base (OKB) has been proposed and its component structure has been identified. This section will now examine how the concept of OKB can be applied in the shipping industry through the discussion of knowledge components and their relevant assessment. Following the component structure in figure 2.7 and assessment in table 2.7, it is suggested that an OKB in the shipping industry is a construct comprising four groups of dimensions as follows:

### Individual explicit knowledge

- Education: as discussed early, formal education is the first important step for individuals to acquire knowledge. Study in maritime institutions provides fundamental knowledge in maritime related areas for example, nautical science, engineering, maritime law, insurance, international Conventions and Codes (SOLAS, ISM), and even language (e.g. maritime English in non-English speaking countries). Maritime education prepares students for various job opportunities ranging from onboard operations (deck officers or engineers), to shore based positions such as management in shipping companies and even positions in the wide maritime industry (marine insurance, terminal operations and management, maritime policy).



It is not uncommon that some management positions in shipping organisations are filled with personnel that came from non-maritime background, although maritime education is preferred. Formal education provides prior knowledge for individuals to learn efficiently in the real world and to develop the ability to explore complex issues and find solutions in their workplace. Formally educated personnel, when join an organisation, bring in with them flesh ideas and the curiosity of exploring the unknown, becoming a part of organisational assets. Indicators of the level of personal education include years of school, certificates and/or degrees, including certificates of language fluency.

- Training: unlike many other industries, the shipping industry requires its personnel of a high level of practical ability due to the huge responsibility born by ship operators. It usually takes 12 to 18 months of sea time<sup>1</sup> training for a degree holder (e.g. a Bachelor of nautical science) to be qualified as an independent ship operator (e.g. a deck officer). The long process of training starts as early as the second year (in some cases, the first) of maritime tertiary study and the total amount of time spent on training is up to 9-12 months of the 4-year study<sup>2</sup>. Training is essential to those who eventually work onboard and invaluable to those who work onshore as it bridges the gap of knowledge and understanding of the two physically separated workplaces. For onboard personnel, training is indispensable part of their working life. Training needs to be carried out when officers upgrade their certificates of competence and whenever there are new international Conventions or Codes that require additional training. Training is a process of applying or assessing what have learnt and acquiring new knowledge in the real world. Therefore it is a process of knowledge internalisation. For a majority of training, relevant

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<sup>1</sup> The actual time required will be much longer considering there will be time on shore for rest or holidays during the training. If a trainee takes 3 months of rest for every 6 months at sea, the whole training period would be up to 27 months!

<sup>2</sup> For example, nautical students in Dalian Maritime University and Shanghai Maritime University in China have to complete 3-6 months of sea training in the second year of their study and another 6-9 months just before they graduate.

qualifications will be awarded to acknowledge the successful completion of the training.

#### Individual tacit knowledge

- Skills/expertise: areas of expertise (nautical or managerial skills), acquired through the combination of education and work experience. Formal education only cannot develop skills or expertise. This is particular true in the shipping industry where hands-on ability is critical for safe and responsible operations. Personnel accumulate their knowledge and develop their skills through learn-by-doing. However, due to potential high cost and sometimes detrimental effects incurred by operational mistakes, learning-by-doing or learning-through-mistakes is carefully orchestrated in the learning process through practices such as apprenticeship and one-to-one mentoring. That is why skills and expertise of individuals are so crucial to every organisation in the industry.

Indicators of skills/expertise include certificates of competence and other relevant professional qualifications. In addition, skills or expertise are the result of individual experience and are reflected not only through the acquisition of professional qualifications, but also in the individual's problem solving capability and innovation ability in the real working world. Therefore, in terms of knowledge components in the OKB, skills/expertise should be represented by three elements, that is, professional qualifications, personal problem solving capability, and personal innovation ability.

- Experience: while working experience, to a great extent, affect the level of skills an individual possesses, non-working experience shapes individual personality and attitude. For management positions in the shipping industry, diverse experience of working in different sectors of the industry, exposure to different types of shipping activities, and onboard practices would be invaluable asset to the organisation. For onboard positions, having worked on different types of ships (dry and wet bulk carriers,

containerships or even gas carriers) in different ocean routes and exposed to multi-cultural environment, would be highly regarded in that such operational knowledge can be acquired only through working experience and not from any other sources.

Experience can only be gained through servicing in the industry and accumulated over time. Length of service in the industry and positions held are good indicators of personal working experience that to a great extent manifest the richness of personal knowledge.

- Attitudes: work attitudes are considered closely related to individual performance and to the future success of an organisation (Hurst 1995). Work attitudes are affected by individuals' working motives, their commitment, influences from their families and friends, and even the perception to the shipping industry of the wide community in which they normally live. Work attitudes determine how much an individual would like to devote him/herself to the work he/she is doing and how much he/she wants to achieve.

In the shipping industry, the importance of work attitudes can be examined from two perspectives. One is the relationship between the formation of individual work attitude and factors that affected individual's initial decision for choosing the industry. The other is the implications of work attitudes to working life and safe shipping. One of the problems the shipping industry has been facing is the difficulty of attracting people for various reasons (Dinwoodie 2000; Leggate 2004; Moreby 1975; Sambracos & Tsiaparikou 2001). As a result, the initial motives (e.g. to make quick money, travel around the world, or simply out of curiosity) of joining the industry do not promise any long term working commitment. The consequence is that personnel easily get into negative work attitudes when situations do not meet their expectations. It is not likely that people will learn and share knowledge when they have negative work attitudes.

The other perspective is for those who work onboard. Work attitudes have great implications to their well-being and have direct effects on safe shipping. Negative attitudes make tough onboard life miserable and unbearable, especially in a multi-cultural environment where communication is more difficult. Safe shipping requires personnel to be alert all the time and to act swiftly to any incidents. Negative attitudes make people blunt and slow to react, let alone problem solving and innovation.

According to Rode and Near (2005), attitudes can be measured through a) overall satisfaction with the current job, b) pride to work for the company, c) alignment of personal and company values, d) commitment to the company (organisational commitment), and e) commitment to the industry (career commitment).

#### Organisational explicit knowledge

- Technologies and Information Systems: these can be broadly categorised into three groups: a) knowledge storage and retrieval, which on the one hand assist management in decision-making and, on the other hand, enable employees in self-improvement, database for information sharing, for example, b) systems that provide access to existing knowledge base, such as intranets, EDI, track and tracing systems. The shipping industry was one of the earliest industries that adopted EDI technology. The establishment of the system itself is a process of knowledge creation and sharing. The on-going exchange of information provides all participants of the system opportunities to learn from each other. c) Communication technologies that facilitate knowledge sharing, such as E-forums, alumni, and online communities of practice (where people having similar interests gather to share experience and discuss their viewpoints). The shipping industry is characterised by the separation of onshore and onboard operations and in some cases disintegration of management functions as a result of outsourcing professional services (e.g. manning, technical, or even commercial management). It is a daily need for people of the separated operations to constantly communicate with each other.

Information technology provides the means for people to stay in touch and to share information when they do not have chances of face-to-face contacts. Virtual community of practices can give people of similar interest a platform of discussing and exchanging viewpoints related to their work.

- **Process Manuals:** these are usually in the form of written instructions or operational procedures. There are many different types of manuals in the workplace of the shipping industry ranging from operation manuals of equipment, emergency procedures and management manuals such as ISM. These manuals are placed in relevant locations for personnel to consult conveniently at any time. In addition, best practices identified from workplaces are also included in this group in the form of codified knowledge. This part is probably more important in that it is learnt from workplace and is specific, may be even exclusive, to the organisation
- **Intellectual property:** while the inclusion of intellectual property into organisational knowledge has been in debate, its elements (patents, copyrights, trademarks, registered designs, and brands) are certainly, to a great extent, to do with the knowledge capacity an organisation possesses. One would argue that there is not much relevance of intellectual property to the shipping industry. However, the legitimacy of such a claim can only be determined by empirical test. In addition, the factor that trademarks and brands have a close relationship with organisational image means that public perceptions towards a shipping organisation (i.e. a company name) will impact the image of the organisation (see following discussion).

#### Organisational tacit knowledge

- **Culture:** organisational culture is considered as a whole component of OKB. No further exploration is attempted, as a thorough discussion is beyond the scope of this research. It is however, worth noting that organisational culture is a component of OKB and also is a means through which knowledge transfer can be facilitated, in turn, enriches the OKB

(see chapter three). An understood and articulated vision and mission statement, a story of a respected individual (e.g. a captain) within the organisation, can be part of organisational culture.

- Image: an organisation's reputation for social and environmental responsibilities that is known to the public or community in general, and to the industry in particular. There are three aspects of implications of organisational image to organisational knowledge. Firstly, image as the external manifestation of reputation of an organisation is one of these determinants to attract potential employees who are knowledge carriers. In a society where the shipping industry as a whole has not been perceived positively by the public, a good image is critical for the recruitment and the sustainability of human resource development. Furthermore, image affects stakeholders' decision as to what extent they will be engaged with the organisation and therefore the flows of information. Finally, organisational image provides personnel internal reflection of how things should be done within the organisation in order for the public perceives the organisation the same way as the organisational image is delivering. Image, thus, to a great extent, is the organisational memory perceived by the public or community and is the source of knowledge inflows.
- External relationships, relationships such as shippers, terminals, manning companies, or agreement with alliances. Knowing who to contact with and where to find help in different occasions itself is knowledge. However, external relationships provide more value for building knowledge assets. For example, a close relationship with its shippers provides a shipping organisation with valuable information such as the flow of freight (e.g. volume and types), packaging, and shipping requirements, which helps the organisation forecast shipping demand and make relevant plans. Cooperation or alliances among shipping organisations, especially when such cooperation or alliances are across business or operation sectors, can significantly increase the knowledge flows between participants and strengthen their knowledge capacity.

A summary of knowledge components in an OKB in the context of the shipping industry is presented in table 2.8.

**Table 2.8 Knowledge components and their indicators in an OKB in the shipping industry**

Groups	Components	Indicators
Individual Explicit Knowledge	1. Education (academic qualifications)	Years of school, certificates, degrees
	2. Training	Qualifications and certificates
Individual Tacit Knowledge	3. Professional qualifications	e.g. Certificates of competence
	4. Personal problem solving capability	Ability to identify problems and the application of knowledge and skill to developing solutions
	5. Personal innovation ability	Ability to develop new applications based on prior knowledge and skills
	6. Work experience	Length of services, positions held, types of ships and oceans routes experienced, exposure to multicultural workplaces.
	7. Work attitudes	Overall satisfaction with current job, feeling proud to work for the company, sharing similar values with the company, will stay with the company, and will stay in the industry
Organisational Explicit Knowledge	8. Technologies and information systems	Knowledge storage and retrieval (databases), information access technologies (intranets, EDI, track and tracing), and communication technologies facilitating knowledge sharing (e-forums, online COPs).
	9. Process manuals	Written instructions or procedures, best practices.
Organisational Tacit Knowledge	10. Organisational culture	Corporate vision/mission statement,
	11. Image	Organisation's reputation for social and environmental responsibilities known to the communities and the industry
	12. External relationships	Relationships with customers, terminals, manning companies, or agreement with alliances.

Source: Author

## **2.5 Summary**

This chapter has reviewed the concept of organisational knowledge and other knowledge-related constructs such as intangible assets, core competency or capabilities, absorptive capacity and organisational memory. The literature review has shown that the concept of the organisational knowledge base (OKB) better captures the whole components of knowledge existing in, and can be leveraged by, the organisation than the current concept of organisational knowledge. By distinguishing organisational knowledge and individual knowledge, knowledge becomes more manageable according to their respective characteristics. In addition, the distinction of organisational and individual knowledge provides a better understanding of how organisational knowledge evolves over time through the integration of individual knowledge to the organisational level.

The knowledge matrix built upon the concept of the OKB is to capture the ontological as well as the epistemological dimension of knowledge, which provides an outline for the components in each cell to be revealed. The literature review shows that while there is no consensus regarding the composition of knowledge in an organisation, through reviewing the measurement models on intellectual capital, components in the OKB matrix can be identified and examined. These components are further examined in the context of the shipping industry together with their relevant indicators, which later will be subject to empirical test.

It is worth noting that the ontological dimension of knowledge identified in the OKB matrix provides a solid basis for the discussion of the effects of human mobility on the OKB (chapter three). If individual knowledge is part of the OKB and can be leveraged by the organisation, then any human movement (inflow and outflow) will surely have effects on the OKB. Next, if individual knowledge can be integrated through knowledge sharing and transfer, into the organisational level, then mechanisms should be sought for the organisation to effectively manage this integration process in order to mitigate any possible negative impact caused by human mobility. These two issues will be explored in the next chapter in the context of the shipping industry.



## **CHAPTER 3: KNOWLEDGE MANAGEMENT AND ITS APPLICATION TO THE SHIPING INDUSTRY**

### **3.1 Introduction**

The earlier chapter discussed the conceptualisation of the organisational knowledge base (OKB) and its relevance to the shipping industry. This chapter will deal with two issues. The first is to explore the perceived effects of human mobility on the OKB in the shipping industry. This is done by examining the concept of turnover, through which the concept of mobility is brought to discussion. It then argues that mobility has strong implications on knowledge flows, which in turn affects the OKB.

The second issue is to identify which knowledge management practices are effective in managing knowledge flows given the prevailing personnel mobility in the shipping industry. The objective is achieved through a review of current knowledge management processes and the identification of concepts relevant to current research. An examination of barriers and facilitators of knowledge transfer is given as a means to identify effective knowledge management practices and their relevant context in the shipping industry.

### **3.2 Effects of human mobility on the OKB**

It is believed that the movement of people is an important mechanism for knowledge transfer in the economy (Graversen *et al.* 2003; Ekeland *et al.* 2003). As individuals are knowledge carriers (Polanyi, 1962; Von Krogh & Roos, 1995), when they move between jobs or between social settings, they carry their skills and experience with them to the new firm or region (Graversen *et al.* 2003). In addition, new knowledge may be created as the result of the moving process where innovation can occur when competence meets with a new situation (Ekeland *et al.* 2003). In this sense, mobility may be seen as a possible strengthening of an organisation because it opens access to new resources in the form of networking and knowledge sharing (Langberg & Graversen 2001). The

flip side however, is what is seen as a positive effect of mobility for the receiving organisation might be a negative effect for the delivering organisation. Moreover, even for the receiving organisation, the extent to which mobility can benefit the organisation is heavily dependent on the individual's knowledge, if during the work within the organisation, this knowledge is shared with other members of the organisation and eventually integrated into organisational knowledge (Langberg & Graversen 2001).

This brings to us two considerations. One is to identify the effects (both positive and negative) of human mobility seen from the point of view of each organisation. The other is to explore possible management practices to retain individual knowledge rather than the person who carries that knowledge given the fact that mobility is an inevitable phenomenon in workplaces. In the following sections, the discussion of effects of mobility starts from a review of turnover literature, which has provided rich insights on the effects of turnover on organisations. It needs to be pointed out that turnover is an organisational level concept, that is, flows of personnel are seen as between organisations (inter-organisation). Mobility on the other hand, not only includes inter-organisational movement, but also includes personnel movement within the same organisation, across industries and even national borders (Ekeland *et al.* 2003; Graversen *et al.* 2003). However, the scope of current research mainly covers inter- and intra-organisation movement. The aspect of a cross-industries movement is discussed under the context of shipping and related industries.

### **3.2.1 Turnover and mobility**

Turnover traditionally has been seen as an important organisational problem that is costly and dysfunctional to the organisation and, therefore, should be reduced. However, research has suggested otherwise (Abelson & Baysinger 1984; Dalton 1981; Dalton & Todor 1979; Dalton, Todor & Krackhardt 1982; Staw 1980). The reasons for overstating the problem of turnover lie mainly on two issues. The first is that the traditional categorisation of turnover to voluntary and involuntary (Price 1977) fails to differentiate dysfunctional and functional turnover within the category of voluntary turnover (Dalton, Todor & Krackhardt 1982). The second

reason is that traditional research on turnover paid more attention to the negative side (for instance, costs and operational disruption), while neglecting the positive perspective of turnover (for example, organisational effectiveness, innovation and adaptation) (Dalton & Todor 1979; Staw 1980). In fact, employee turnover may actually benefit both the individual and the organisation (Dalton & Todor 1979; Muchinsky & Tuttle 1979).

### **3.2.1.1 Dysfunctional and functional turnover**

The traditional approach separates turnover into voluntary and involuntary (Price, 1977). While this dichotomy of turnover is necessary, it is insufficient for an accurate examination of organisational turnover (Dalton, Todor & Krackhardt 1982). It is dysfunctional to the organisation that employees are leaving when the organisation would prefer that they stay. However, it is functional that an individual leave the organisation when the organisation has a negative evaluation of the employee. The reasons that marginal employees (Dalton, Todor & Krackhardt 1982) are not terminated may vary, but include such factors as the institutionalisation of employment security, labour unions, and employee associations. Nevertheless, such turnover is functional and may be beneficial to the organisation, although it still involves costs of recruitment, training and some portion of administrative overhead (Dalton, Todor & Krackhardt 1982). The functional turnover, if from the knowledge management perspective, is the abandonment of obsolete knowledge for a new one.

From the management perspective, it is necessary to weigh the costs of turnover against its benefits because the costs of retaining any employee can be excessive, as the marginal costs of preventing turnover rise. Organisations, therefore, could welcome a positive rate of turnover and attempt to achieve an optimal rate of aggregate organisational turnover (Abelson & Baysinger 1984), as 'It may be far less expensive to cope with turnover than to prevent it' (Dalton & Todor 1979, p. 226). Furthermore, it is possible, from a knowledge management perspective, that a part of knowledge that the leaving employee possesses can be retained if proper management practices are employed. This is reflected in LaBarre's (1998, p. 48) statement: 'I know I cannot stop people from walking out the door – but how do I stop them from taking their knowledge with them?'

### **3.2.1.2 Consequences of turnover**

An important consequence of turnover is the opportunity it provides for the organisation to adapt to its environment. Turnover and the resulting inflow of new personnel may be the primary source of variety within the organisation (Campbell 1965). Existing rules, norms, the filtering of information, as well as the exposure to a common set of experiences breed similarity in viewpoints and knowledge (Staw 1980). Homogeneity and stability may be costly in a radically changing environment where new rules, insights and knowledge base are required. Turnover, therefore, can be used as a constant source of input from the environment to keep organisational beliefs and knowledge congruent with external changes.

Turnover implies the movement of personnel, that is, mobility. The process of mobility brings fresh ideas into the organisation, which enables the organisation to adapt more adequately to internal demand and ever changing environment pressures (Grusky 1960). The personnel movement from firm to firm also acts as a mechanism for the transfer of innovation (Pfeffer 1976), as new employees may bring knowledge that the organisation previously did not have. Movement, either horizontal or vertical, provides personnel a legitimating mechanism for them to move toward those positions best suited to their abilities, therefore increasing organisational effectiveness (Ritti 1970) and chances of creating new knowledge. On the other hand, immobility means the inability to conceive of, or utilise, new ideas (Dubin 1970). This is, therefore, dysfunctional to innovation and may reduce organisational effectiveness. Mobility is thus, of importance, not only to individual, to the organisation, but to the efficiency and well being of society (Dalton & Todor 1979).

Having discussed the positive aspects of turnover, one cannot deny the possible negative impacts dysfunctional turnover may have on the organisation. Employees of an organisation represent at least two of the three categories of the intellectual capital of the organisation: human capital and relational capital (Stovel & Bontis 2002). Human capital is the individual intellect of the employee, representing the cumulative tacit knowledge within an organisation (Bontis 1998, 1999, 2001; Choo & Bontis 2002). It is the main source of organisational

competitiveness and has the ability to enable the organisation to thrive within the industry in a turbulent environment (Stovel & Bontis 2002). Relational capital is the intangible connection, rapport and synergies created interpersonally both within the organisation and externally. Relational capital not only helps to maintain normal operations processes internally, but also through personal networks, bridge the organisation with external environment. Both human capital and relational capital, by their nature, are inherent in individual employees. They are hard to codify and difficult to pass on to successors (Stovel & Bontis 2002). Therefore, employee turnover will ultimately result in the loss of intellectual capital to the organisation.

In addition to the loss of intellectual capital as a result of dysfunctional turnover, departing employees often migrate to competing firms, making the situation more critical. Since departing employees will carry their knowledge to the new organisation and use it against their previous employer, this further magnifies the impact of the loss of intellectual assets as the result of a voluntary turnover. To prevent the loss of knowledge incurred by employee turnover, an organisation then has to prevent or at least reduce turnover, or seek other options.

The fact is that voluntary turnover has been accelerating, showing that employees on average switch employers every six years (Kransdorff 1996). Eroding employee loyalty makes traditional employee retention ineffective, if not impossible (Abassi & Hollman 2000). Furthermore, research on voluntary turnover suggests that the attractiveness of the current job and the availability of other opportunities are the two primary factors of turnover intentions (Hulin, Roznowski & Hachiya 1985; Shaw, Delery & Gupta 1998). This reality highlights the need for the HR department to search for new approaches to combat the voluntary turnover problem. Instead of the traditional way of retaining employees, which has been proven to be a costly solution (Dalton & Todor 1979), codifying intellectual assets in a strategically designed knowledge management system might be a wise alternative if voluntary turnover is unavoidable (Kransdorff 1996). By implementing a knowledge management strategy, the organisation can protect itself from knowledge attrition, while leveraging previous experience for strategic advantage.

### **3.2.2 Mobility and knowledge flows**

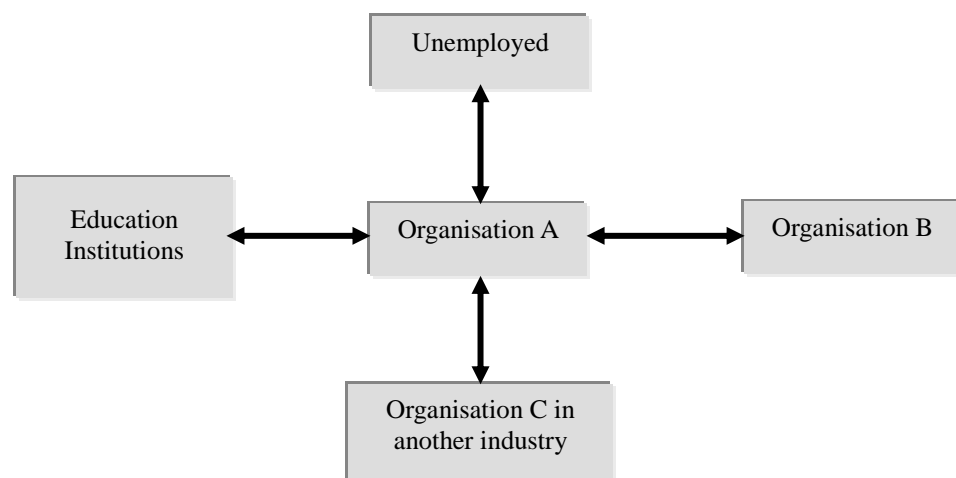
Mobility can be defined as a change of organisation or, a geographical change (Langberg & Graversen 2001) where movement occurs in three dimensions: mobility according to a place of employment, to a place of education and according to a scientific area. Mobility can also be defined as a change of employer or employment status (Åkerblom 1999). These two definitions cover three groups of personnel movement: 1) between firms and other organisations; 2) between research producing and research using sectors; and 3) movement across national borders. This current study adopts Graversen's (2003) definition of mobility as a change of workplace.

Under Graversen's (2003) definition, mobility can be grouped into inflow and outflow mobility. Inflow mobility is then further subdivided into into-job mobility and job-to-job mobility. The former includes people from unemployed to employed and graduates joining the workforce. Job-to-job mobility refers to a change of employment place, which covers both inter-organisational and inter-sectoral mobility. In the same way, outflow mobility is subdivided into out-of-job mobility and job-to-job mobility. Out-of-job changes the employment status from employed to unemployed. Job-to-job again includes inter-organisational and inter-sectoral mobility. However, for the purpose of this study, internal mobility (movement within the same organisation) is also included. The scope of mobility as defined is illustrated in figure 3.1.

It can be seen from figure 3.1 that all personnel movement has the characteristic of two-way directions. Within an industry, individuals jump between different organisations to seek best suitable jobs or positions. In some cases, people may choose to leave the workplace altogether for various reasons. The opposite is also true that after years of unemployment, people might decide to return to work again. The movement between education institutions and organisations reflects the intakes of graduates by an industry and those who go back to pursue further education after years of work experience in the industry. Within this group, some might stay in the institution as lecturers or researchers. Others might move to a different industry after getting new qualifications. In these cases, the former can

still be considered graduates (with work experience) moving into the industry. The latter however, will be included in inter-sectoral mobility. Inter-sectoral mobility is the movement across industry boundaries. This is the case in the shipping industry where prevailing personnel movement exists between the shipping industry and other industries, not only within the scope of maritime industry. However, inter-sectoral mobility in this case has been almost an one-way direction movement with the shipping industry suffering a net outflow of an experienced workforce. Later discussions will explore this issue further.

**Figure 3.1 Scope of mobility**



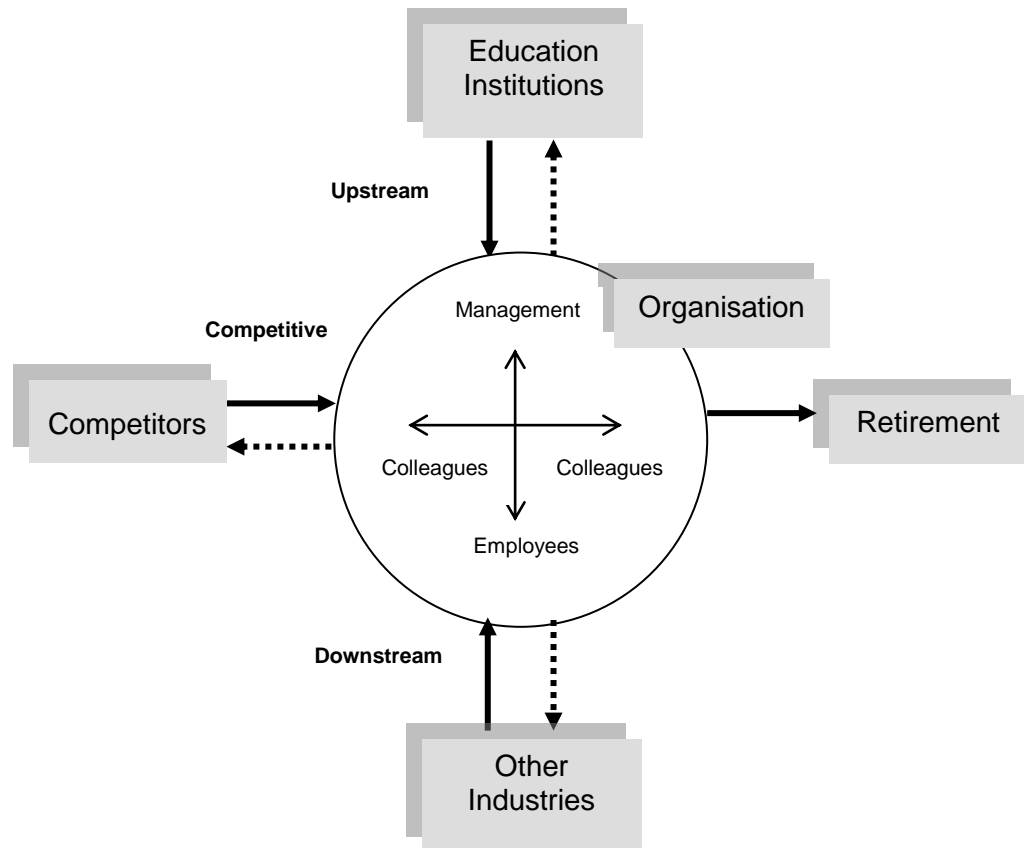
Source: Author

The movement of personnel is widely recognised as a mechanism for distributing tacit knowledge and skills across space and time (Almeida & Kogut 1999; Cooper 2001; Gruenfeld, Martorana & Fan 2000). As personnel are knowledge carriers (Grant 1996a; Polanyi 1962; Von Krogh & Roos 1995), when they move they bring their knowledge into the new workplace. While inflow mobility may bring in new knowledge that the organisation previously did not have (therefore reflecting an increase in its OKB), outflow mobility may be translated into a loss of certain knowledge if the knowledge of the person leaving is not known to the others in the organisation (therefore a decrease in its OKB). However, as discussed earlier, the OKB itself being dynamic, the measurement of its sheer size is of little relevance to organisational management. Rather the identification of knowledge flows related to an organisation may help management to initiate best practices to make best use of knowledge flows brought by personnel mobility.

### 3.2.2.1 Intra- and inter-firm knowledge flows

In literature, knowledge flows are identified as both intra- and inter-firm (Eisenhardt & Santos 2002; Winter & Szulanski 2001), with the organisation as a unit of analysis. Intra-firm knowledge flows take place within an organisation, between management and employees (vertical) or between colleagues (horizontal). Subgroups of knowledge flows may exist within the boundary of the organisation such as teams, groups and projects. Inter-firm knowledge flows include: 1) upstream flows from suppliers (e.g. universities) (Bolton 1994; Hauknes & Ekeland 2002); 2) downstream flows across industry boundaries (Tomlinson 1999) and 3) knowledge flows between other organisations, that is, between organisations in competitive interaction (Almeida, Song & Grant 2002). The only one-way movement direction is from organisation to the domain of retirement. The literature, thus, provides a picture of how knowledge flows within and across the boundary of an organisation (figure 3.2). In figure 3.2, knowledge flows in a two-way direction with firm arrows representing knowledge inflows and dot arrow as outflows.

**Figure 3.2 Intra- and inter- firm knowledge flows**



Source: Author



It is clear that the structure of knowledge flows corresponds to that of human mobility. The difference is, apart from inter-organisational knowledge flows, knowledge also flows horizontally as well as vertically within the organisation. The internal knowledge flows are a vital part of the whole knowledge flow structure in that knowledge retention occurs during this process through knowledge sharing and transfer. This reflects the individual-group-organisational (IGO) learning framework which highlights the importance of learning that resides in the organisation's systems, structures, procedures and routines (Fiol & Lyles 1985). It is noted that in discussing the effects of mobility on the OKB, the internal flow is not included, as the scope of 'mobility' has been defined. Nevertheless, the second part of this chapter will return to this issue and explore it further in detail.

### **3.2.2.2 Explaining knowledge flows**

**Organisation – Education Institutions** The entire formal education system is believed to be the first measurable step in a human's acquisition of knowledge (Graversen 2003). Knowledge acquired through formal education in most cases is explicit in nature, which is visible, reproducible and sharable. This knowledge is essential for the human's ability to absorb and develop new knowledge in the second step of their knowledge acquisition, that is, tacit knowledge. The inflow of graduates to the organisation brings fresh ideas into the workplace. The effects of the inflow on the OKB depend on the level of formal education because a) formal education is an indicator of how much explicit knowledge the individuals have acquired and b) formal education is highly correlated with the individual's ability to acquire tacit knowledge in workplaces.

The outflow (personnel movement from an industry to education institutions) is able to provide students with access to leading-edge thinking and technology in their field of interest. Industrial representation on university planning raises awareness of the needs of the industry resulting in the development of educational programs that are more relevant to the demands of the industry (Bolton, 1994). This outflow movement also includes those who will pursue further education or training in order to take higher positions when they return to the industry or to

find a different occupation in another industry. The former will be treated as graduates and the latter considered as across a sectoral movement. In terms of its effects on the OKB, the organisation has a loss of knowledge when its employees leave for positions in the education sector. However, because these employees will diffuse their knowledge to their students through the lecturing process, this in turn will benefit the industry as a whole when these students join the workplace. The net effect of this movement is therefore hard to determine for a specific organisation. The overall result to the whole industry is nevertheless positive.

Among the inflow movement, included are also those who have been in the education sector for years but will spend time in the industry for research purposes or as an occupation. To simplify the discussion, this group of people will be treated in the industry- education collaboration. Research joint ventures, as one form of industry – education collaboration, have been increasing over time (Caloghirou, Tsakanikas, & Vonortas 2001), reflecting the advantages of knowledge creation and sharing in the process of joint research. The major benefit to the industry from university-industry collaboration is the enhancement of the knowledge base of the firm. This includes the improvement of the firm's technological and organisational capabilities, the exploitation of complementary resources, new knowledge creation and/or acquisition, and the acceleration of research.

**Organisation – organisation** Movement between organisations in the same industry is sometimes called 'temporary mobility' (Langberg & Graversen 2001). Personnel learn from their workplaces and bring their knowledge with them to the new workplace when they move. At the industry level, since personnel remain in the same industry and they learn from each organisation that they work for, mobility increases personal knowledge and has a positive effect on the industry. At the organisational level, since mobility is a two-way movement to the organisation its effects on the OKB therefore depend on two factors and a moderator. The first one is if mobility is the result of dysfunctional or functional turnover (Dalton, Todor & Krackhardt 1982). The second is if there is a balance between inflow and outflow in knowledge movement in terms of individual qualifications, experience and skills, that is, personal knowledge as discussed

earlier. The moderator is related to knowledge management practices that can be possibly employed to retain personal knowledge. The more effective the practices are, the less impact turnover has on the OKB.

**Organisation – other industry** Research indicates that cross sectoral mobility happens more commonly between industries and R & D institutes or between higher education institutions (Graversen 2003). Other cross industry mobility might be caused by macro-economic or industrial restructure resulting in flows of skills acquired in one part of the economy into another for example, shifts of employment from manufacturing to services in 1980s (Tomlinson 1999). The shipping industry in China experienced strong inflows of personnel from various other industries in the 1980s when the shipping industry was perceived as offering very high salaries compared to other industries. Other nations such as the UK however, observed a net loss of experienced personnel to other maritime related industries (Gardner & Pettit 1999). While the effects of inflow cross industry mobility is to a great extent dependant on the relevance of the skills to the receiving industry, the outflow is considered as a loss of knowledge for the industry in general and for the delivering organisation in particular.

**Organisation – retirement** Personnel movement from an active workforce to the domain of retirement is a less explored area. Generally, retiring personnel have rich tacit knowledge that has been accumulated from many years of work experience. This knowledge is hard to articulate and is a valuable asset to the organisation. Research in the gas and oil industry indicates that the aging workforce is posing a severe threat to the whole industry, if significant steps are not taken (Leavitt 2002; Sapient Corporation 2001) to retain the rich knowledge that the aging workforce is carrying. If this knowledge is not known to the other members of the organisation, the retirement of these personnel will surely have a negative impact on the OKB.

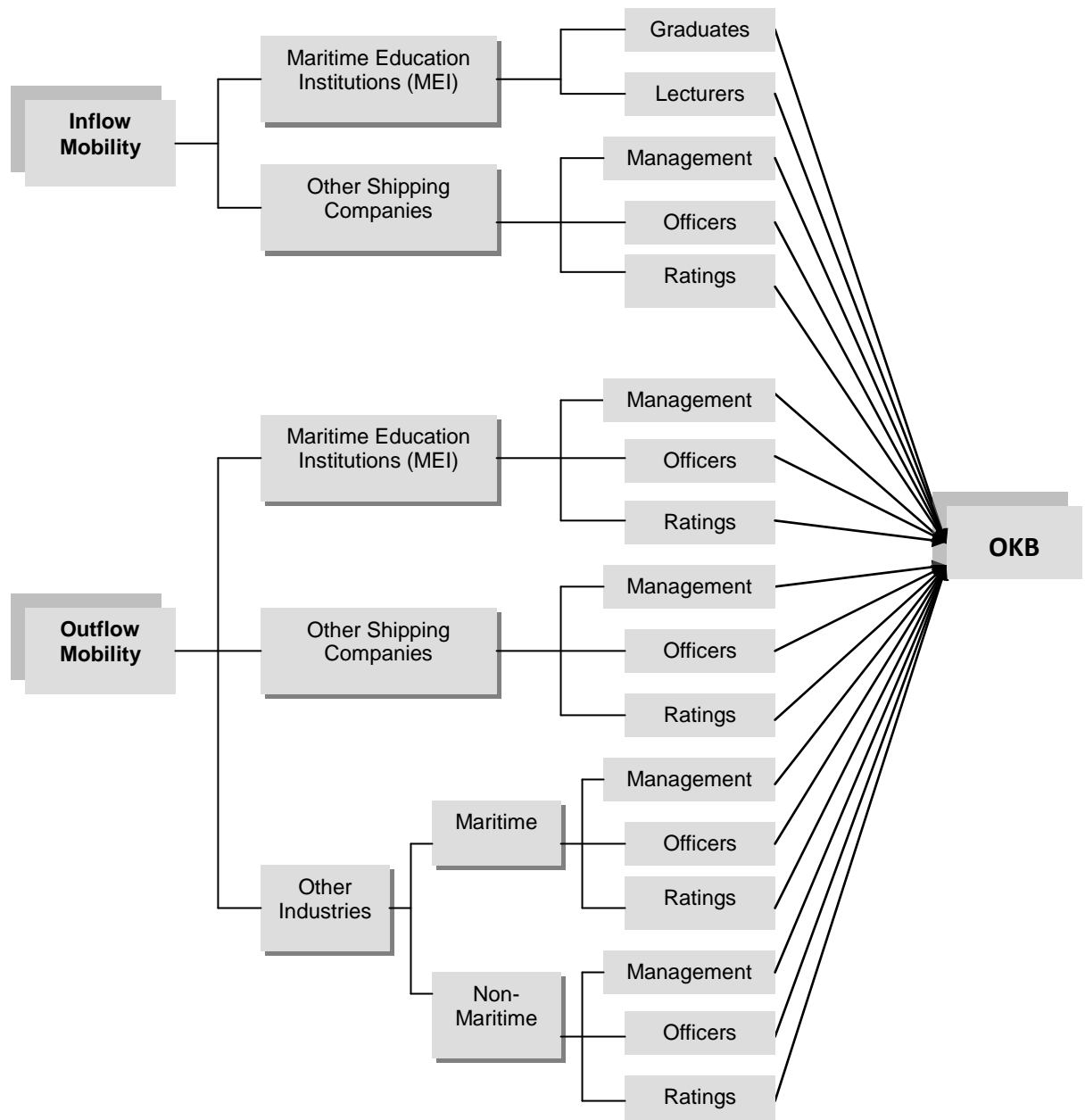
### **3.2.3 Perceived effects of human mobility on the OKB in the shipping industry**

Overall, human mobility in the shipping industry is rather high. The survey of seafarers conducted during the Rochdale Committee of Inquiry into Shipping showed that 66% of all seafarers switch between companies while 32% remain with the first company they joined (Moreby 1975). Findings from recent research for example, Wu and Winchester (2005) show similar pattern. Accompanying the high inter-company mobility is the high cross sectoral movement of personnel, which has been termed as ‘wastage’ so called because this personnel movement has been an one-way direction and therefore a loss to the shipping industry. Previous research indicated that an average time-span of shipping officers’ active seafaring career was seven years (Moreby 1975). Recent reports in China recorded a 60% of attrition of graduates in a period of five years after they had joined the shipping industry (Kong & Ruan 2001). In addition, there has been difficulty in attracting personnel into the industry for various reasons (Dinwoodie 2000; Leggate 2004; Moreby 1975; Sambracos & Tsiaparikou 2001). The mobility in the shipping industry thus has three distinct characteristics:

- The high mobility rate between companies within the industry;
- The high and almost one-way direction movement of personnel from the shipping industry to other maritime related industries; and
- The low intake of graduates from maritime education institutions due to the difficulty in attracting candidates studying nautical courses.

To examine the perceived effects of high mobility on the OKB in the shipping industry, statements are derived from section 3.2.2 and compiled for an empirical test. As previously discussed, mobility is divided into two categories, inflow and outflow with subgroups in each of the categories (see figure 3.3). Mobile personnel are broadly categorised as management (personnel working onshore) and seafarers who are further divided into officers and ratings with the former representing deck officers and engineers and the latter including ratings from both the deck and engine room.

Figure 3.3 Personnel mobility and its effects on the OKB in the shipping industry



Source: Author

Based on the discussion on mobility and knowledge flows in 3.2.2, it is projected that:

1. *The inflow mobility of both graduates and lecturers from maritime education institutions has a positive effect on the OKB;*
2. *The inflow mobility of management staff, officers and ratings has a positive effect on the OKB;*

3. *The outflow mobility of management staff, officers and ratings has a negative effect on the OKB;*

Due to the different roles personnel play in the organisation, it is projected that the effects of personnel movement on the OKB will differ according to their relevant qualifications or positions they hold, therefore it is expected that:

4. *The movement of management staff has a stronger effect on the OKB than that of seafarers;*
5. *The movement of officers has a stronger effect on the OKB than that of ratings;*

According to the earlier discussion and figure 3.3, personnel movement happens across industry boundaries as well. When this happens, the effects of such movement are no longer limited at the organisational level; rather the effects extend to the knowledge base at the industrial level, which in turn, has a compound impact on the OKB. It is, therefore, projected that:

6. *The movement of personnel within the shipping industry does not affect the overall knowledge base of the industry;*
7. *Further education or training of personnel has a positive effect on the knowledge base of the whole industry;*
8. *The knowledge base of the shipping industry is negatively affected when personnel leave for positions outside the shipping industry;*
9. *Shipping organisations benefit from the overall improvement of the knowledge base of the shipping industry;*
10. *Compared with the personnel movement within the maritime industry, the impact is greater when personnel move to non-maritime industries, or into retirement.*

The projected statements are further divided by the categories of personnel mobility and summarised in table 3.1.

**Table 3.1 Perceived effects of personnel mobility on the OKB in the shipping industry**

<b>Groups</b>	<b>Statements</b>
<b>Inflow</b>	1. The intake of graduates from Maritime Education Institutions (MEI) has a positive effect on the OKB
	2. The intake of lecturers from MEI increases the OKB
	3. The inflow of management staff increases the receiving organisation's OKB
	4. The inflow of officers increases the receiving organisation's OKB
	5. The inflow of ratings increases the receiving organisation's OKB
<b>Outflow</b>	6. The OKB is negatively affected when management staff leave the organisation
	7. The OKB is negatively affected when officers leave the organisation
	8. The outflow of ratings has a negative effect on the OKB
<b>Extent of effects</b>	9. The movement of management staff has a stronger effect on the OKB than that of seafarers
	10. The movement of officers has a stronger effect on the OKB than that of ratings
<b>Cross-industry movement</b>	11. The movement of personnel within the shipping industry does not affect the overall knowledge base of the industry
	12. Further education or training of personnel has a positive effect on the knowledge base of the whole industry
	13. The knowledge base of the shipping industry is negatively affected when personnel leave for positions outside the shipping industry
	14. Shipping organisations benefit from the overall improvement of the knowledge base of the shipping industry
	15. Compared with the personnel movement within the maritime industry, the impact is greater when personnel move to non-maritime industries, or into retirement

Source: Author

### **3.3 Human mobility and knowledge transfer**

#### **3.3.1 Individual learning and organisational learning**

Although there are different definitions and approaches to organisational learning in the literature, the objective, process and outcome of learning is implicit. Organisational learning is the process of improving actions through better

knowledge and understanding (Fiol & Lyles 1985). It involves the detection and correction of errors, repeated testing, construction and reconstruction of knowledge (Argyris 1977; Argyris & Schön 1978). Learning enables a firm to encode inferences from past experiences into routines that guide current behaviours (Levitt & March 1988). It helps the firm to build, supplement and organise knowledge and routines around their activities and within their culture, and develop organisational efficiency by improving the use of the skills of their workforces (Dodgson 1993). Learning generates new insights, modifies behaviours (Stata 1989) and increases the capacity to take effective actions (Kim 1993). In short, organisational learning is the process of adding new knowledge to the OKB. This is achieved by integrating individual knowledge into the organisational level.

In the literature on organisational learning, three main topics are identified that are relevant for knowledge management: the perspectives of learning, the levels of learning and the relationship between individual and organisational learning. The perspectives of learning introduce the characteristics of learning and its learning outcome, that is, cognitive change or behavioural change. The levels of learning explain how the knowledge process takes place in different environments and to what extent the learning impacts organisations. The relationship between individual and organisational learning illustrates how individual knowledge becomes organisational knowledge. The three topics of learning are discussed briefly as follows with a focus on the third topic.

### **3.3.1.1 Perspectives of organisational learning**

Four perspectives of organisational learning emerge in literature, which can be further generalised into two groups concerning the concept of learning as cognitive change or behavioural change (Leroy & Ramanantsoa 1997). A summary of four perspectives of organisational learning can be found in Shrivastava (1983, p.10), which is provided in table 3.2.



**Table 3.2 Perspectives on organisational learning**

<b>Organisational learning perspectives</b>	<b>Core ideas</b>	<b>Major contributing authors</b>
Adaptive learning	Organisations adapt to changes in the environment by readjusting their goals, attention rules and search rules	Cyert & March (1963) Cangelosi and Dill (1965) March & Olsen (1976)
Assumption sharing	Organisational theories in use result from shared assumptions. Learning involves changes in these theories	Argyris & Schön (1978) Mitroff & Emshoff (1979)
Development of knowledge base	Learning is a process by which knowledge about action-outcome relations is developed	Duncan & Weiss (1979) Dutton & Duncan (1981)
Institutionalised experience effects	Learning curve extended to managerial decision making	Boston Consulting Group (1968) Abernathy & Wayne (1974)

Source: Shrivastava (1983, p.10)

The cognitive approach focuses on the internal complexity of the learning subject by analysing what occurs inside the “black box” (Davis 1992; Duncan & Weiss 1979; Huber 1991). The main characteristic of this approach is that it dissociates changes in the state of knowledge from changes in the organisational or individual behaviour (Duncan & Weiss 1979), so that learning does not necessarily result in observable changes in behaviour (Fiol 1994).

The behavioural approach tries to reveal the rules under the learning process by relating the behavioural response with the stimuli received by the subject (Cyert & March 1963; Fiol & Lyles 1985; Leonard-Barton 1992; Levitt & March 1988; March 1991; Nelson & Winter 1982). Behaviourists regard an organisation as a rational system or a system of routines that learns from experience (Cyert & March 1963) and learning is an adaptive process that maintains the survival of the firm (Fiol & Lyles 1985). Routines, the outcome of learning, reduce the uncertainty of the decision-making process and enable the organisation to cope with the ever changing environment by means of standardisation (Levitt & March 1988; Nelson & Winter 1982). The behavioural perspective, therefore, pays more attention to the application of knowledge that is learned from experience into the new environment.

### **3.3.1.2 Levels of learning**

Levels of learning overcome the classical distinction between cognitivism and behaviourism by transforming this distinction to single versus double-loop learning (Agyris & Schön 1978) and the lower versus the higher-level learning (Fiol & Lyles 1985). Single and double-loop learning are based on the learning impact on the cognitive level, while lower and higher-level learning are based on the effect on behaviours or cognition, duration and scope.

Single-loop or adaptive learning (Cyert & March 1963; Duncan & Weiss 1979; Levitt & March 1988) occurs when an organisation utilises information inputs in order to modify its products, but without modifying current organisational norms and technologies. Double-loop learning occurs when modification or changes are required to organisational norms and technologies. It involves questioning current organisational norms and values, setting new priorities, and conducting an evaluation of these norms. As a result of learning, the internal value systems may have to be restructured, critically examined, which in turn, changes the underlying knowledge structure of the organisation. Lower-level learning leads to the development of short-term behaviours and has a limited impact on the organisation. Higher-level learning, on the other hand, aims to adjust the overall rules and norms of the organisation instead of specific behaviours and activities and has long-term effects on the organisation as a whole.

### **3.3.1.3 The relationship between individual and organisational learning**

The relationship between individual and organisation learning is a key issue in learning literature. It is closely related to individual and organisational knowledge and the process of how individual knowledge integrates with organisational knowledge. Whereas some (Grant 1996a; Polanyi 1962; Von Krogh & Roos 1995) insist on the personal character of knowledge, others, for example Wittgenstein (1995), claim that all knowledge is, in a fundamental way, collective. Some authors (Baumard 1999; Nonaka & Takeuchi 1995; Tsoukas & Vladimirou 2001), however, compromise these two contradictory concepts by stating that knowledge is individual capacity but becomes organisational through certain processes. As it

is pointed out (Dodgson 1993), focusing on only one of the concepts underestimates some characteristics of learning.

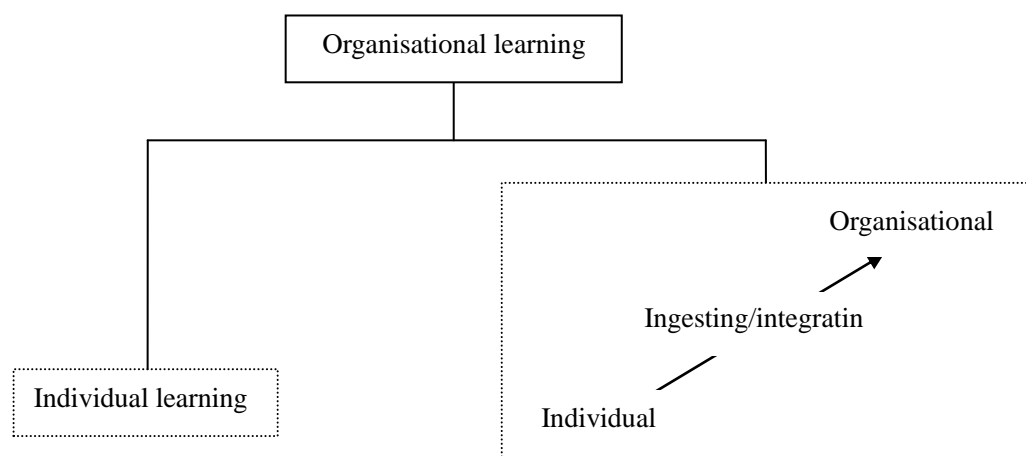
**Agents of learning** The agents of learning can be individuals, groups (teams), or organisations. Approaches which make individuals central to organisational learning focus on people and their motives, interests and values (Argyris & Schön 1978; Hedberg 1981). Models based on individual learning emphasise the personal component in behavioural change and neglect the collective aspect. Some (Schopter 1987; Brooks 1994) have recognised that groups exert a major influence on decision-making and learning. The group learning approach means that the agents of learning may include not only a dominant coalition, but groups of all kinds, such as innovation teams or even whole functional areas, either of which can be vehicles for learning. Other organisational learning theories do not focus on agents of learning (groups or individuals), rather they concern themselves with changes in the organisation itself (Cyert & March 1963; Fiol & Lyles 1985; Levitt & March 1988; Huber 1991). Differentiating agents of learning does not deny the fact that an organisation does learn but the question remains: how does the organisation learn?

Individual knowledge needs to be shared and legitimised through integrating interactions and information technology before it becomes group knowledge (Tsuchiya, 1994). Once it becomes group knowledge, learning at the organisational level starts. This level of the IGO framework resides in the organisation's structures, procedures and routines (Fiol & Lyle 1985).

**Organisational learning** An organisation learns by the learning of its members and/or by ingesting new members who have knowledge the organisation did not previously have (Simon 1991, p. 125) (Figure 3.4). A member learns when he or she realises the need to learn in order to be competent in his or her current job or to be well prepared for a new, better job. In addition, a member may learn unconsciously through working within a team or group. Individual learning involves resources both inside and outside the organisation. To a great extent, the contents of individual learning are dependent on what is already known or believed by the other members of the organisation and what kind of information is

present in the organisational environment (Simon 1991). That is to say, the individual learning depends on the current OKB. Simon's statement of how organisations learn is a good explanation of why an OKB comprises personal and organisational knowledge (refer to chapter two). As organisations learn in two ways, so any changes on personal knowledge will have an effect on the OKB. The result of individual learning is the increases of the total knowledge base of the organisation.

**Figure 3.4 How does an organisation learn**



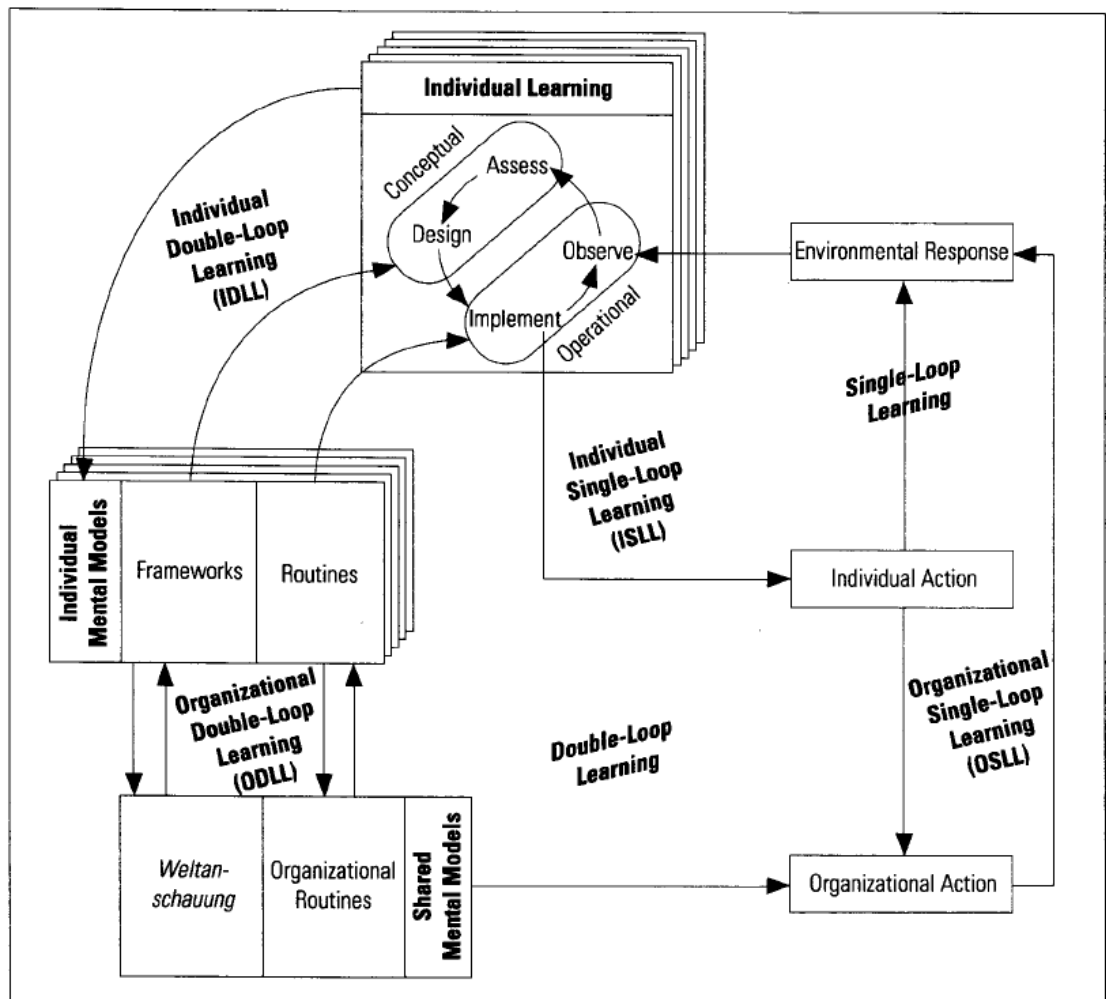
Source: Author, based on Simon (1991)

As far as human mobility is concerned, newcomers bring their personal knowledge into the organisation when they join it. The extent to which these new members can contribute new knowledge to the organisation depends on the difference between their personal knowledge and the existing organisation knowledge and the effectiveness of learning a new knowledge by the organisation (Simon 1991). Intakes of new members not only bring in new knowledge but also stimulate the learning atmosphere in the organisation.

The relationship between individual and organisational learning has been well explained in Kim's SMM model. Based on March and Olsen's (1975) "model of organisational learning", Kim (1993) developed an "integrated model of organisational learning: OADI-Shared Mental Models (SMM) Cycle" (see figure 3.5) to build a theory about the process through which individual learning

advances organisational learning. This model specifies the transfer mechanism, the shared mental models, between individual and organisational learning. Mental models are collections of ideas, experiences and schemas through which individuals interpret their own reality (Senge 1990). It is believed that the intangible assets of an organisation reside in individual mental models that collectively contribute to the shared mental models (Kim 1993).

**Figure 3.5 An integrated model of organisational learning: OADI-shared mental models (SMM) cycle**



Source: Kim (1993, p. 44)

This model explains how individual learning advances to organisational learning. Organisational learning is interpreted as a loop of “individual beliefs – individual action – organisational action – environment response” (March & Olsen 1976). The loop is complete if the organisational response influences individual beliefs.

However, individual learning does not automatically lead to organisational learning in this model. In order for the organisation to learn, there must be shared mental models to bridge the individual learning and organisational learning. Shared mental models constitute the way an organisation interprets its own world and assumes that individuals improve their mental models. This model is coherent with the theory of viewing an organisation as an interpretation system (Daft & Weick 1984), where organisational learning is a process of exploration, interpretation and learning. Moreover, the model also adapts to the concept of single and double-loop learning (Agyris & Schön 1978). Double-loop occurs when mental models are influenced, improved or changed.

The Shared Mental Models have a clear lead in organisational memory theory (Walsh & Ungson 1991), where an organisation is regarded as having storage systems, which represents the organisational knowledge or memory. The storage systems enable the organisation to store knowledge and continue to process it without the aid of individual members. Individuals come and go, the organisation remains. In this sense, individuals can be interpreted as part of a collective organisational memory (Walsh & Ungson 1991). When information is stored in organisational knowledge systems, operational patterns are preserved. The behaviours and actions of individuals are transformed into lasting knowledge possessed by the organisation. The different components of the organisation, individuals, elites and groups, interact over an extended period of time resulting in complex relationships, which can be characterised as emergent properties of the organisational system (Walsh and Ungson 1991). Learning thus occurs not only when parts combine, but also when a new total system develops, with its own laws. Being an intangible asset (Anand, Manz, & Glick 1998; Schwabe 1999; Sparrow 1999), organisational memory if successfully managed, can enhance and accelerate learning, develop innovative products and lower transaction costs (Argote 1999; Casey 1997; Haragdon & Sutton 1997; Walsh & Ungson 1991; Wexler 2002). In summary, organisational capabilities permit the organisation to be more than the sum of its parts by giving it a life of its own above and beyond those of the individuals involved (Chandler 1992).

Kim's model has important implications to the present research. Firstly, the shared

mental models imply the concept of organisational memory or the OKB (Chapter two). Secondly, the relationship between individual and organisational learning sheds light on the issue of how individual knowledge becomes organisational, a base for retaining personal knowledge through effective knowledge sharing and transfer.

**Learning organisation**      The learning organisation is another concept that is related to organisational learning. A learning organisation is skilled at creating, acquiring, and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights (Garvin 1993). This definition captures the major elements of knowledge management: knowledge creation, acquisition and transference. In addition, it also underlines the results of the learning or knowledge management process, and the cognitive and behavioural change. The five main activities (systematic problem solving, experimentation, learning from experience, learning from others and transferring knowledge) of a learning organisation (Garvin 1993) reflect the main activities promoted by knowledge management practice

### **3.3.2 Knowledge management processes**

#### **3.3.2.1 The scope and activities of knowledge management**

Defining the scope and the aim of knowledge management is as difficult as defining the nature of knowledge. There is no universally accepted definition for knowledge management among researchers and practitioners, despite a wealth of books, reports and studies (Neef 1999; Tsui 2000; Bhatt 2001 Mentzas *et al.* 2003). Existing literature has provided a description of processes and activities involved in knowledge management practice (see table 3.3). Although the term “knowledge management” has been used loosely to refer to a broad collection of organisational practices and approaches related to generating, capturing and sharing knowledge that is relevant to the organisation’s business, the main activities and processes are still identifiable.

**Table 3.3 Classification and scope of knowledge management**

Types of classification	Scope of KM	Contributions
<b>Level of focus</b>	Micro-organisational, social and cognitive processes.	Nonaka & Takeuchi, 1995; Baumard, 1999
	Organisational level processes.	Brown & Duguid, 1998; Cohen & Levinthal, 1990; Senge, 1990; Zahra & George, 2002
	Industry or national level.	Nelson, 1993; Solvell & Zander, 1999; Teece, 2001; von Hippel, 1998
<b>Process and main activities</b>	Creation, transfer, sharing, application, measurement	Ruggles, 1998
	Creation, validation, presentation, distribution and application.	Bhatt, 2001
	Creation, transfer, assembly, integration and exploitation.	Teece, 1998
	Creation, storage/retrieval, transfer, and application.	Alavi & Leidner, 2001; Boisot, 1998; Davenport & Prusak, 1998; Pentland, 1995
	Acquisition, sharing, and utilization.	Nevis <i>et al.</i> , 1995
	Creation, interpretation, dissemination, application, retention and refinement	De Jarnett, 1996

Source: Author

Research on knowledge management practices can be classified into two streams according to their points of focus. While one group focuses on the different levels to which knowledge management can be applied, the other has an emphasis on the processes and activities that have been involved in knowledge management practices. From the level of focus, some address the micro-organisational, social and cognitive processes, in which knowledge is created, conversed and transferred (Baumard 1999; Nonaka & Takeuchi 1995). Others look at organisational level processes, components and developed capabilities that support knowledge acquisition, assimilation and exploitation (Brown & Duguid 1998; Cohen & Levinthal 1990; Senge 1990; Zahra & George 2002). A third group examines knowledge creation and transfer at an industry or national level (Nelson 1993; Solvell & Zander 1999; Teece 2001; von Hippel 1988). While the issues at different levels are interrelated, approaches are rarely integrated. Although emphasising on specific mechanisms for promoting conversion and



transfer of knowledge at each level, they do not address for example, the significance of how the industry paths of knowledge transfer affect organisational and micro cognitive processes or vice versa. Therefore, there is a need for an integrated approach to be employed to explore and explain how knowledge flows and is managed through the three levels (see figure 3.2).

Knowledge management also is viewed as a collection of activities (Alavi & Leidner 2001; Bhatt 2001; Teece 1998) or a sequential process (Boisot 1998; Davenport & Prusak 1998; De Jarnett 1996; Nevis *et al.* 1995; Pentland 1995). While Bhatt (2001) categorises the knowledge management process into knowledge creation, validation, presentation, distribution and application, Alavi and Leidner (2001) add elements of knowledge storage and retrieval. In addition, knowledge integration and exploitation are suggested to be included in the knowledge management process to reflect the acquisition of new knowledge and its integration from individual to organisational knowledge (Teece 1998). These activities are seen as embedded in a sequential process, starting from knowledge creation to knowledge organisation and storage/retrieval, then knowledge transfer, and ending with knowledge application (Boisot 1998; Davenport & Prusak 1998; Pentland 1995) or followed by two more activities: knowledge retention and refinement (De Jarnett 1996). Nevis *et al.* (1995), however, incorporates knowledge management activities into stages of the learning process and provides a three stage model: 1) knowledge acquisition – the development or creation of skills, insights, relationships; 2) knowledge sharing – the dissemination of what has been learned; 3) knowledge utilisation – the integration of learning so it is broadly available and can be generated to new situations.

However, these activities and processes are not seen as equally important to the management of knowledge in an organisation. Some (for example, Grant 1996) suggest that the focus of knowledge management practice should be on knowledge integration as the primary role of the firm; and the essence of the organisational capability is the ability to integrate organisational knowledge, whereas Kogut and Zander (1992) emphasise the application of existing knowledge, as the strength of knowledge lies in its application to create a competitive advantage to the organisation. In fact, knowledge integration and

application are closely related. Personal knowledge, if not integrated into the organisation and not made available to other members of the organisation, is limited and vulnerable to personnel turnover (Storey 2001). Each activity and process therefore is an integral part of the whole knowledge management process.

### **3.3.2.2 The knowledge management process**

Descriptions of the knowledge management process are closely related to contributions from the literature addressing phases of learning (Davenport, De Long & Beers 1998; Dibella, Nevis & Gould 1996; Huber 1991; Quinn, Anderson & Finkelstein 1996). The overall process, addressed by several streams of literature, has four main phases: knowledge acquisition, distribution, interpretation and organisational memory, to which a number of processes and sub-processes is included (Huber 1991) (shown in table 3.4). This overall process can be viewed as a reconfiguration of the processes and activities discussed in the last section.

**Table 3.4 Phases of knowledge processes**

<b>Phases</b>	<b>processes</b>	<b>Sub-processes</b>
<b>Knowledge acquisition</b>	Congenital learning	
	Experiential learning	■ Organisational experiments ■ Organisational self-appraisal ■ Experimenting organisations ■ Unintentional/unsystematic learning ■ Experience-based learning curves
	Vicarious learning	
	Grafting	
	Searching and noticing	■ Scanning ■ Focused search ■ Performance monitoring
<b>Knowledge distribution</b>	■ Initiation ■ Implementation ■ Ramp up ■ Integration	
<b>Knowledge interpretation</b>	■ Cognitive maps and framing ■ Media richness ■ Information overload ■ Unlearning	
<b>Organisational memory</b>	■ Storing and retrieving information ■ Computer based organisational memory	

Source: Huber (1991, p.90)

**Knowledge acquisition** Five processes are formalised by which an organisation can acquire knowledge (Huber 1991). These processes differ according to the scope (individual, unit and organisation), the actors involved in the process (internal and external), and the process itself (creation and assimilation of knowledge). Congenital learning is a combination of inherited knowledge at the conception and additional knowledge prior to its birth (Schein, 1984). Experiential learning is related to formal organisational experiments (Warner, 1981), its self-appraisal (Argyris 1982; McNamara & Weeks 1982; Peters & Robison 1984) approaches towards experimentation (Starbuck 1984), learning (Harrison & March, 1984; Levinthal & March, 1981) and learning curves (Mody 1989; Muth 1986) from experimentation.

Vicarious learning refers to the attempts of an organisation to learn about strategies, administrative practices and technologies of other organisations through consultancy, professional meetings, trade shows, publications, vendors and suppliers, and a network of professionals (Dutton & Freedman 1985; Levitt & March 1988; Sahal 1982). Knowledge acquisition through grafting is a process of acquiring new members who possess this knowledge. Sometimes this happens on a large scale by the acquisition of other companies or through joint ventures (Lyles 1988). Finally, the two streams of literature refer to scanning and noticing, according to the unit of analysis. The analysis on organisations is related to strategic management and assumes that scanning contributes to performance (Dutton & Freedman 1985; Tushman & Katz 1980). Individual analysis investigates the role of gatekeepers in R&D (Gesterfend & Berger 1980; Tushman 1977) and the role of upper management (Mintzberg 1975).

**Knowledge distribution** Knowledge distribution is also described as knowledge transfer or knowledge diffusion to emphasise that movement of knowledge depends on everyone involved (Szulanski 1995). This process includes 1) initiation, that is, all events leading to the decision to transfer; 2) implementation, the process of transfer; 3) ramp up, the use of transferred knowledge by the recipient and 4) integration, the acceptance of transferred knowledge after satisfactory results are achieved by the new knowledge. There are elements impeding the transfer of knowledge such as causal ambiguity and

unproveness (Szulanski 1995). A detailed discussion is provided in section 3.3.3 with regard to the barriers and facilitators of the knowledge transfer in the context of organisational knowledge flows.

**Knowledge interpretation** Knowledge is given meaning, and shared understanding is developed when knowledge is interpreted (Daft & Weick 1984). Knowledge interpretation is influenced by four main factors (Huber 1991). 1) The first is cognitive maps and framing, which vary across organisational units and responsibilities (Kennedy 1983; Kim 1993). 2) A second factor is media richness, which determines the extent to which information is given the same meaning by the sender and receiver (Daft & Huber 1987). 3) Information overload as a factor of knowledge interpretation affects the capacity of interpretation (Miller 1978). 4) Finally, unlearning influences knowledge interpretation through continually reviewing and renewing existing knowledge.

**Organisational memory** Organisational memory refers to the storing, retaining and maintenance of knowledge (Walsh & Ungson 1991). It affects other phases in the process of knowledge management. Knowledge acquisition is dependent on attention directed by previous learning stored in memory; knowledge distribution is affected by decisions using information and knowledge contained in organisational memory, and interpretation, to a great extent, relies on the existing knowledge of the receiver (Huber 1991). It is important to note that the storing and retaining of knowledge are not enough to enhance and develop organisational memory. Knowledge maintenance is equally important for the organisation to keep its knowledge base dynamic rather than static (see chapter two).

Huber's list may not be exhaustive. However it does provide a good picture of what activities and processes are involved in knowledge management practices. Underlying these activities and processes is an important element of knowledge management practice: knowledge transfer. The acquisition of knowledge implies the movement of knowledge that results in the multiple possession of the acquiring knowledge. Secondly, knowledge distribution explicitly indicates the movement of knowledge from its origin to where it is needed. Moreover,

knowledge interpretation is to give meaning and understanding to knowledge that has been *transferred*. Finally, organisational memory is *transferred knowledge* that is understood, validated and has become part of organisational knowledge. Without knowledge transfer, other activities will not happen.

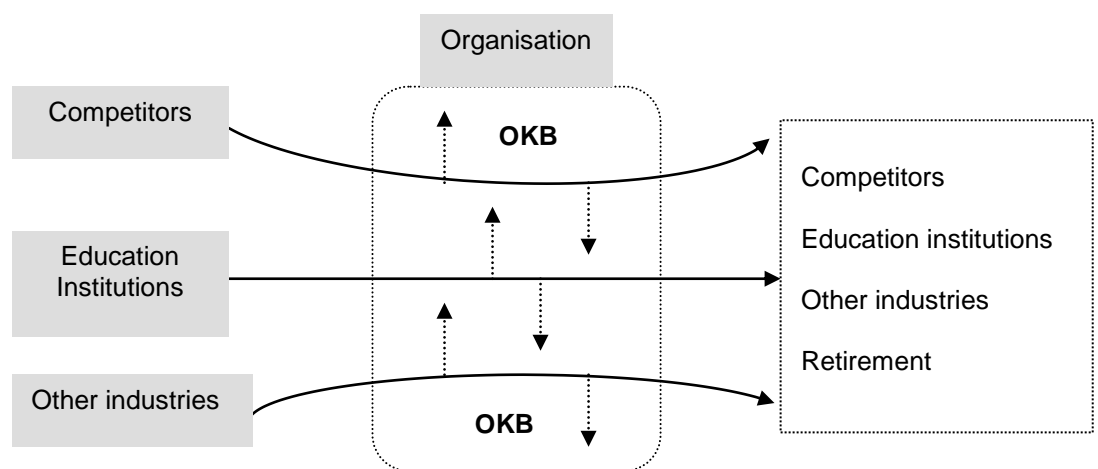
From the perspective of the OKB, successful knowledge transfer activities enrich the OKB thereby improving organisational performance. Studies have confirmed a positive relationship between the total stock of organisational knowledge and organisational performance (Cockburn & Griliches 1988; Jaffe 1986; Pakes 1985). An organisation's performance ultimately depends on how well it can enhance its own knowledge base both from internal and external sources, integrate its different specialised knowledge areas and apply its knowledge to develop new products or improve existing ones (Bierly & Chakrabarti 1996; Kessler, Bierly & Gopalakrishnan 2000). Moreover, the characteristics of the organisational knowledge base and its maintenance are a vital source for sustained competitive advantage (March 1991; Prahalad & Hamel 1990; Starbuck 1992; SubbaNarasimha, Ahmad & Mallya 2003). The development and maintenance of the OKB call for continuous inflows of knowledge to the organisation. This can only be achieved through effective knowledge transfer mechanisms.

The earlier discussion on human mobility and knowledge flows indicates that there are different sources of knowledge flow through the organisation at any given time. The organisation is able to use the inflowing knowledge when the knowledge stays within the organisation. However, high mobility makes personal knowledge temporal to the organisation. If no retention mechanism is in place, these inflows of knowledge will be lost again when personnel leave the organisation. If knowledge flows are properly managed, then the OKB will be enhanced and continuously updated. Figure 3.6 illustrates the relationship between knowledge flows and the OKB. If proper methods are adopted, part of the knowledge that flows into the organisation will be retained even if personnel leave.

Given the prevailing human mobility, the main task for knowledge management is to make the dot arrows in figure 3.6 solid, that is, to make knowledge transfer

effective. Personnel coming in from competitors provide the organisation opportunities to learn from others through the sharing of their personal knowledge. People from education institutions and other industries often carry fresh ideas into the industry and represent opportunities for the organisation to advance its knowledge base. From the perspective of an industry, human mobility among organisations, between education institutions and the industry, and across industries, might maintain a dynamic balance, that is, the inflow and outflow of personnel to the industry is balanced and therefore there is a balance of inflow and outflow knowledge. Personnel retirement however certainly represents a sheer loss of knowledge to the industry as a whole if no knowledge retention mechanism is employed. In addition, for an industry where inflow and outflow of personnel is unbalanced, especially when outflow outweighs inflow, mobility poses a severe issue for the industry to maintain a competent knowledge base. This is the case for the shipping industry where the attrition of seafarers is high and the intake of personnel is difficult. For a particular organisation within the industry, effective knowledge management practices can retain the knowledge carried by mobile personnel, which is interpreted as an increase on the OKB. To make the process effective, obstacles of knowledge transfer need to be identified in order for management to employ relevant mechanisms to facilitate the transfer process.

**Figure 3.6 Knowledge flows and the OKB**



Source: Author

### **3.4 Identifying Barriers to knowledge transfer**

#### **3.4.1 Factors influencing knowledge transfer**

Literature on knowledge flows and knowledge transfer indicates a number of factors that might affect the process of knowledge transfer. Simonin (1999) observes knowledge ambiguity as a full mediator of tacitness, prior experience, complexity, cultural distance, and organisational distance on knowledge transfer. Others (Kogut & Zander 1993; Winter 1987; Zander & Kogut 1995) however, propose a more comprehensive list of taxonomic dimensions of knowledge that can impede knowledge transfer: tacit vs. explicit; unteachable vs. teachable; not articulated vs. articulated; not observable vs. observable; complex vs. simple; and the element of a system vs. independence. In addition to the knowledge characteristics, other attributes such as context, the source and recipient of knowledge, have been identified as the major sources of impediments to knowledge transfer (Szulanski 1996; von Hippel 1994). While previous research has provided insights on the factors that might affect knowledge transfer, there are differences in terms of contexts in which research was carried out and the type of knowledge transferred. For example, Simonin's (1999) research was conducted in the context of strategic alliances and has focused on the transfer of technological knowledge. Gupta and Govindarajan (2000) carried their research in multinational corporations (MNCs) for the transfer of procedural knowledge. Furthermore, Szulanski (1996) identified impediments of knowledge transfer within the firm. The following subsections provide more detailed discussion on factors that may affect knowledge transfer. At the end of this section, a framework is given to illustrate how these factors affect the organisation to accumulate its knowledge thereby increasing its OKB.

Research in different contexts has identified knowledge-related and partner-specific factors that might affect the effective transfer of knowledge (Gupta & Govindarajan 2000; Simonin 1999; Szulanski 1996). Knowledge-related factors include such factors as the value of knowledge being transferred (Gupta & Govindarajan 2000), tacitness and complexity (Simonin 1999) and causal ambiguity (Szulanski 1996). Partner-specific factors mainly concern the

recipient's absorptive capacity (Gupta & Govindarajan 2000; Szulanski 1996) or prior knowledge (Simonin 1999), the relationship between source and recipient (Szulanski 1996), the cultural and organisational distance (Simonin 1999), and the motivation of source and recipient (Gupta & Govindarajan 2000; Simonin 1999; Szulanski 1996). Table 3.5 lists the factors that are related to knowledge transfer. Among these factors, motivational factors have been surprisingly not supported in the research conducted by Gupta and Govindarajan (2000) and Szulanski (1996). However, others (Hauschild, Licht & Stein 2001; Ribiere 2001; Storey & Quintas 2001) identify the employees' willingness to share their knowledge is crucial for the success of knowledge management initiatives.

**Table 3.5 Factors affecting knowledge transfer**

	Knowledge- related	Partner-specific	Other factors	Research context
Gupta & Govindarajan (2000)	- Value of knowledge being transferred	- Motivation (source and recipient) - Absorptive capacity of the recipient	- Transmission channels	MNCs
Simonin (1999)	- Tacitness - Complexity	- Prior knowledge - Protectiveness - Cultural distance - Organisational distance		Strategic alliances
Szulanski (1996)	- Causal ambiguity	- Absorptive capacity of the recipient - Relationship between the source and recipient		Within the firm

Source: Author

#### **3.4.1.1 The characteristics of context**

As previously discussed, knowledge flows occur in both intra- and inter-firm settings. The importance of situational settings or context, within which knowledge transfer is taking place, has been stressed on the practice of learning and knowledge sharing (Bell, Gioradno & Putz 2002). For example, within a strategic alliance, the context complicates the process of transferring knowledge partly due to the competitive nature of the alliance (Bengtsson & Kock 2000; Dussauge, Garette & Mitchell 2000), whereas the competitive element vanishes from the buyer-supplier relationship leading to the proposition that a situational setting may be an important factor that shapes the knowledge transfer practice. Similarly, Tsai (2001) focuses on knowledge transfer within the boundaries of a



shared social context, which is operationalised as a network of units within a firm thereby stressing the importance of context in an intra-organisational setting.

#### **3.4.1.2 The characteristics of relationship**

The relationship between the knowledge sender and the recipient has the implication on how knowledge is transferred and how efficient the process is. The types of relationship (Moorman & Miner 1997) and similarity between individuals (Argote & Ingram 2000) act as an important role in internal knowledge transfer while legal, temporal and long-term characteristics of relationship (Larsson *et al.* 1998; Mowery *et al.* 1996; Simonin 1999) affect the external transfer of knowledge. Among factors that may influence the knowledge transfer process, interpersonal trust and the level of organisational commitment have been identified as key elements in the process of knowledge sharing and transfer.

Trust influences the actions of those involved in the knowledge transfer process (Ghoshal & Bartlett 1994). In a learning environment, trust facilitates learning between partners and is the basis for deciding the knowledge exchange (Huemer, Krogh & Roos 1998). The importance of developing high levels of trust between partners has been recognised by authors such as Andrews and Delahaye (2000), Davenport and Prusak (1998) and Roberts (2000), as the knowledge being exchanged may be not only tacit but also proprietary (Dodgson 1996). A lack of trust between individuals is likely to inhibit the extent to which people are willing to share knowledge with each other. This is because a lack of trust creates uncertainty and risk that all parties may not participate, or benefit equally, and that due to opportunistic behaviour, someone may lose out from sharing their knowledge (Andrews & Delahaye 2000). Additionally, a close relationship builds an understanding of each person's particular knowledge and skills, which allows employees to seek out the right peers for the knowledge transfer in the future (Cross & Baird 2000). Therefore, within an organisation, both affect and cognition based trust (McAllister 1995) is an important requirement for knowledge management (Woods 2001) and is a must especially for the search and transfer of tacit knowledge (Nonaka, Toyama & Konno 2000; Roberts 2000).

Research suggests that the level of organisational commitment may affect individual knowledge sharing attitudes and behaviours as well as the level of loyalty (Byrne 2001; Guest & Patch 2000; Scarbrough & Carter 2000; Storey & Quintas 2001). High levels of organisational commitment can be achieved by a positive psychological contract, where an employee's expectations are met (Flood *et al.* 2001). In such a circumstance, there is a sense of goal alignment between the employee and the organisation, and there is an emotional as well as economic component to the employment relationship, where loyalty and commitment levels are high (McDonald & Makin 2000; Morrison & Robinson 1997; Rousseau 1990). High levels of organisational commitment result in positive attitudes to the knowledge sharing process.

#### **3.4.1.3 The characteristics of organisations**

Cultural differences between transfer partners are identified as key obstacles to inter-firm knowledge transfer (Lyles & Salk 1996; Mowery *et al.* 1996; Simonin 1999) and are the most frequently mentioned source of causal ambiguity (Mosakowski 1997). In a culturally different environment, the transfer of tacit knowledge is even more difficult, where differences exist with respect to fundamental organisational and work-related assumptions about people and performance, rewards, training and development (von Glinow & Teagarden 1998). The differences lead to an unbalanced situation between partners in their aptitude for decoding and interpreting knowledge (Hamel 1991). In addition, cultural differences may raise the barriers for communication between partners where language proficiency and alignment [in fact, language is seen as the medium of culture (Czarniawska-Joerges 1992)] dictate the boundaries of communication and knowledge flows (Grant 1996b). This is especially true when knowledge transfer builds on numerous individual exchanges, as the success of transfer depends on the ease of communication and intimacy between the source and the recipient of knowledge (Szulanski 1996).

Furthermore, organisational structure, such as the hierarchical structure, autonomy, and control (Foss & Pedersen 2002; Tsai 2002) influences the channels of knowledge flows within the organisation. The extent of transparency

or permeability of the organisational membrane between partners, or partner protectiveness (Simonin 1999), can influence knowledge stickiness. The adoption of strict policies or the deployment of shielding mechanisms through partitioning of tasks and the physical separation of experts builds up the barriers of knowledge transfer (Baughn *et al.* 1997; Inkpen & Beamish 1997). In Szulanski's (1996) words, "a fertile organisational context facilitates knowledge transfer while a barren context hinders it."

Moreover, absorptive capacity, which is 'a function of the recipient's knowledge endowment prior to the transfer', that is, experience (Szulanski 1996, p. 36), of the organisation is highly relevant to the successful application of knowledge on the recipient side (Cohen & Levinthal 1990; Gupta & Govindarajan 2000). For an organisation to be able to use the knowledge being transferred, it must have prior experience within the knowledge domain (von Hippel 1994). The lack of such experience is believed to be one of the most important origins of stickiness (Szulanski 1996). Significant differences in knowledge base between partners impede learning (Baughn *et al.* 1997; Crossan & Inkpen 1995) and make knowledge transfer almost impossible (Grant 1996b; Hamel 1991).

#### **3.4.1.4 The characteristics of the individual**

Effects from individuals involved in the transfer process are analysed from both the knowledge sender and the recipient. The individual capabilities (Argote & Ingram 2000; Hansen 1999) and attitudes (Hansen 1999) are believed to have influence on an internal knowledge transfer. Personal absorptive capacity has proven to be one of the most important factors that can affect effective knowledge transfer (Cohen & Levinthal 1990; Gupta & Govindarajan 2000; Szulanski 1996). For a knowledge recipient, prior experience with a given knowledge base predetermines the level of familiarity and comfort with both the content and context of the knowledge being transferred, therefore facilitating the transfer process (Simonin 1999). Experience helps the recipient to build up the relevant tacit know-how to fill in the gaps left by the codified description which, without it,

may provide only vague clues about what has been tried and what might be tried next (Pisano 1988).

In addition to the absorptive capacity, successful knowledge transfer also depends on the willingness or motivation of the knowledge provider (Winter 1987). A lack of motivation from the source of the knowledge may be due to the fear of losing ownership, to a position of privilege or superiority, to inadequate rewards or simply to the unwillingness to devote time and resources towards the transfer process (Simonin 1999). In addition, the reliability of the source of knowledge also influences recipient behaviour, for example, a trustworthy source is more likely to elicit a positive attitude for the recipient to learn (Szulanski 1996). For the recipient, motivation and willingness to learn cannot be taken for granted either. One of the factors affecting the recipient to accept knowledge is the “Not-Invented-Here” (NIH) syndrome due to ego-defence mechanisms (Allport 1937; Sherif & Cantrill 1947 in Gupta & Govindarajan 2000) and power struggles within organisations (Pfeffer 1981 in Gupta & Govindarajan 2000). High motivation stimulates learning and may be a factor in overcoming obstacles caused by causal ambiguity, absorptive capacity, and the tacitness of the knowledge to be transferred (Kalling 2003).

The willingness of employees to share their knowledge and expertise is crucial to the success of knowledge management initiatives (Hauschild, Licht & Stein 2001; Ribiere 2001; Storey & Quintas 2001). Evidence on knowledge management initiatives indicates that human, social, and cultural factors are typically key determinants of the success or failure of such initiatives (Empson 2001; Flood Ramamoorthy & Pearson 2001; Kim & Mauborgne 1998). These socio-cultural factors however have not been recognised in the ‘first generation’ literature on knowledge management (Scarbrough & Carter 2000). The primary interests of this generation were focused on information system related issues while neglecting the significance of socio-cultural factors (Scarbrough, Swan & Preston 1999; Scarbrough & Swan 2001). The earliest knowledge management initiatives were thus based on a number of key assumptions, that is, people are willing to share knowledge; knowledge is either codified or is codifiable; and knowledge can be shared through IT systems.

The critique of the first generation literature suggests that human motivation is of fundamental importance to the knowledge transfer process, and people's willingness to share their knowledge should not be taken for granted (Flood *et al.* 2001; Scarbrough *et al.* 1999). The characteristics of knowledge suggest that knowledge is a resource locked in the human mind (Kim & Mauborgne 1998). The sharing and transfer of such knowledge occur through the interaction and communication between people. The tacit knowledge that employees possess may be exploited only if they decide to share the knowledge on a voluntary basis (Flood *et al.* 2001). Furthermore, the nature of the employment relationship highlights the potential tension between employees and the organisation over the ownership and control of their knowledge, which may inhibit the willingness of employees to share their knowledge (Scarbrough 1999). The upheaval in the nature of employment relationship since mid-1970s has witnessed less secure employment and internal promotion opportunities (Capelli 1999), a limited level of commitment and loyalty to the organisation (Gallie *et al.* 2001; Smithson & Lewis 1999). This suggests the significance of potential conflict between the objectives of the employees and their employers over how personal knowledge is utilised. Moreover, actual or perceived conflicts of interests between groups or individuals create reluctance for knowledge sharing (Empson 2001; Morris 2001; Willman *et al.* 2001). Thus, people's willingness to share their knowledge needs to be nurtured in a proper organisational environment and through effective management practices.

The recognition of the importance of the social and cultural on knowledge management practices has led to enormous research activities to address aspects of the socio-cultural factors that may influence people's attitude to knowledge sharing (table 3.6). The identification of these factors has shed light on how to plan and implement knowledge management initiatives more effectively.

**Table 3.6 Factors related to people's willingness to share knowledge**

Levels of concern	Factors affecting willingness to share	Contribution authors/case studies
Individual	Interpersonal trust	Andrews & Delahaye, 2001; Devenport & Prusak, 1998; Morris & Empson, 1998; Roberts, 2000
	Organisational commitment	Byrne, 2001; Guest & Patch, 2000; Storey & Quintas, 2001
	Concerns over loss of status and expertise	Andrews & Delahaye, 2001; Morris, 2001; Willman <i>et al.</i> , 2001
	Intergroup/personal conflicts	De Long & Fahey, 2000; Empson, 2001; Storey & Barnett, 2000; Ward, 2000
Organisational	Organisational culture	De Long & Fahey, 2000; McDermott & O'Dell, 2001; Pan & Scarbrough, 1999; Ribiere, 2001; Robertson & Swan, 2003
	HRM practices	Beaumont & Hunter, 2002; Hansen <i>et al.</i> , 1999; Jarvenpaa & Staples, 2000; Kubo & Saka, 2002; Swart & Kinnie, 2003; Tampoe, 1993

Source: Author

#### 3.4.1.5 The characteristics of the knowledge

The characteristics of the knowledge being transferred play an important role in the process of knowledge transfer (Simonin 1999; Szulanski 1996). Chapter Two has discussed the tacit and explicit dimension of knowledge. In the literature, the dichotomy between tacit and explicit knowledge has been documented on the basis of whether knowledge can, or cannot, be codified and transmitted in a formal, systematic language or representation (for example, Choi & Lee 1997; Kogut & Zander 1993; Senker & Faulkner 1996). While tacit knowledge is hard to articulate (Nonaka & Takeuchi 1995), explicit knowledge can be transmitted without losing integrity (Dyer & Nobeoka 2000). Knowledge transfer is more efficient if the knowledge is codified (Prencipe & Tell 2001). On the other hand, the tacitness of knowledge complicates the process of selecting, moving and applying the knowledge (Grant 1996b; Kogut & Zander 1992; Simonin 1999).

Knowledge tacitness is the implicit and noncodifiable accumulation of skills that results from learning by doing (Reed & DeFillippi 1990). Tacit knowledge is highly personal, deeply rooted in action and in an individual's involvement within a specific context (Nonaka 1994). Tacitness of knowledge has been equated to its

non-transferability (Mody 1989) or seen as a major source of ambiguity (Reed & DeFillipi 1990; Simonin 1999), making the transfer of knowledge between organisational members exceptionally difficult (Grant 1996b, Zander & Kogut 1995).

#### **3.4.1.6 Transfer mechanisms**

Mechanisms have high managerial implications, if properly managed, can facilitate the process of knowledge transfer. Almeida and Grant (1998) have identified 13 major knowledge transfer mechanisms, which can be grouped into three categories: personal communication, codified communication and embodied knowledge transfer. Personal communication includes mechanisms such as personal transfer, face-to-face meetings, training seminars and courses, communities of practices and other IT facilitated mechanisms. Codified communication includes electronic data exchange (EDI), written reports and manuals. Embodied transfer includes procedures, rules, directives and product or equipment. The choice of transfer mechanisms, according to Almeida and Grant (1998), depends on a) the type of the knowledge to be transferred; b) the intended use of that knowledge; and c) organisational context.

#### **3.4.2 A framework of knowledge transfer and the gap in the literature**

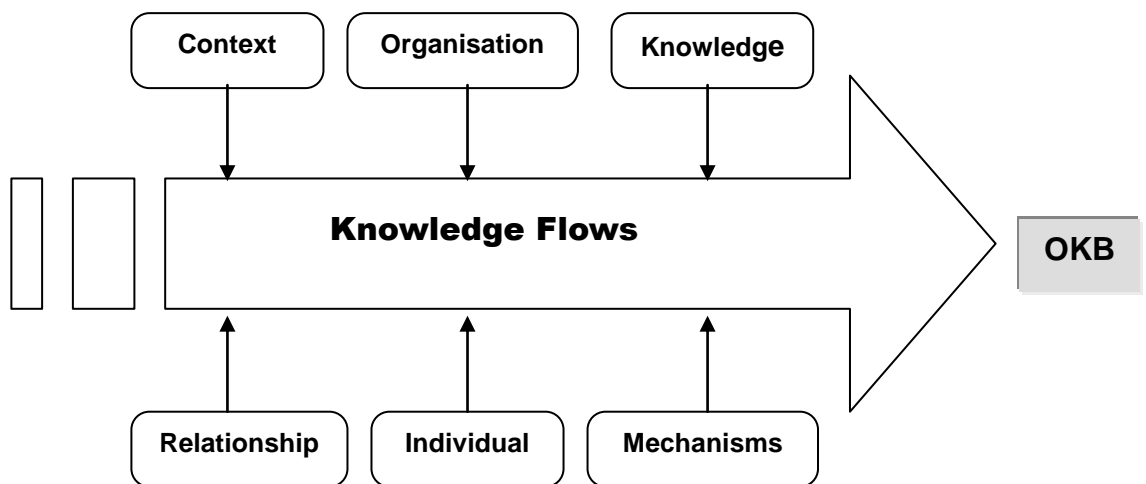
A framework is constructed based on the above discussed factors that are related to knowledge flows both internally and externally (figure 3.7). While these factors could be both barriers and facilitators to the process of knowledge transfer, effective management such as creating knowledge sharing culture, building a supportive organisational structure and environment, and using the right transfer mechanisms, can turn barriers to facilitators or at least, reduce the negative effects of barriers to the transfer process.

Existing literature has examined these factors in different contexts, though their emphasis varies. There is no identifiable research to date to explore the full picture of how these factors affect the knowledge transfer process and their interrelationship in a given organisation. Questions need to be answered in order

to gain a good understanding of the effective knowledge transfer process. These questions include:

- How and to what extent can tacit knowledge be externalised in a given industry and what is the implication for the employment of appropriate transfer mechanisms?
- How can an organisation help build formal and informal networks among individuals and groups within an organisation and across its borders in order for relationships to be established?
- How is individual motivation affected by organisational culture and human resource management practices?

**Figure 3.7 A framework of knowledge flows and related factors**



Source: Author

In addition, research has emphasised external knowledge transfer while overlooking the vast amount of untapped knowledge already residing inside the organisation, which can be tapped through an internal knowledge transfer (O'Dell & Grayson 1998). Moreover, most research on knowledge transfer has been from the point of view of the organisation, few studies have been done on individual knowledge transfer (Tsai & Tasi 2005). It is argued that even in an inter-firm scenario, knowledge transfer occurs at individual levels through formal and informal networks (Darr & Kurtzberg 2000). Organisational knowledge transfer ultimately builds on numerous individual exchanges (Szulanski 1996).



Knowledge transfer at the individual level plays a crucial role in both the intra- and inter- firm knowledge transfer.

Finally, research on knowledge management practices has been conducted not only in different contexts but also across industries, for example, biotechnology and pharmaceutical industries (Abidi 2005; Cheah, Rashid & Abidi 2002; Powell 1998), semiconductor industry (Almeida & Grant 1998), and energy industry (Leavitt 2002; Sapient Corporation 2001). Whereas general principles shed light on the adoption of knowledge management practices in different industries, special considerations need to be taken to ensure practices are relevant and effective for the specific industry. There are different agendas across industries in terms of knowledge management (Cardinal, Alessandri & Turner 2001). For example, the primary issue in the energy industry is to retain knowledge in the face of an aging workforce and the repaid attrition of expertise due to retirement while in biotechnology and pharmaceutical industries, the dominant agenda is to establish effective sharing systems while maintaining organisational identity. Secondly the characteristics of the knowledge differ across industries. Knowledge in the semiconductor industry is more technological in comparison with that in the energy industry which is more experiential. Effective knowledge management practices therefore need to be identified according to the characteristics of the industry.

### **3.5 Effective knowledge transfer practices in the shipping industry**

As previously discussed, there is prevailing human mobility and high attrition of expertise in the shipping industry. The agenda for the industry is therefore to retain the knowledge of departing personnel. It is also established that knowledge transfer is an effective way of protecting an organisation from knowledge attrition incurred by a high mobility rate. This section will examine the factors affecting knowledge transfer in the context of the shipping industry and to identify effective management practices to reduce the barriers and to facilitate the transfer of knowledge within a shipping organisation.

### **3.5.1 Characteristics of the shipping industry**

There are distinct characteristics in the shipping industry, which may affect the transfer of knowledge among individuals in organisations. These include the characteristics of knowledge in the shipping industry, the composition of the workforce, the unique working environment on ships, the management structure of shipping organisations, the highly mobile personnel, and possible mechanisms for knowledge transfer. These elements have a direct impact on the factors discussed which in turn have implications on the adoption of effective management practices to facilitate knowledge transfer.

The types of knowledge in the shipping industry tend to be distinctively divided. On the one hand skills and expertises are very experiential and are obtained only through observation and real working experiences. On the other hand, however, there are abundant of written instructions, procedures, and manuals to follow under certain circumstances due to the fact that shipping is one of the most regulated industries because of its possible impacts on human lives and marine environment. It is a misperception that safe operations can be carried out solely based on the knowledge of various International Conventions, Codes, or other regulations. While the understanding of rules and procedures for a particular operation can be obtained through articulation of explicit knowledge in forms of Conventions, Codes, Manuals, the manoeuvring of an operation needs far more tacit knowledge which can only be mastered through observation and mentoring.

The shipping industry by its nature is international. Personnel in a shipping organisation often come from many different countries and with multicultural backgrounds. In fact, research indicates that two thirds of the workforce is working in a multicultural environment (Kahveci & Sampson 2001). Cultural differences can make daily communication difficult and even more difficult in knowledge sharing. In addition, people coming from different cultural backgrounds often speak different languages. Although English has been the working language on ocean-going ships, the ability to communicate in English varies significantly among seafarers. 'Language filters and organises information from the physical and cultural realms and transform it into meanings that make up

human knowledge and experience' (Polkinghorne 1988, p. 158). Research shows that there are tight links between verbal skills and the acquisition of abstract concepts, conceptual depth, critical analysis, logical argumentation and the articulation of ideas (Orr 1987). Different national languages are reported as a key obstacle for knowledge transfer in MNC context (Almeida & Grant 1998). The complexity of the workforce in the form of different culture backgrounds and languages in the shipping industry is a source of the barrier for knowledge transfer.

The working environment on ships has been well documented in literature (for example, Forsyth 1989; Gerstenberger 2002; Glen & McConville 2001; Moreby 1975; Roger 1983). Apart from linguistic and cultural issues, there is little time for personal communication due to a clear duty definition and tight daily shifts. Most people carry out their duties alone and have a different schedule from others. The staffing policy of reducing the number of personnel on modern ships makes the situation even worse. Furthermore, the physical design of space, machines, and workflow has been given little attention to the impact of social and organisational requirements for creating an efficient, productive organisation (Whyte 1983). Moreover, every ship is an isolated world (Zhao 2001). A ship at sea is effectively isolated from the rest of the world spatially and socially. Even with the help of modern information technology (Goel 2003; Mazières *et al.* 2002), their ability to be socially connected is still limited. Therefore the workplace situation decreases the likelihood of these personnel being a part of a network for either social or learning purposes.

The management structure of the shipping industry has two distinct features. One is the hierarchy on ships (Lane 1986; Zuboff 1983). The other is the time and spatial difference between onshore management and its vessels. While hierarchy is necessary to get things done in many circumstances, it is of no help in building informal relationships across hierarchical ranks. This makes onboard interaction limited to superficial working relations rather than personal, making detailed interpersonal communication most difficult. On the other hand, the spatial distance and time difference from onshore management make interpersonal connection between crew members and staff ashore very remote (Gerstenberger 2002). Members of both sides hardly reach out to each other in a meaningful way.

The reality of this management structure calls for the realignment of personnel from all parts of the organisation in order to facilitate both vertical and horizontal interactions between its members and groups.

As previously discussed, mobility in the shipping industry is rather high, especially its “wastage”, compared to other industries. This is partly due to the eroding of employee loyalty prevalent in modern workplaces (Abassi & Hollman 2000; Kransdorff 1996) and partly due to the uniqueness of occupations in the shipping industry (Moreby 1975). For many, working in the shipping industry is not a lifelong occupation, rather an interlude in their occupational life. The initial motives to choose the industry and later the broken “psychological contract” frequently lead many to drop out (Moreby 1975). In addition, flagging out and the development of financial markets have broken the genuine link between the owner of the ship and crewmembers who work and live on it (Gerstenberger 2002). As a result, commitment for both the organisation and personnel no longer exists.

Given the working environment in the shipping industry, knowledge transfer can be facilitated at different stages of a career path or through other related activities. Cadetship/apprenticeship is important part of the real world learning curve, where candidates start the process of applying what they have learnt from school to the real world situation, a process of knowledge validation and assimilation. Furthermore, job rotation provides participants the opportunity to access to different working environments where different skills are required. Such rotation stimulates learning motivation and promotes knowledge sharing environment. A distinctive feature of working in the shipping industry is the need to upgrade skills required by International Conventions in order to be competent for what they are doing. Therefore, regular training and development is important part of knowledge acquisition. Moreover, networking, especially informal, is important way of sharing knowledge given the multicultural workforce of the industry.

The above discussion can be summarised in table 3.7, where the specific characteristics of the shipping industry are categorised into six knowledge transfer (KT) related factors, which have been examined previously. These factors are

inter-related. Spatial or the perceived distance between management and its workforce, and the lack of a genuine link between crew members and the shipping company have adverse effects on trust building, which, in turn, affects the willingness of employees to share their knowledge (Empson 2001; Morris 2001; Scarbrough 1999). The weak employment tie also discourages companies from investing on training and providing other means for their employees to improve personal knowledge. Another barrier of sharing knowledge comes from the low trust between employees as a result of linguistic and cultural differences. In addition, the inactive attitudes of many employees to pursue new knowledge due to the temporal nature of the occupation in the shipping industry (Moreby 1975) further impede possible knowledge transfer. The characteristics of knowledge require appropriate transfer mechanisms to be employed. The organisation, by dedicating appropriate resources, can reduce these barriers and effectively facilitate the transfer of knowledge among its employees.

**Table 3.7 Six KT-related factors in the shipping industry**

<b>Factors</b>	<b>Description</b>
Context	1. Highly regulated industry; 2. International workforce.
Organisation	1. Remoteness of management and workforce; 2. Low organisational commitment.
Relationship	1. Linguistic barrier; 2. Different cultural backgrounds; 3. Temporal relationship due to high mobility; 4. Strict hierarchy; 5. Low trust.
Individual	1. Lack of willingness to share and low motivation to learn due to low trust; 2. Low commitment to the organisation; 3. Lack of motivation to learn due to the temporality of the career.
Knowledge	Highly experiential vs. written rules and instructions.
Mechanisms	1. Apprenticeship/cadetship; 2. Formal/informal networking; 3. Job rotation; 4. Formal/informal training; 5. Written reports, procedures and manuals.

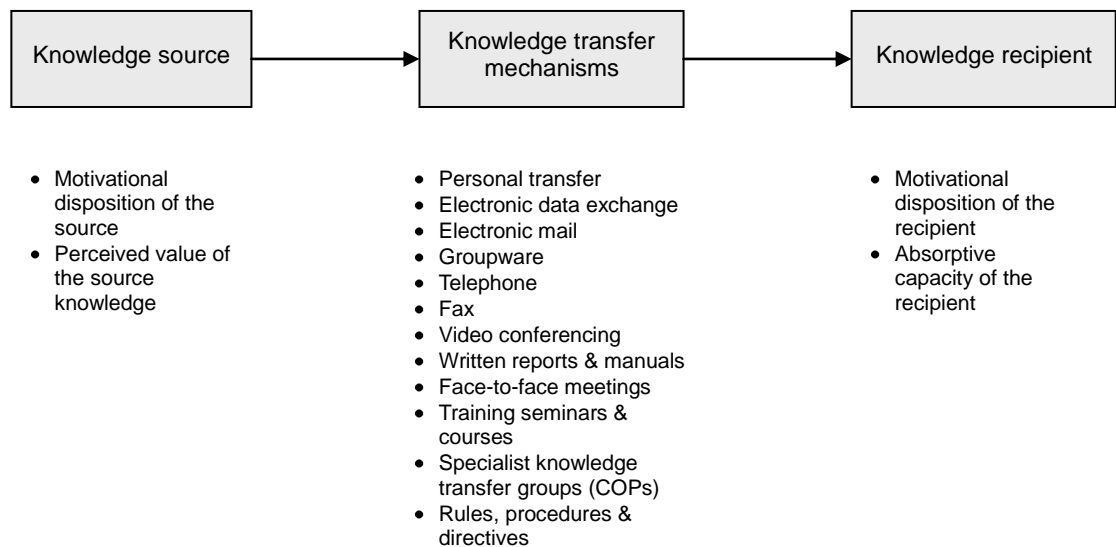
Source: Author

### **3.5.2 A knowledge transfer model**

Drawing on Gupta and Govindarjan (2000) and Almeida and Grant (1998), Abou-Zeid (2002) builds an inter-organisational knowledge transfer model. Figure 3.8 is an adaptation of this model to capture knowledge transfer related factors

discussed previously. For an organisation in a given industry, the context in which knowledge transfer occurs has been decided. The remaining five factors can be grouped into individual-related (individuals and their relationships), organisation-related, and knowledge-related (characteristics of knowledge and relevant transfer mechanisms). One of the tasks of this thesis is to address how an organisation can affect individually and knowledge-related factors to facilitate knowledge transfer within an organisation. For this to be smooth and successful, the organisation needs to address the barriers and create a supportive climate for transfer. The knowledge transfer enablers or facilitators include technology, culture, leadership, and measurement (O'Dell & Grayson 1998).

**Figure 3.8 A knowledge transfer model**



Source: Adapted from Abou-Zeid (2002, p.35)

### **3.5.2.1 Technology**

Technology is one of the infrastructures that an organisation can provide to facilitate the knowledge transfer process. A variety of information systems and technologies supports knowledge management processes such as the creation, storage, transfer, and application of knowledge. For example, data mining techniques such as neural networks find new patterns in data and enhance knowledge creation – knowledge repository database store and retrieve knowledge, electronic bulletin boards, discussion forums, knowledge directories, and other knowledge networks enable efficient and accurate transfer of

knowledge. In Almeida and Grant's (1998) knowledge transfer mechanisms, four of them are technology related: electronic data exchange (for codifiable information with a highly standardised format and low ambiguity, efficient for both limited and wide dissemination), electronic mail (characterised by versatility with regard to format and information types and increasingly capable of expressing individuality and subtlety), groupware (characterised by versatility in its ability to transfer and integrate many types of information and to provide a platform for the integration of different individuals' tacit knowledge), and video conferencing (video capability permits a richer inter-personal context conducive to joint problem-solving processes). However, for IT to be effective in knowledge transfer, there is the requirement for participants to share similar knowledge, backgrounds and experiences (Zack 1999).

Technology is a helpful tool in facilitating knowledge transfers not the driver, because most tacit knowledge is too complex and too experiential to be captured electronically, and because the incentives for and barriers to sharing are not technical (O'Dell & Grayson 1998). For example, database only complement the personal networks of those seeking answers to problems. Employees of an organisation usually turn first to friends and peers to learn where to find relevant knowledge rather than engaging in an extensive search through an organisation's database, regardless of how robust the search functionality or how customised the database is (Cross & Baird 2000).

Moreover, the ability of IT in facilitating knowledge transfer is limited by the characteristics of the knowledge being transferred. When mainly tacit knowledge is involved, the face-to-face approach to communicate knowledge should be facilitated, rather than an attempt to store it (Hansen, Nohria & Tierney 1999). In addition, articulation of knowledge runs the risk of losing the finer aspects of the knowledge (Boisot, Griffiths & Moles 1997) and therefore should be avoided (Grant 1996). However, by stopping diffusing tacit knowledge, an organisation will not be able to reap the benefits of leveraging knowledge (Sanchez 1997). The point is then to balance these two through identifying an appropriate approach for the relevant knowledge.

In the shipping industry, technology such as EDI has been widely used for a long time and the application of information technology in shore-based administration has no difference from any other industries. However, while readily available onshore, information technology is sometimes a luxury exception on ships. Only a small percentage of modern ships have installed advanced equipment that allows internet access. Even for those who have access to internet on ships, the high cost associated with the usage stops many using these onboard facilities. Due to the remoteness of an onboard workplace, the provision of affordable information technology will to a great extent facilitate communication between crew and onshore management, which in turn would strengthen their relationship and nurture mutual trust, thereby facilitating knowledge transfer. In addition, affordable internet access facilitates the establishment of communities of practice where participants tend to willingly share their experiences and expertise through informal networking. Moreover, the accessibility of information technology is an important means by which explicit knowledge is obtained. It is therefore clear that technology plays an important role in facilitating an effective knowledge transfer in any shipping organisation.

Five statements can be derived from the above argument with regard to the role information technology can play in facilitating knowledge transfer:

- 1. Database-related technology (storage and retrieval systems) such as groupware, EDI, data mining, and knowledge repository, provides an accessible knowledge source thus facilitating knowledge transfer.*
- 2. The availability of communication-related technology such as email, video conferencing, e-directories, bulletin boards, and discussion forums establishes platforms for easy communication, which in turn helps build up personal relationships therefore facilitating knowledge transfer.*
- 3. Communication-related technology such as email, video conferencing, bulletin boards, and discussion forums, provides a means for exchanging views and ideas therefore enabling knowledge transfer among participants.*
- 4. Information technology is effective in facilitating transfer of codified knowledge, for instance written instructions or manuals.*
- 5. Information technology itself is ineffective in transferring experiential knowledge, the diagnosis of a problem for example.*

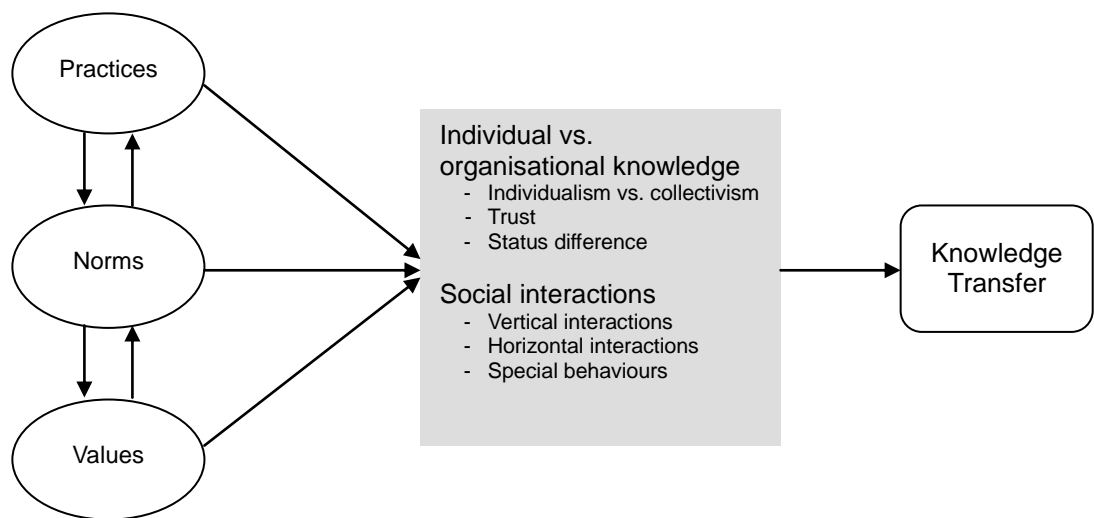


### 3.5.2.2 Culture

Technology by itself is of course insufficient, since people are central to creating and sharing knowledge. Information technology can only help to store and transfer knowledge and does not facilitate the creation or sharing of knowledge if an organisation does not have a culture favouring these activities (Davenport & Prusak 1998). Besides, for barriers caused by culture differences, technology cannot overcome all, but can reduce some cultural nuances (Soley & Pandya 2004).

**Figure 3.9 Culture elements influence knowledge transfer**

Elements of culture:



Source: Adapted from De Long & Fahey (2000)

De Long and Fahey (2000) identify four ways in which culture influences the behaviours central to knowledge management. Two of them are related to knowledge transfer and sharing in an organisation, as illustrated in figure 3.9. According to De Long and Fahey (2000), culture dictates what knowledge belongs to the organisation and what knowledge remains in the control of individuals. The culture of individualism versus collectivism affects the extent to which knowledge can be transferred or shared in an organisation. Where norms and practices that advocate and reinforce the supremacy of individual knowledge, activities of knowledge transfer and sharing are limited. Furthermore, the level of trust that exists between the organisation and its employees greatly influences the amount of knowledge that flows both between individuals and from individuals

into the organisation's databases, best practices archives, and other records. Moreover, perceived status differences among units lead to the adoption of defensive measures to protect knowledge assets of individual units, therefore impeding the sharing and transfer of knowledge within the organisation.

One of the unique phenomena the shipping industry has is the absence of a genuine link in many shipping organisations between the employer and its employees, for instance, between the shipowner and its seafarers, due to factors such as flagging out and outsourcing of crew management. In organisational culture where commitment and loyalty are non-existent as the result of disconnected employment linkages, knowledge integration hardly happens. This situation can be mitigated through the proper acknowledgement of the contributions made by those outsourced personnel (contracted seafarers for example) at organisational level. In addition, the allocation of resources by an organisation to encourage personal development is another indicator of organisational commitment to its employees which, when properly organised, can facilitate knowledge transfer. Furthermore, the absence of a genuine employment link does not stop informal networking among employees. Encouragement of such informal networking from the organisation can foster the development of communities of practices, therefore increasing the likelihood of knowledge sharing among personnel.

Three statements can be drawn, based on the above discussion:

- 6. Organisational culture that values collective efforts (collectivism) encourages knowledge sharing thus facilitating knowledge transfer.*
- 7. Organisational culture that nourishes trust between the employer and employees facilitates the flow of knowledge within the organisation thereby the transfer of knowledge.*
- 8. Organisational culture that advocates equity among units reduces the tendency of knowledge protection therefore increasing the likelihood of knowledge transfer.*

The ease or difficulty of moving knowledge is a reflection of its social context. Technologies inevitably have an enormous role to play, but they play it only to

the extent that they respond to the social context. A great deal of new technology attends primarily to individuals and the explicit information that passes between them. To support the flow of knowledge, within or between communities and organisations, this focus must expand to encompass communities and the full richness of communication (Brown & Duguid 1998). This calls for the building of networks either formal or informal.

Informal human networks provide sources for people to seek knowledge they need. Individuals in these networks develop strong personal relationships over time and trust in each other and feel obliged to share knowledge with each other (McDermott 1999). While informal relations often occur naturally, they can be fostered through internal social arrangements that promote horizontal communications and interactions among different organisational units (Ghoshal, Korine & Szulanski 1994; Gupta, Govindarajan, & Malhotra 1999; Tsai 2002). Rather than building new networks for knowledge sharing, an organisation can formalise or lightly authorise existing informal networks by giving them a budget, information systems, space, library support, time for network coordinators to manage network affairs, and a recognition of their contribution (McDermott & O'Dell 2001).

Culture impacts social interactions through creating certain contexts in which interactions occur within an organisation (De Long & Fahey 2000). The impact can be assessed on three dimensions: vertical interactions, horizontal interactions, and special behaviours that promote knowledge sharing and use. Vertically, knowledge-sharing friendly norms and practices accept employees' discussion of sensitive topics and allow easy access to senior management and is therefore a more effective knowledge transfer. Horizontally, culture shapes the patterns and quality of interactions among individuals at the same level in the organisation. An encouraging culture nourishes formal and informal communication, and enhances high levels of collaboration among individuals across functional departments and units. Finally, a culture of learning from mistakes allows lessons to be captured and learned across the organisation. Social interactions promote trust and reduce perceived uncertainty for knowledge transfer either as a knowledge provider or as

a recipient. Research confirms that social interactions have a significant positive effect on knowledge sharing (Tsai 2002).

- 9. Organisational culture that sustains vertical communication builds up mutual trust between employees and their senior management thus facilitating vertical knowledge transfer.*
- 10. Organisational culture that nourishes horizontal communication enhances high level of collaboration among individuals across functional units thereby effectively increasing the flow of knowledge within the organisation.*
- 11. Organisational culture that encourages experiments and tolerates failures reduces perceived uncertainty of sharing experience (or lessons from mistakes) thus enhancing knowledge transfer.*

Davenport and Prusak (1998) consider three aspects of knowledge activities that might be impacted by such cultural issues: making knowledge more visible in the organisation; developing a knowledge-intensive culture by encouraging and facilitating activities such as knowledge sharing; and building and supporting a knowledge infrastructure by giving opportunity, space and resources to those wishing to interact and collaborate. More specifically, O'Dell and Grayson (1998) point out that internal knowledge transfer has to address three aspects of structural and cultural issues:

- How can people be motivated and rewarded for sharing their knowledge? Artificial rewards will not have much effect and can make people cynical if the process of sharing and transfer is not inherently rewarding, celebrated, and supported by the culture (p. 168). Any knowledge transfer practices should be designed in such a way that they become a part of the employees' daily work methods and the using of such practices itself is rewarding. That is to say to make knowledge sharing a part of organisational culture (McDermott & O'Dell 2001).
- The role of leadership in establishing and reinforcing a supportive culture for knowledge sharing and transfer. Tactics include the creation of a mission or vision statement that endorses and sustains learning and

transfer (Leonard 1995; Levinthal & March 1993; von Krogh 1998), recognition of successful stories, reinforcing and rewarding positive behaviour, showing commitment to learning through action and removing barriers to progress.

- What is the role of measurement in internal knowledge transfer? Measuring performance can identify a best practice, that is, identification of a knowledge source. This is the prerequisite of knowledge transfer. Measuring the impact of transfer itself provides a clear indicator of improvements brought by the knowledge transfer. This is another way of recognition and rewarding, which makes the importance of sharing knowledge visible (McDermott & O'Dell 2001).

### **3.5.2.3 Leadership**

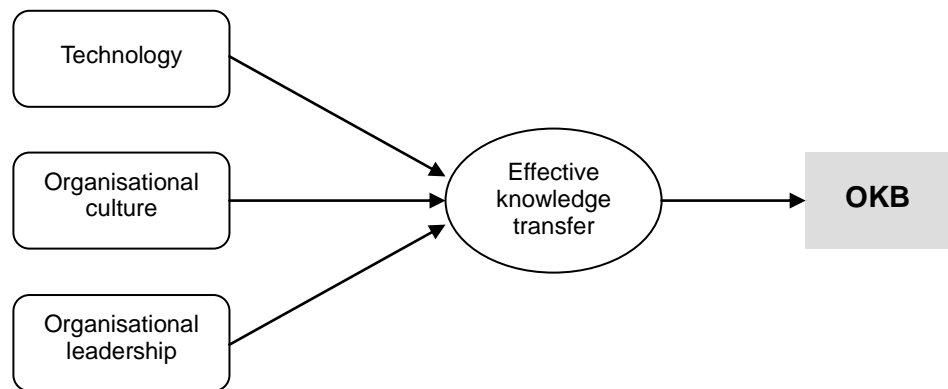
It is clear that apart from organisational culture, organisational leadership plays a vital role in facilitating knowledge transfer through establishing and reinforcing a supportive culture. In many onboard workplaces, hierarchy is still strongly maintained and respected. In such a working environment, a role model from the top level (the captain, for instance) will have a strong influence on the rest of the members. In the same way, a strong commitment of top management to knowledge sharing activities will affect onboard management teams. The consistent leadership of an organisation has much to play in maintaining a healthy organisational knowledge base through facilitating knowledge transfer and sharing activities. Statements can be examined to determine to what extent organisational leadership can influence the process of knowledge transfer.

- 12. A mission or a vision statement that endorses and sustains learning and sharing helps to create an environment where knowledge flows effectively within the organisation.*
- 13. A properly recognition and reward of active learning and sharing behaviours reinforce a sharing and learning culture therefore facilitating knowledge transfer.*
- 14. The provision of organisational resources on knowledge transfer activities magnifies the commitment of the organisation on such activities, therefore encouraging knowledge transfer.*

- 15. The measurement of internal knowledge transfer not only identifies best practices, but also through recognising and rewarding knowledge transfer efforts, reinforces a supportive culture thus facilitating knowledge transfer.*

In summary, instead of using only incentive systems to mitigate internal stickiness, scarce resources and managerial attention should be devoted to developing the learning capacities of the organisation (Hamel 1991; Szulanski 1996). The appropriateness of resource deployment, both human and support assets, shapes the learning outcomes (Hamel, Doz & Prahalad 1989; Pucik 1988). Adequate staffing, involvement of high quality personnel and the provision of appropriate information processing and communication capabilities, supported by favourable organisational culture, facilitate the process of knowledge transfer. An effective knowledge transfer model then can be drawn from the above discussion and expressed as in figure 3.10 where factors have been grouped into technology, organisational culture, and leadership.

**Figure 3.10 Effective knowledge transfer practices**



Source: Author

### **3.6 Summary**

This chapter includes two parts. The first part is to identify the pattern of knowledge flows caused by human mobility. Literature shows that personnel are knowledge carriers, when they leave they carry their personal knowledge with them. The pattern of knowledge flows resembles that of human mobility at all

levels (intra-firm, inter-firm, and cross industry boundaries). It is projected that knowledge flows incurred by human mobility will impact the OKB, especially when inflows and outflows are unbalanced.

Conventional practices to combat the dysfunctional turnover are mostly initiated through human resource management and prove to be costly and ineffective given the unavoidable nature of turnover caused by eroding loyalty and available vocational alternatives. Therefore, rather than keeping mobility as low as possible by retaining personnel at all expenses, an organisation can choose to retain the knowledge carried by the personnel who leave through effective knowledge management practices. Individual knowledge can be integrated into the organisational level through effective transfer mechanisms. The literature review identifies barriers and facilitators related to knowledge transfer within an organisation, which provides a basis for the organisation to apply appropriate management practices.

For internal knowledge transfer to be effective, the organisation has a vital role to play. This includes a supportive culture, leadership at all management levels, and necessary information and communication technologies. An organisation's commitment and dedication towards knowledge sharing affect individual learning attitudes and their motivation and willingness to sharing personal knowledge. The dedication of organisational resources, be it physical or structural, nourishes personal trust which is the very basis of knowledge transfer, and provides a means through which knowledge can be readily accessed and shared. A framework of effective knowledge transfer practices is presented to reflect the integral role that the organisation should act to facilitate effective knowledge transfer. Finally, specific considerations are given to apply the knowledge transfer framework in the context of the shipping industry.

## **CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY**

### **4.1 Introduction**

The purpose of this chapter is to present the design and methodology of this research. The chapter contains three main parts. The first is a discussion on the research process adopted in this research which includes streams of literature mentioned during the literature review period. The conceptual framework of this study is presented in the second part, in which research constructs and their relationships are identified and conceptualised. Based on the research framework and the literature review carried out in the previous chapter, hypotheses are formulated for the empirical test. The third part of this chapter provides a detailed explanation of methodology of this research including a discussion of the unit of analysis, sampling, data collection methods, and data editing, coding and entering with the emphasis on sampling and instrument design. The chapter concludes with a discussion on the bias control of this study.

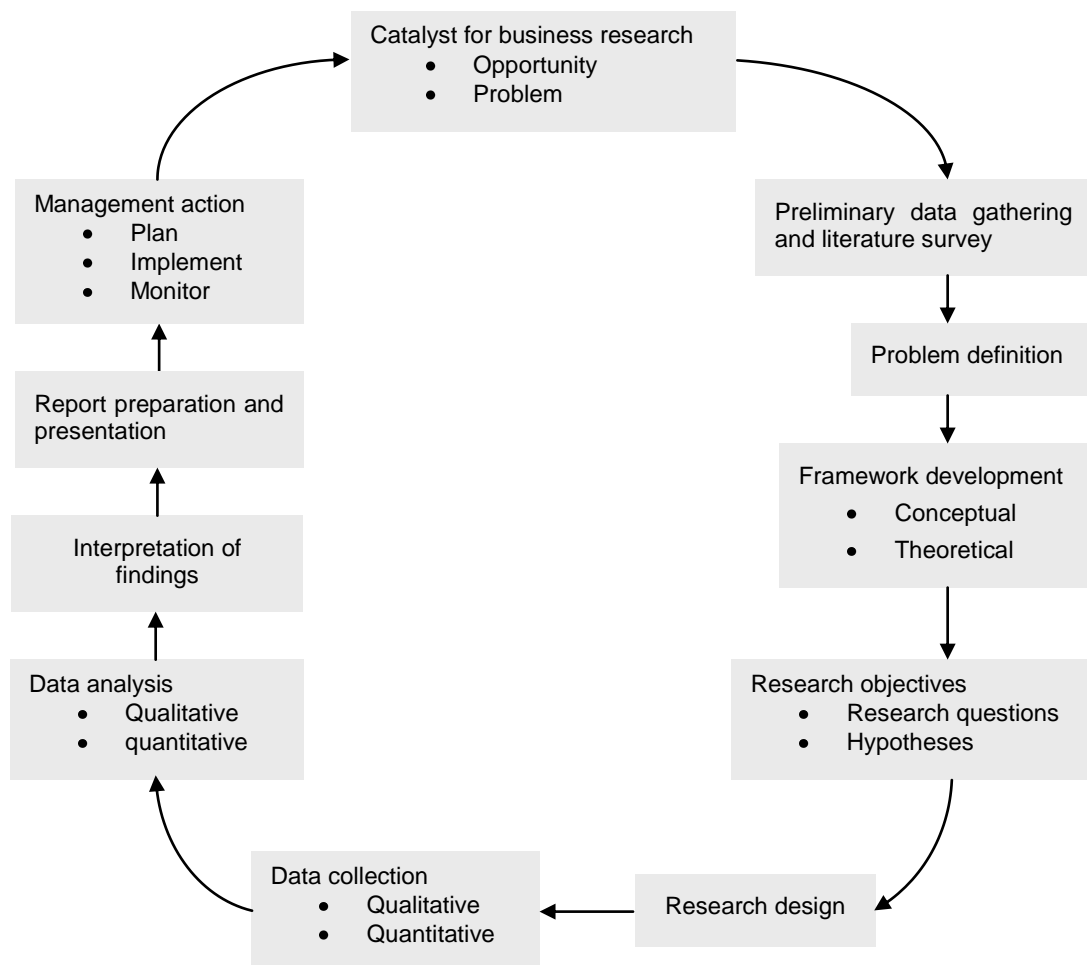
### **4.2 Research process and development**

Business research is a systematic inquiry into a specific problem or issue, which requires careful planning in an orderly investigation (Ticehurst & Veal 1999; Zikmund 2000). The stages in the research process overlap continuously and often do not follow a neat and ordered sequence of activities (Zikmund 2000). However, business research often follows a generalised pattern with several fundamental stages in the research process (Cavana *et al.* 2001; Hussey & Hussey 1997; Zikmund 2000). It is argued that the researcher's investigation must be thorough and rigorous at all stages of the research process (Cavana *et al.* 2001; Ticehurst & Veal 1999; Zikmund 2000). The research process is intricate and rigorous and should not be taken lightly or pursued in an unstructured manner (Mentzer & Kahn 1995). Among the intensive investigation and discussion conducted in relation to the research process (Cavana *et al.* 2001; Hair *et al.* 2003; Neuman 2003; Sekaran 2003; Ticehurst & Veal 1999; Zikmund 2000), Cavana *et al.* (2001)



suggest a comprehensive framework, identifying stages and main activities involved in the research process (figure 4.1). The current research has followed this research process. One of the features of this framework is that the whole process is completed in a loop, starting from an opportunity or a problem and ending with management action as the result of the research. Once the management action takes place in a real environment, new opportunities or problems may rise and a new loop of the research process is required.

**Figure 4.1 The business research process**



Source: Cavana *et al.* (2001)

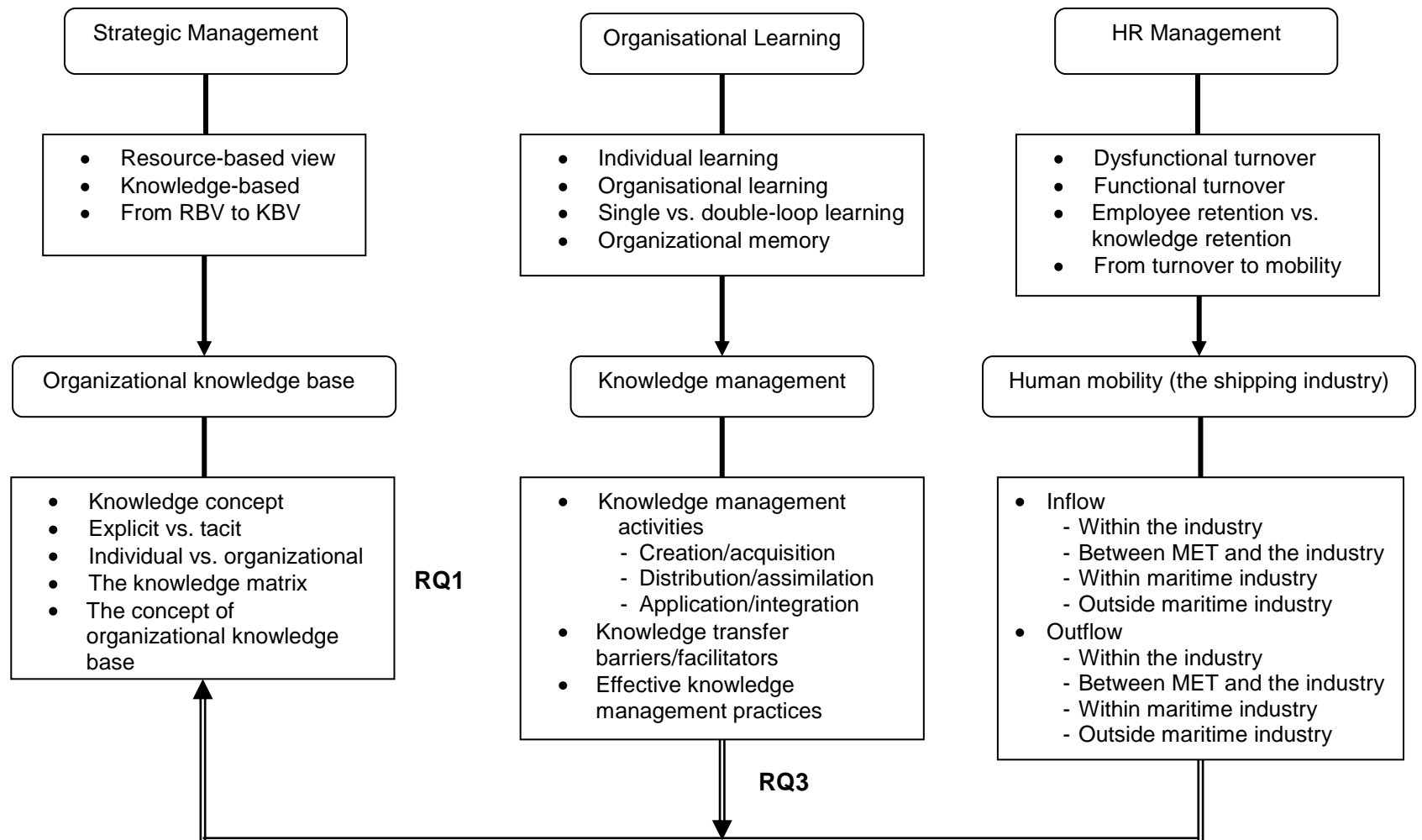
While the current research was triggered by the fact that there has been a shortage of qualified seafarers and the difficulty in attracting candidates and retaining experienced ones in the shipping industry, the selection of this topic came from a combination of an extensive literature survey, a concern regarding the loss of shipping expertise and the author's work experience in the industry. Abundant

research and report have been conducted with regard to the supply of seafarers (for example AMSA 2002; BIMCO/ISF 2000, 2005; Leggate 2004), yet the approach to this issue with knowledge management practices is new and was inspired and encouraged by the author's supervisor. There are several justifications for the selection of this research topic. Firstly, although the pressing problem of shortages in qualified seafarers has been addressed by many, the main concerns of these studies have been on difficulties in recruitment (Dinwoodie 2000; Leggate 2004; Moreby 1975; Sambracos & Tsiaparikou 2001; Thomas 2004) and wastage patterns (Gardner *et al.* 2001; Obando-Rojas, Gardner & Naim 1999). Others have framed this issue in a broader maritime skills-base where shipping expertise is much appreciated (Gardner & Pettit 1999a; 1999b; Gardner, Pettit & Thanopoulou 1996). To the shipping industry, which has been suffering a sheer loss of expertise as a result of high attrition either to maritime or non-maritime industries, the effectiveness of conventional ways of human resources management practices to tackle this problem needs to be reviewed. Secondly, given the characteristics of the shipping industry, new perspectives need to be revealed where high human mobility should be accepted as a positive reality, which in fact might help to increase the attractiveness of the industry. This calls for new management approaches to be applied to complement existing practices. Thirdly, although a relatively new area, knowledge management practices have been successfully applied in industries such as oil and gas (Leavitt 2002; Sapient corporation 2001), construction (Venters *et al.* 2003), and pharmaceutical (Abidi 2005; Cheah, Rashid & Abidi 2002; Powell 1998). The shipping industry shares similar knowledge attrition problems with these industries. Research on this topic thus will not only contribute to and enrich the existing literature, but also through introducing new management practices to the industry, will open a new perspective on searching for effective solutions to the problems the industry is facing.

To establish the research framework and develop the conceptual model, three streams of theories, strategic management, organisational learning theories and human resource management have been consulted in depth (figure 4.2). Knowledge as an organisational asset has its roots in resource-based-view theories and its measurement is closely related to those of intellectual capitals. The

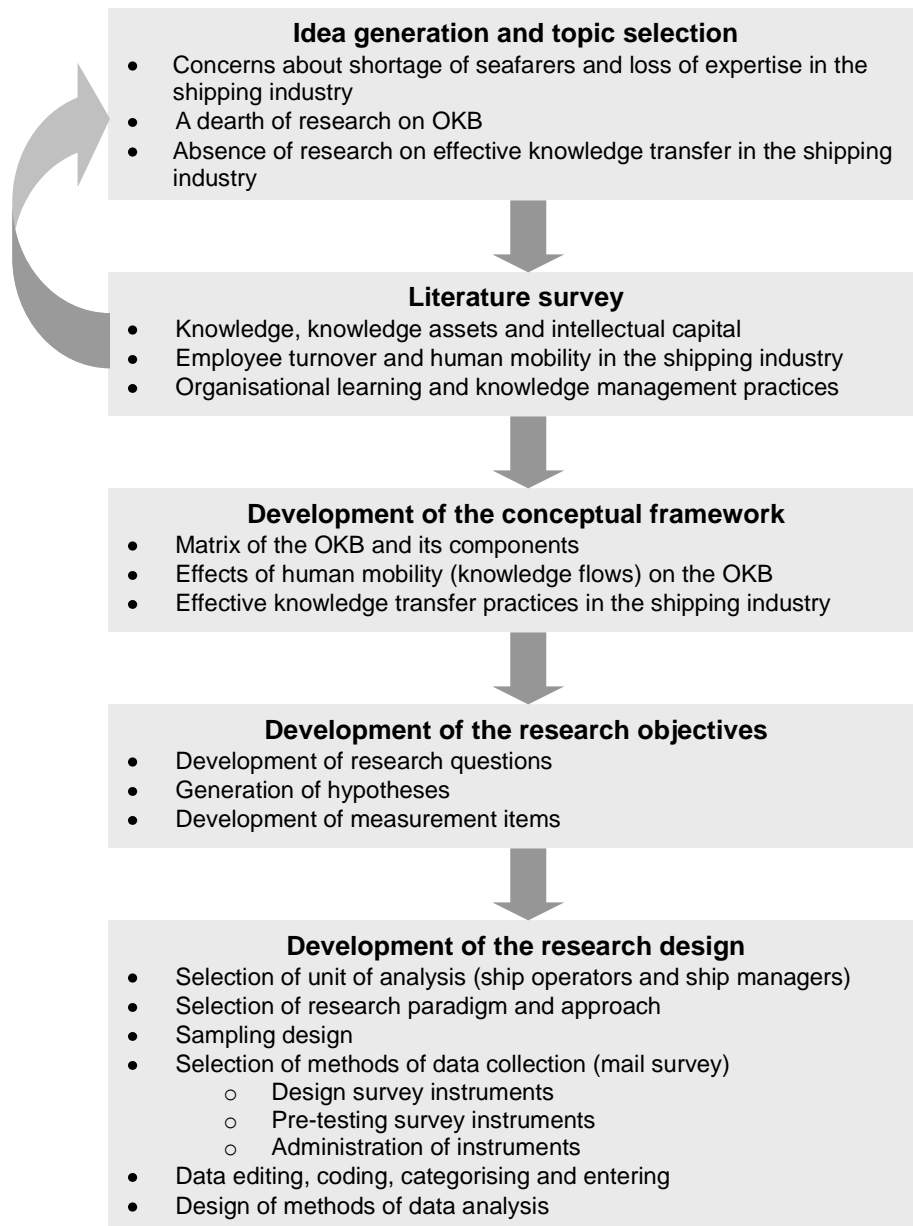
conceptualisation of the organisational knowledge base (OKB) is built upon this stream of theories, which in turn provides instruments to analyse the effects of human mobility. The discussion of human mobility rests on employee turnover issues and has been linked to the knowledge flow on the basis that personnel are knowledge carriers. Finally, organisational learning theories lay the foundation to advocate knowledge transfer among organisation members and knowledge integration from the individual to the organisational level. Relevant barriers and facilitators/enablers of knowledge transfer are identified. Based on the extensive review of literature on the above three streams of theories, hypotheses are developed to be empirically tested. Measurement items are also defined and developed to assess the related constructs in the hypotheses, in order to answer research questions about components of the OKB, the linkage between human mobility and the OKB, and effective knowledge transfer practices in the shipping industry. The research development of this current study, adopting the framework suggested by Cavana *et al.* (2001), can be illustrated in figure 4.3.

Figure 4.2 Literature review structure



Source: Author

**Figure 4.3 Research development of this study**



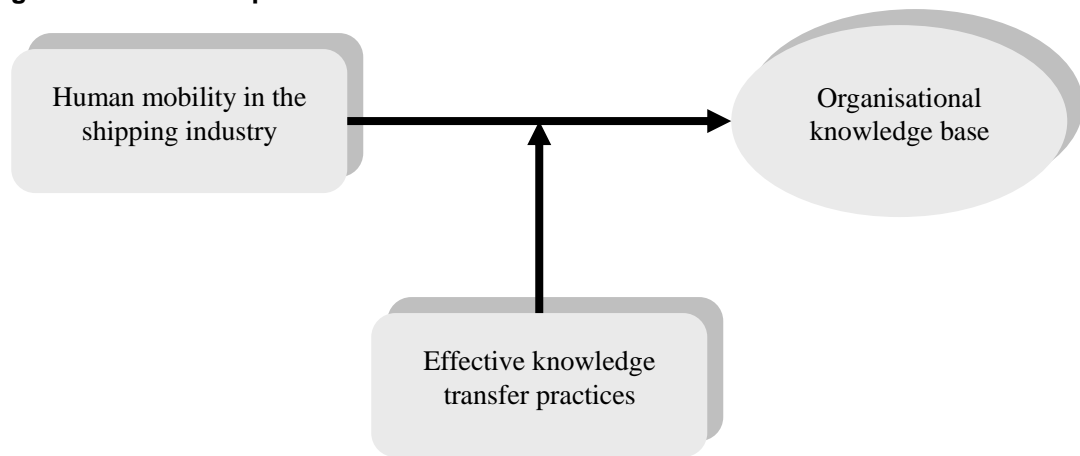
Source: Author

### 4.3 The research conceptual framework

The current research employs a multi-disciplinary approach encompassing knowledge management, human resource management and strategic management. The conceptual framework of this study focuses on three interrelated research areas

from the literature survey: 1) the OKB in the shipping industry, 2) the effects of human mobility on the OKB, and 3) the effectiveness of knowledge transfer practices in the shipping industry. To develop the conceptual framework, a thorough and comprehensive literature survey has been conducted to a) identify the dimensions of knowledge, the characteristics of personal and organisational knowledge and measurement issues; b) examine the relationship between human mobility and knowledge flows, and the perceived effects of human mobility on the OKB, and c) given the high mobility in the shipping industry, review knowledge management activities and identify effective practices to be employed to facilitate knowledge transfer in the industry. Once the effective knowledge management practices are identified and empirically tested, it is possible that the pressing problem of the high attrition of shipping experience can be approached from a new perspective. Figure 4.4 illustrates the conceptual framework of this study.

**Figure 4.4 The conceptual framework**



Source: Author

#### **4.3.1 Components of an organisational knowledge base in the shipping industry**

To examine any possible effects of human mobility on an organisational knowledge base (OKB) it is essential that the concept of OKB is well established. It was argued in chapter two that the loose and interchangeable use of concepts such as

organisational knowledge, organisational assets, competences or capabilities, organisational memory, and absorptive capacity has given rise to confusion and ambiguity in understanding how knowledge can be leveraged in an organisation. It was also argued that the concept of OKB better captures the dynamic nature of knowledge that belongs to, and can be utilised, by an organisation. Although OKB and other similar concepts have been used in the literature (e.g. Levinthal & March 1993; Miller 2002; Narasimha 2000; Penrose 1959; Powell 2003; Scarbrough 1996; SubbaNarasimha, Ahmad & Mallya 2003), no consensus has been reached yet in relation to the scope and attributes of an OKB. In particular, there is an absence of this concept in the shipping industry. The first research question is therefore derived as follows:

**Research question 1:** *How is an organisational knowledge base described in the shipping industry?*

As discussed earlier in chapter two, the classification and definition of knowledge vary in the literature and the concept of organisational knowledge has been closely related or equalised to many different constructs. It is possible through extensive literature review to capture the scope of organisational knowledge in a matrix (figure 2.4, 2.5, 2.6) with its epistemological and ontological dimensions. The analysis of knowledge assets measurement approaches and the synthesis of elements in these measurement models provide a full picture of what an OKB consists of. The knowledge components identified in an organisation context (as summarised in table 2.9) reflect the classic classification of knowledge and well represent the elements examined in the existing measurement approaches on knowledge assets. It is therefore suggested that the OKB is a construct that consists of four groups of ten components as indicated in table 2.9.

A hypothesis that aims to answer the first research question is thus framed as follows:

**Hypothesis 1:** *Organisational knowledge base is a construct of 14 identified*

*components associated with four groups of knowledge: individual explicit, individual tacit, organisational explicit and organisational tacit.*

The primary purpose of the first research question is to explore the concept of OKB in the shipping industry from perspectives of respondents of business sectors and fleet sizes. Due to a dearth of research in this area, no information is available regarding whether perceptions of knowledge components vary from respondents from different business sectors, fleet sizes, and working experiences. Therefore, a second hypothesis is developed as follows to explore the possible differences in their perceptions:

***Hypothesis 2:*** *The perceived importance of knowledge components in an OKB varies according to the observer's business sector, fleet size, and work experience.*

#### **4.3.2 The perceived effects of human mobility on OKB**

The high mobility in the shipping industry is a phenomenon that has been accepted since the beginning of the industry. Only when the worldwide shortage of qualified seafarers has become acute, has academia and practitioners alike paid particular attention to this high mobility issue in terms of high seafarer attrition or wastage. As discussed in chapter three, human mobility in the shipping industry has been characterised as a one-way movement of personnel and was thus considered as a major contributor to seafarer shortage in the industry. On the other end of this spectrum, fewer career paths available in the industry may stop many from choosing the industry for their professional development. The contradicting scenario is that while high mobility poses difficulties in retaining experienced personnel, it attracts potential candidates into the industry if high mobility means more career options either within or outside the shipping industry. It is a daunting, if not impossible, task to find and maintain an optimal mobility level to balance the negative and positive effects that incurred by is mobility. It is however possible as argued in the chapter three that through looking at the knowledge carried by personnel, new management



approaches can be developed to identify the effects of human mobility and how it can be leveraged to benefit both the organisations and the individuals.

The establishment of the concept of the OKB in chapter two has laid the foundation for the examination of any possible effects caused by high human mobility in the shipping industry. As individuals are knowledge carriers, their movement inevitably triggers flows of knowledge along with their movement routes. The learning abilities of organisations further enhance such knowledge flows through individual-to-organisation knowledge integration activities. A researchable issue thus arises from the discussion as whether there is any linkage between human mobility and the OKB and how it is perceived. This leads to the second research question:

***Research question 2:*** *How are the effects of human mobility on the organisational knowledge base perceived in the shipping industry?*

This research question is further divided into two subsidiary questions:

***SRO2.1:*** *What are the effects of human mobility on the OKB?*

For a particular organisation in the shipping industry, external personnel movement can be firstly grouped into inflow and outflow movement. Then, according to the source and destination of the movement, subgroups can be obtained to further identify the effect of each subgroup (refer to figure 3.3, chapter three). For a receiving organisation, graduates and lectures from maritime education institutions often bring fresh knowledge and their joining the organisation has a positive effect on the organisation. The inflow of personnel with their experience and expertise from other shipping organisations increases the receiving organisation's knowledge assets especially when such experience and expertise are supplementary. On the contrary, the outflow of personnel incurs knowledge loss to the source organisation due to the experience and expertise they carry away with them when they leave the organisation. Depending on the destination, the outflow movement may have different effects on

the OKB due to the reasons discussed earlier in this section. Two hypotheses are established to explore the relationship between mobility and the OKB:

**Hypothesis 2a:** *There is a positive relationship between the inflow of personnel and the OKB.*

**Hypothesis 2b:** *There is a negative relationship between the outflow of personnel and the OKB.*

As discussed previously, individuals may move between organisations within the shipping industry or possibly into non-shipping industries. In some cases, individuals may move into non-maritime industries. These cross industry movements are indeed the main sources of knowledge attrition in the shipping industry. However, no quantitative research has been done to examine the effects of such cross industry movements.

**Hypothesis 3:** *The effects of mobility on the OKB differ with different movement patterns.*

High personnel mobility is a common issue to all organisations within the shipping industry. However, the level and pattern of turnover may vary among shipping organisations. Such differences may impact on the perceived effects of mobility on the OKB. A further subsidiary research question is therefore framed to explore the relationship between perceived effects of mobility and current stability of a workforce in an organisation.

**SRO2.2:** *How well can perceived effects of human mobility on the OKB be predicted by the current workforce stability.*

### **4.3.3 Effective knowledge management transfer practices in the shipping industry**

High human mobility in the shipping industry is a long-existing phenomenon and by itself is not a problem for the management. It is however the almost one-way movement of personnel that poses serious problems for the management to maintain a competent bank of personnel for safe shipping. The difficulty to attract new candidates and retain existing personnel has cost the industry a substantial loss of expertise and skills. While conventional approaches have explored various ways to retain experienced personnel, the problem of seafarer shortage remains and to some extent is worsening. A new approach has been introduced in chapter three to look into this issue differently. The knowledge-based view argues that knowledge is the engine of the economy and the key to unlock competitiveness. This raises the issue of managing knowledge flows rather than physically retain personnel given the mobility reality of the industry (refer to figure 3.6 in chapter three).

Although no longer a new topic to both academia and practitioners, its practices having been adopted by many industries, knowledge management is fresh to the shipping industry. Moreover, due to the unique characteristics of the shipping industry discussed in chapter three, the adaptation of any knowledge management practices should be based on a careful consideration of its context. This leads to the third research question:

***Research question 3:*** *What are the effective knowledge transfer practices in the context of the shipping industry?*

As elaborated in chapter three, 14 practices are derived from three categories (culture, leadership, and technology) of organisational management, which can facilitate knowledge transfer within an organisation. It is thus hypothesised that:

***Hypothesis 4:*** *Effective knowledge transfer practices in the shipping industry consist of 14 factors involving three groups of management practices: organisational culture*

(6), leadership (3), and technology (5).

High mobility has been a long standing challenge for the shipping industry. Many shipping organisations have adopted different strategies to combat its adverse effects. The existing practices may impact on the perceived effectiveness of these suggested knowledge transfer practices due to the validation process through which various approaches have been experimented. A subsidiary research question is therefore framed to explore the predictability of existing practices on the perceived effectiveness of the 14 factors in facilitating knowledge transfer:

***SRO3.2:*** *Can perceived effectiveness of knowledge transfer practices be predicted by existing management practices in a shipping organisation?*

## **4.4 Justification for the paradigm and methodology**

### **4.4.1 Justification for the methodology**

There are different views on the way that research should be conducted. Three research paradigms are frequently mentioned in science research, namely, positivist, interpretivist, and critical research (Cavana *et al.* 2001; Neuman 2003). Some (such as Collis & Hussey 2003; Saunders, Lewis & Thornhill 2000; Ticehurst & Veal 1999) group these three into two paradigms with positivist at one side and the critical-interpretivist or phenomenologist at the other. There are, however, alternative paradigms between these two extremes making the research paradigms a continuum (Ticehurst & Veal 1999) rather than two opposite ends and, in fact, research rarely falls neatly into only one philosophical domain (Ticehurst & Veal 1999). Which research paradigm to be chosen depends on the research questions, as it is not necessary that one paradigm is better than the other.

The present research adopted a mixture of positivist and interpretivist paradigms to

maximise the expected research outcome as suggested by Ticehurst and Veal (1999). From the literature review in Chapter two and the first research question, it is clear that the concept of the organisational knowledge base (OKB) has been based on existing rich literature on knowledge assets and intellectual capitals and is expected to be generalised and replicated in other industries apart from the shipping industry. From this perspective, a positivism research philosophy was adopted. However, the second and third research questions and the literature review in Chapter two reveal that effects of human mobility on the OKB and how knowledge management practices can be employed to mitigate the effects of high mobility are unique to the shipping industry. Rich insights into the complex business situation are lost if such complexity is reduced entirely to a series of law-like generalisations (Saunders *et al.* 2000). Therefore, phenomenology was embraced as the research philosophy in the second part of this research.

According to Saunders *et al.* (2000), the adoption of either positivism or phenomenology or both is just the philosophical position a researcher may have when doing a research and is only the outer layer of the research ‘onion’ process (Saunders *et al.* 2000, p 85). What is more practical and relevant to research is the next layer, i.e. the research approaches. There are two distinct research approaches (deductive and inductive approaches) that can be used separately or combined. The deductive approach is used when a theory or hypothesis (or hypotheses) has been developed and is to be tested, while the inductive approach is to develop a theory based on data analysis. It is suggested that a deductive approach is appropriate when there is a wealth of literature from which a theoretical framework can be defined (Creswell 1994). Although the application of knowledge management concepts and practices are new to the shipping industry, there is abundant information from streams of literature in strategic management, human resources management, and knowledge management (refer to figure 4.2), from which a research framework is able to be defined. In this sense, the deductive approach is considered to be appropriate for this current research.

#### **4.4.2 The unit of analysis**

The unit of analysis refers to the type of unit a researcher uses when measuring variables (Neuman 2003). It is the level of aggregation of the data collected during the subsequent data analysis stage (Cavana *et al.* 2001; Sekaran 2003). A researcher generally uses one or more units of analysis ranging from an individual to an aggregate (Kervin 1992). Determining the unit of analysis is a crucial aspect of problem definition and should not be overlooked at the early stage of the research (Zikmund 2000). It is argued that the nature of the information gathered, and the level at which data are aggregated for analysis, are integral to decisions made in the choice of the unit of analysis (Sekaran 2003). In a word, research questions or objectives determine the unit of analysis.

This research chooses organisation, and specifically shipping organisations, as the unit of analysis. Shipping organisations include three categories, namely, shipowners, ship managers, and manning companies. Shipowners are those who own ships and operate ships by themselves. Apart from onshore business operations, they may have their own team of offshore employees or may source this part of the business out to those professional manning companies. Ship managers are those organisations that provide professional services for organisations that own ships but do not want to involve the operations of these ships. Manning companies mainly provide seafarers for shipowners and/or ship managers. In some cases, ship managers may include manning service as crew management is part of their three main professional services (that is, technical management, crew management, and commercial management). However, in the shipping industry, it is common that manning companies are considered as having a separate business identity and therefore are being listed as one of the three groups of organisations in the shipping industry. It is those three groups of shipping organisations that are most affected by, and concerned about, a shortage of qualified seafarers. Any possible approaches towards this issue shall be established at the organisational level. Furthermore, the main dependent variable of this research, organisational knowledge base (OKB), is an organisational level concept, and shall be analysed at the same level. Other management practices discussed in this research

need to be initiated and implemented by the organisation; therefore it is considered appropriate to use organisation as the unit of analysis.

#### **4.4.3 Population, sampling design, and sample size**

To solve the research problems, data have to be obtained from the right people or objects to provide correct answers (Cavana *et al.* 2000). Good samples should provide adequate representation and accuracy for decision-making. A well-defined procedure is proposed to achieve high representation and accuracy (Hair *et al.* 2003 p.209):

- Defining the target population
- Choosing the sampling frame
- Selecting the sampling method
- Determining the sample size
- Implementing the sampling plan

##### **4.4.3.1 Target population and sampling frame**

The target population is the complete group of objects or elements that the researcher wishes to investigate (Canava *et al.* 2000; Hair *et al.* 2003). The main research objective of this research is to apply knowledge management practices into the shipping industry in the context of China. Therefore all organisations in the shipping industry in China are the target population and each organisation is understood as an element of the population in this research.

A sampling frame is a comprehensive, accurate list of the elements from which the sample is drawn (Hair *et al.* 2003). To find a reliable list of shipping organisations in China, various different sources of information have been consulted. These sources include the World Shipping Directory of the Lloyd's Register, the China Shipowners Association, and the China Classification Society. It was found that the World Shipping Directory had the most comprehensive lists of ship operators and ship managers. In addition, the Directory was published in 2007 and is believed to contain

the latest information available when the mailing list of this survey was compiled. It is acknowledged that in reality, a list may not be necessarily up-to-date. It may include elements that do not belong to the target population or may exclude relevant elements. It may contain duplicate elements.

From the World Shipping Directory (Lloyd's Register 2007), 928 (SO11889-10977; SM1063-1077) shipping organisations were found. These were then considered the total target population for the survey from which the sample would be drawn for the final mail survey.

#### **4.3.3.2 Sampling methods**

Sampling design and sample size are important to establish the representativeness of the sample for generalisation. A large sample itself does not necessarily produce findings that can be generalised in the population if the sampling design is inappropriate. Similarly, no sampling design can be useful in achieving research objectives if the sample size is inadequate (Cavana *et al.* 2000). The task of this section is therefore to use the correct sampling methods to determine the right sample size.

Probability and non-probability sampling are two traditional sampling methods. While in a no-probability sampling, the inclusion or exclusion of elements in a sample is determined by the research; in probability sampling, sampling elements are selected randomly and the probability of being selected is known. The main differences of these two methods are the representativeness of the sample and the ability to generalise the result. The probability method minimises the selection bias and is considered to be representative of the target population. In addition, findings based on a probability sample can be generalised to the target population with a specific level of confidence (Hair *et al.* 2003). Thus a probability sampling method is used in this thesis.

Roscoe (1975) proposes that sample sizes between 30 to 500 are appropriate for most



research. The sample size is determined by three main factors (Zikmund 2003), that is, a) the variance or heterogeneity of the population (standard deviation); b) the magnitude of error, or the confidence interval (range of random error); and c) the confidence level. The standard deviation can be obtained from a pilot study or as a rule of thumb the standard deviation is one-sixth of the range, while the magnitude of error  $E$  and confidence level  $Z$  are based on managerial judgement.

$$n = \left( \frac{ZS}{E} \right)^2$$

Where  $Z$  = standardized value corresponding to a confidence level

$S$  = sample standard deviation or an estimate of the population standard deviation

$E$  = acceptable magnitude of error, plus or minus an error factor

A majority of questions in the survey uses the five point Likert scale (for example, strongly disagree to strongly agree). As a rule of thumb discussed earlier, the value of the standard deviation for calculation is one-sixth of the range:

$$S = \frac{1}{6} \times (5-1) = \frac{2}{3}$$

A 95 per cent confidence level ( $Z$ ) and a magnitude of error of 0.07 are used to calculate the sample size:

$$n = \left( \frac{1.96 \times \frac{2}{3}}{0.07} \right)^2 = 348$$

When referring to the influence of the population size on sample size, Zikmund (2003) argues that in most cases the size of population does not have a major effect on the sample size. However, correction is needed if the sample size is more than 5% of a finite population (Zikmund 2003) or when the total population is less than 10,000 (Saunders *et al.* 2000). As the target population of this study is 928, a sample size of 348 represents more than one third of the population, and therefore an adjustment is required. The adjusted sample size is calculated by the following formula (Zikmund 2003):

$$n' = n \sqrt{(N - n) / (N - 1)}$$

Where  $n'$  is the adjusted sample size  
 $n$  is the initial sample size  
 $N$  is the population size

Thus:

$$n' = 348 \sqrt{(928 - 348) / (928 - 1)} = 348 \times 0.79 = 275$$

This sample size is consistent with sample sizes for the different sizes of population at a 95% confidence level provided by Saunders *et al.* (2000) (see Appendix I).

#### **4.4.4 Methods of data collection**

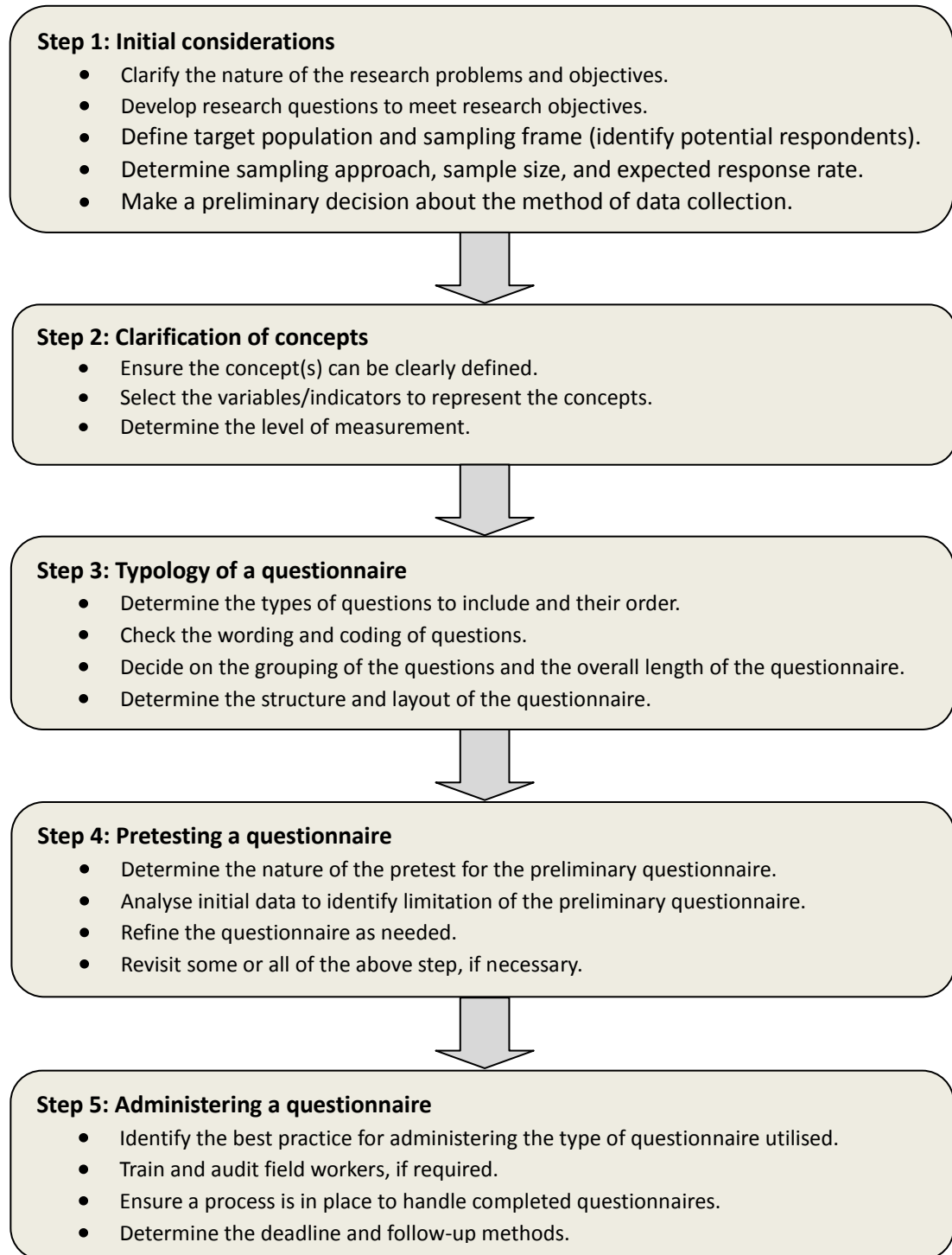
##### **4.4.4.1 Designing survey instruments (including translation)**

The purpose of the survey is to collect primary data for the research project at hand. Although there are various means of gathering information, survey research is considered to be an easier, less expensive, and more accurate way of collecting the required information and is arguably the most commonly used research technique in management research (Zikmund 2003). Among different survey data collection techniques, the questionnaire is one of the most widely used methods. It provides an efficient way of collecting responses from a large sample for a quantitative analysis due to each person being asked to respond to the same set of questions in a predetermined order (Saunders *et al.* 2000). Questionnaires are preferable to quantitative research because of their standardised and highly structured design, and with less costs and time required given the wider geographical coverage (Fowler 1993). The design of a questionnaire differs according to how it is administered, including self-administered (online, mail, or delivery and collection) and interviewer administered (telephone questionnaire or structured interview) (Saunders *et al.* 2000). The decision on the type of questionnaire chosen for the research is influenced by a variety of factors related to research questions, objectives, and available resources, such as characteristics of the respondents, size of sample, types and number of questions, available time and finance (Saunders *et al.* 2000).

Taking into account of financial constraints of this research, a mail questionnaire is adopted due to the reasons specified as follows. A mail questionnaire has several advantages and disadvantages. Compared with the costs of conducting interviews, the costs for a large mail survey is much lower (Ticehurst & Veal 1999). When there are limited resources available, a mail survey gives wider geographical coverage due to its relatively low cost, compared with personal interviews and telephone surveys (Zikmund 2003). In addition, mail surveys, when conducted anonymously, will yield more reliable information because respondents are more likely to give genuine answers in dealing with especially sensitive questions knowing that anonymity is guaranteed (Wimmer & Dominick 1983). The drawbacks of mail questionnaires include the factor that once the questionnaires are mailed out, the questioning process is beyond the researcher's control (Ticehurst & Veal 1999). In addition, due to their highly standardised and structured nature, any ambiguity or inappropriateness in questionnaire design may result in reliability and validity issues as respondents having to make their own assumptions and interpretations which may be wrong. Finally, while a mail survey may have a wider coverage, its response rate tends to be low. Thus strategies must be in place to ensure that a high level of response rate is achieved.

To address the drawbacks of the mail survey, the questionnaire design of this research followed five steps proposed by Hair *et al.* (2003) (figure 4.5) and three principles suggested by Cavana *et al.* (2001) (figure 4.6). The issue of response rate is dealt with in section 4.4.4.3. Prior to the commencement of the questionnaire design, research problems have been clearly identified and defined. Research questions and hypotheses have been developed to answer defined questions. Considerations have been given to the population and sampling strategy and methods of data collection based on the research objectives clarified previously. With regard to the concepts and measurement issues, a discussion has been made to clarify concepts that are used in this research with related indicators to measure variables mainly through literature review and model building (chapters two and three).

**Figure 4.5: Steps followed in the design of the questionnaire**



Source: Hair *et al.* (2003)

**Figure 4.6: Principles for questionnaire design**

**Principles for questionnaire design**

1. Principles of wording
  - The appropriateness of the content of the questions
  - How questions are worded and the level of sophistication of the language used
  - The type and form of questions asked
  - The sequencing of the questions
  - The personal data sought from the respondents
2. Principles of measurement
  - Categorisation
  - Coding
  - Scales and scaling
  - Reliability and validity
3. General appearance
  - Appearance of questionnaire
  - Length of questionnaire
  - Introduction of respondents
  - Instructions for completion

Source: Cavana *et al.* (2001)

As Zikmund (2003) argues, a survey is only as good as the questions it asks. The typology of the questionnaire, apart from adhering to the research questions and objectives defined, was given particular attention with regard to types, wording and coding, grouping and sequencing of questions and the overall layout of the questionnaire.

A number of question types were used in the survey instrument to elicit differing depths of detail (table 4.1). Overall, questions in the survey instrument were close-ended, considering the nature of the survey being self-administered, although open-ended questions may provide richer information and sometimes insight into the response (Hair *et al.* 2003). However, open-ended questions and spaces were given after each section to provide the respondents an opportunity to explain their viewpoints in greater detail. A majority of questions in the questionnaire used Likert scales to assess the respondents' attitudes and level of agreement to various statements. An advantage of the Likert questions is that they acquire details easily and quickly from respondents. A five point Likert scale rather than a four point scale

was used because a midpoint option designated as “Unsure” was included to provide response that were more accurate (Fink 1995). Other question types included forced choice, dichotomous and multiple choice questions. In developing lists of possible response for forced choice and multiple questions, the objective was to be comprehensive and mutually exclusive to assist with pre-coding. However, to allow for ‘any exceptional or unusual responses’ (Alreck & Settle 1995 p108), a category designated “Other” was included. An advantage of using a variety of question types, while serving the data collection purposes, is that it keeps the process interesting and stimulating for the respondents and thus may reduce an early termination.

**Table 4.1 Survey questions by type**

Question type	Number of Question	Percentage %
Likert	96	85.0
Forced choice	9	8.0
Dichotomous	4	3.5
Open-ended	4	3.5
<b>Total</b>	<b>113</b>	<b>100</b>

Sources: Author

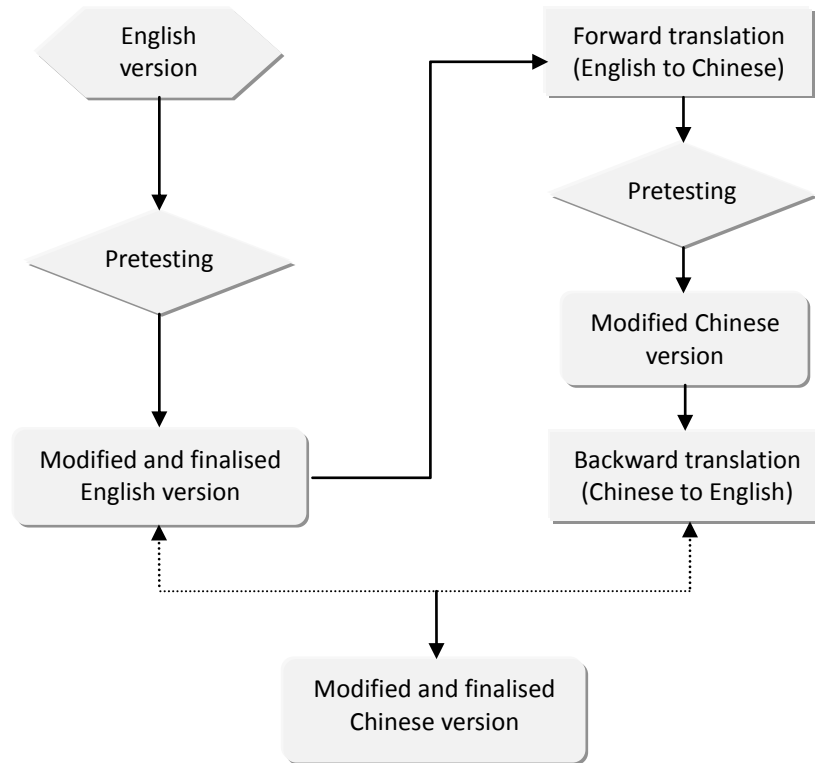
The survey research literature (for example, Alreck & Settle 1995; Cavana *et al.* 2001; Fink 1995; Hair *et al.* 2003; Neuman 2003; Ticehurst & Veal 1999; Zikmund 2003) provides guidance on a range of issues to consider when writing questions such as complexity/simplicity, leading and loaded questions, ambiguity, double-barrelled questions, the use of jargon and slang, double negatives, implicit negatives, dangling alternatives, and clarity. Efforts were made to simplify the wording of the Section A of the survey as there were terms that might not be familiar to the respondents while keeping the original meaning of each item. This was achieved through the pretesting and later the back translation process. Particular attention was given to the Section E. Efforts were made to shorten the questions by either splitting or rewording the long questions to avoid complexity and the possible double-barrelled questions.

In addition to the general guidelines on the wording of questions, the instrument involved linguistic issues as the survey was intended to be conducted in China where Chinese mandarin is the official language. It is suggested that cross-cultural research is threatened by the failure to produce culturally and linguistically appropriate survey instruments. It is vitally important that the translation of the instrument in the target language is equivalent to the original language in which the instrument was developed (Cavana *et al.* 2001; Zikmund 2003). The translation process is shown in figure 4.7, which includes activities such as forward and backward translations, pretestings, modifications and comparisons. The final English version of the instrument was obtained after the pretesting process and the following modifications. Based on the final English version, the instrument was translated into Chinese, followed by another pretesting in a Chinese context where the survey was intended to be carried out. Modifications were made to the Chinese version based on the comments from the pretesting. The modified Chinese version was then translated back to English by a second independent translator whose native tongue is Chinese as suggested by Zikmund (2003). Two English versions of the instrument were compared to identify any inconsistencies. Modifications were once again made to ensure two versions are equivalent in terms of vocabulary, idiom, and concept (Cavana *et al.* 2001)

Questions were presented in a logical order and such that the respondent is led from the general to the more specific topics and from the relatively easy to the progressively more difficult questions (Collis & Hussey 2003; Cavana *et al.* 2001). This funnel approach facilitates the easy and smooth progress of the respondent through the items in the questionnaire (Cavana *et al.* 2001). The overall organisation of questions in the instrument followed this principle. There are six sections in total and with Section A having the shortest questions therefore leading the questionnaire. Section C and E have questions that are more complex and require more thought. These two sections are therefore led by Section B and D that contain easier questions to prepare the respondent to proceed to the following sections. The sensitive demographic items were positioned in the last section of the instrument as a greater

item response was the likely outcome due to rapport and trust being developed in the preceding process.

**Figure 4.7 The translation process**



Source: Author

The way questions are sequenced could also introduce certain biases (Cavana *et al.* 2003). For example, although items in Section A could have been grouped together, their items were randomly positioned to avoid possible order biases. Similarly, questions in Section C and E were also placed randomly rather than by group. Such a placement has its drawbacks, for example, the similarity of questions appearing in the different parts of the instrument poses come confusion as to the repetition of questions. To ease the confusion, clarifications were made in the wording of these questions to ensure that the apparent distinction between questions is maintained while consistency is not compromised.

For the self-administered mail survey, the presentation, spacing and layout of



questions can affect response (Hair *et al.* 2003). Sufficient white spacing was given to reduce eye strain and confusion. To improve readability, a standardised format was used throughout the instrument – questions were not broken between pages, and the instrument was printed on one side of the paper to minimise the chances of missing questions (De Vaus 1995). It should be noted that the actual instrument used for the target population is in Chinese mandarin with characters completely different from English. This requires particular attention when arranging the layout and spacing of questions. Because there is no spacing between Chinese characters, sufficient spacing was given between lines for easy reading.

Sections were clearly separated by putting section titles into shadowed areas. Introductions and instructions were given under each section or subsection on how to complete the items to help the respondents to answer them without difficulty. In addition, coding was built into the instrument for ease of use during data analysis by inserting small numerals to the right side of possible responses. No additional coding was necessary for Likert questions as they had built-in coding (Alreck & Settle 1995). Dichotomous response normally do not require precoding because the response is used (Alreck & Settle 1995), however for consistency, precoding was completed for all items with the exception of open-ended questions.

#### **4.4.4.2 Pre-testing survey instruments**

Prior to administering the mail survey, the instrument was pretested to reduce error and ensure it was appropriate for use with the population and to obtain some assessment of the questions' validity and the likely reliability of the data to be collected (Alreck & Settle 1995; Saunders 2000; Zikmund 2003). Two pretests, one for the English version and the other for the Chinese, were carried out. Both pretest samples consisted of academics and shipping professionals to cover a wide number of issues from different perspectives with the English version having an extra group of three. The academic group included five (for each pretest) with a maritime background, thereby contributing both in terms of academic rigour and in assessing

the wording of questions to ensure suitability for shipping managers. Six shipping professionals (for each pretest) were an important part of the pretest sample as they were most similar to the population being surveyed. Their comments on the contents of the questionnaire, the wording of questions provided invaluable input for the refinement of the instrument. The extra group of three (non-academic and of a non-professional background) for the English version represent the important part of the pretesting in relation to assessing the readability and clarity of the survey instrument. Particularly the pretest for the Chinese version was extremely helpful to ensure the translation was idiomatically and conceptually equivalent to its original English version.

It is suggested that a sample size of 10-20 is sufficient for pretesting in most cases (Cavana *et al.* 2001; Saunders 2000). The total number of participants in these two pretests was 25 (14 for the English version and 11 for the Chinese version). This pretest sample size was considered to be appropriate, considering the mix of people included and the fact that pretest sample sizes larger than thirty typically do not provide substantial incremental information to use in the revising of the questionnaire (Hair *et al.* 2003).

In carrying out the pretesting, Bell (1999) suggests that the pretesting should be used to find out:

- How long the questionnaire took to complete;
- The clarity of instructions;
- Which, if any, questions were unclear or ambiguous;
- Which, if any, questions the respondent felt uneasy about answering;
- Whether in their opinion there were any major topic omissions;
- Whether the layout was clear and attractive;
- Any other comments.

To achieve the above pretesting objectives, the pretest samples were provided with a hard copy of the survey instrument (see Appendix V), and an explanatory pretest

letter (Appendix II) explaining the purpose of the research, research questions, and providing a checklist concerning the questionnaire. The purpose of the list of issues was to draw particular attention to problematic issues indicative of many questionnaires. The same checklist was provided to both academics and professionals except for the three who were only provided the first two groups of questions due to the fact that they would test the instrument mainly from linguistic perspectives.

Comments from the pretesting included possible double-barrelled questions and redundant questions, and the length of some of the sentences in Section D of the instrument. All comments were carefully taken into consideration and necessary alterations were made to the instrument.

#### **4.4.4.3 Administration of instruments or procedures**

Upon the completion of the pretesting, the survey instrument was ready for use. Due to financial constraints, the author could not be personally present in China to administer the survey process. However, prior to the survey, three industry managers were contacted and asked to help the administration process. These three managers were selected due to their strategic locations in the shipping industry which the survey was intended to target. These three managers were located in Guangzhou, Shanghai, and Dalian, covering the south, middle, and north, of China respectively. An electronic copy of the instrument was sent to these three managers in two formats (Word and PDF). Hard copies of the instrument were printed in these three locations from the PDF format to ensure absolute consistency. All questionnaires were put in envelopes, together with the covering letter and self-addressed, pre-paid envelopes for the return of the completed questionnaires. Three different types of format of the survey instrument were sent to each respondent, one being the hardcopy by post, and two electronic copies (Word and PDF) by email. The reason for this was to provide each respondent ample options to complete the survey. It should be noted that while the Word format could offer flexible and easy ways to highlight, tick, or fill answers electronically, the compatibility of its different versions could cause substantial

changes to the layout and presentation of the instrument, as the instrument was initially designed in the Microsoft Word 2007 version. The PDF format, on the other hand, while ensuring absolute consistency, could not offer flexible electronic means to complete and return the questionnaire unless the respondent had the relevant software installed.

Questionnaires were mailed out in early February 2008 from three locations. The mailing list was rearranged according to the three geographical areas. Each location was assigned with the relevant number of questionnaires and all their activities were coordinated. The survey administration was well planned and adopted a range of tactics provided in the literature (for example Alreck & Settle 1995; Haire *et al.* 2003; Neuman 2003; Zikmund 2003). These tactics are discussed as follows:

- Use of covering letter: each questionnaire (including the hardcopy, Word and PDF formats) was preceded by a covering letter using the letterhead of the author's institution and signed by the author's supervisor. The covering letter clearly explained the purpose of the study, its significance and relevance to the industry that the respondent belonged to, the value of the respondent's input, and the potential benefit to the participating organisation (Appendix III).
- The title of the questionnaire: instead of using 'questionnaire' as one of the words appearing in the title of the survey, this instrument used the word 'study' to avoid a negative attitude of any of respondents towards all kinds of questionnaires they might have received (Berdie, Anderson & Biebuhr 1986). In fact, the word 'study' better conveys the scope and general content of the questionnaire, which would potentially improve the response rate.
- Printing and paper: apart from the careful design, layout, presentation, and wording of the questionnaire as previously discussed, attention was paid to the printing of questionnaires. All questionnaires were printed on single-sided, high quality paper to avoid missing answers and to emphasise the value of the study. In addition, each questionnaire had a well designed cover page with the logos and names of the author's institution, the title of the study, and the code number on it.

- Personalisation and anonymity: when compiling the mailing list, considerable effort was made to find out the name, email address, and phone number of the general manager (for a small company) or the manager of human resources management (for a large organisation) of each organisation. All questionnaires were therefore addressed to the names of the person in charge, indicating the relevance and importance of the survey. All respondents were assured that their anonymity would be strictly maintained and no individual respondent or organisation would be associated with the report and that only the summarised information would be revealed. In addition, respondents were also advised in the covering letter that the survey was approved by the Human Research Ethics Committee (Tasmania) and relevant contact information was given in case there were any concerns or complaints regarding the survey or the way it was carried out. Demographic questions in section F only asked for general information and no sensitive questions requested information such as gender, name, and age. The contact information was required only if the respondent wanted to have a summary of results of this survey. Such a personal contact (including postal address, email, and phone number) would be strictly kept confidential.
- Alternatives of questionnaire return: in order to encourage respondents to complete the questionnaire, three different types of formats were used as discussed earlier. Respondents could either return the questionnaires by post (self-addressed and prepaid envelopes were provided), or complete the questionnaires electronically in Word or PDF formats and return by email, or complete the questionnaires on hardcopies and scan them and return by email, or simply fax them.
- Incentives for participation: it was indicated in both the covering letter and the final section of the questionnaire that respondents would be offered the opportunity to receive a summary of the study results should they so wish. This was deemed important to encourage respondents to complete the questionnaires and indeed, about one third of the respondents indicated their interest to receive the summary.

- Follow-up: various follow-up procedures were made to increase the response rate. Four weeks after the mailing of questionnaires, letters (Appendices VII, VIII) were sent to respondents thanking those who had already returned their answers and reminding those who had not. The reminder letter acknowledged the important value of respondents' input and emphasised the potential benefit of the study to the industry to which they belong. Six weeks after the initial mailing, emails were sent to those who had not yet responded. Attention was paid to the wording of the email contents, making sure that no hostile sentiment would be incurred. In eight weeks, a final reminder was made through phone calls apologising for the interruption and explaining the purpose of the call. Each call was kept to within a couple of minutes. Overall, about 65 per cent of responses were returned within the initial four weeks. 20 per cent were returned after the first reminder; 5 per cent after the email; and about 10 per cent after the phone call. It should be noted that during the administration process, visits were made to companies located in three cities which acted as geographical centres for the survey. Such visits proved to be very useful in encouraging the respondents to complete the questionnaires.

The use of a combination of tactics discussed above yielded a good response rate for the survey. Among 275 questionnaires sent out, 166 valid responses were received, representing a response rate of 60 per cent. This was considered acceptable to similar types of mail survey. It should be noted that some of the non-responses were due to incorrect contact information published on the World Shipping Directory, as some emails bounced back; other mails were undeliverable; or phone numbers were disconnected. It is also acknowledged that the response rate would be higher if visits to other cities were made, as visits generated more than 90 per cent of the response rate. However, due to time and cost constraints, such visits were not possible for the current research. However, this is noted for any future studies.

#### **4.4.5 Data editing, coding, and entering**

As mentioned earlier, the survey instrument was pre-coded during its design for an easier data entry. However, before data can be entered for analysis, all received responses must be accurate, consistent with other information, uniformly entered, and complete (Emory & Cooper 1991; Zikmund 2003). The main tasks of editing are to check for errors and omissions on the questionnaire and to adjust data to make them more complete, consistent, and readable (Zikmund 2003). For example, when asked to indicate their operation sector(s) in question F.2 (Appendix V), respondents may tick both “Ocean and inland waters” and “Inland waters only”, which is obviously contradictory. Further checking finds that the respondents choose “Over 51” in F.4 and “Over 1,000,000” in F.5 when asked to show their fleet size in number of vessels and dead weight tonnage respectively. Logically speaking, a company with more than 1 million tonnage and an average ship size of over 20,000t should not operate in inland waters only. Therefore, for the matter of logical consistency, the answer to F.2 should be adjusted to “Both ocean and inland waters”.

Although primarily a mail survey, questionnaires were also sent to respondents in electronic forms (Word and PDF formats) to provide more options to complete and to return the questionnaires. Therefore, completed questionnaires were received in three forms – hard copies, electronic Word format and PDF. For different forms of questionnaires, emphasis on editing differs. For hard copies, all questionnaires received were allocated a code number and then examined carefully to identify any possible incompleteness, inconsistency, and errors. Missing values were marked and highlighted. When the completed questionnaires were received in Word format, attention was paid to ensure that marked answers were easily identifiable when printed out, as some respondents simply highlighted the relevant answers while others ticked them. Questionnaires in PDF format were scanned from hard copies, and care was taken to ensure that there was no missing and duplicated pages. Questionnaires received in electronic form were saved and printed out straightway and code numbers were assigned. Once printed, a similar editing process was carried out to ensure the accuracy, completeness and consistency of the questionnaires.

Overall, the majority of questionnaires returned were filled up completely with consistency and uniformity with only one questionnaire returned with two pages of questions unanswered.

The survey design adopted a pre-coding approach with all survey responses, except for open ended questions, assigned numerical scores to enable answers to be grouped into a limited number of categories for rapid and flexible storage, retrieval, and tabulation through computer programs. The pre-coding process followed Zikmund's (2003) two rules for code construction, that is, the coding categories must be exhaustive and mutually exclusive and independent. This is, while coding, categories should be provided for all subjects or responses, there should be no overlap between the categories to ensure that a subject or response can be placed in one category only.

It is worth noting that items F.1 and F.3 while pre-coded, were split into 3 and 6 sub-items respectively, due to the fact that respondents may be involved in more than one business sector and have a diverse fleet. Doing this was for the ease of data entry and made it more flexible when data was analysed. Although these two items were split, the numerical scores assigned to each response during pre-coding process remained unchanged. It proved, during the data entry process, that the pre-coding was accurate and appropriate and made the task of the data entry more convenient and efficient.

The raw data was manually keyed into the Data Editor of SPSS directly from the questionnaire. Because all questionnaires were assigned with code numbers when received, these codes were used as case numbers in the Data Editor of SPSS. It was acknowledged that human errors could occur under such a circumstance. Precaution was therefore adopted to ensure 100 per cent accuracy. On the completion of the data entry, the whole process was verified by a second person who checked the accuracy of the data entered. The reason for using a second person was that a person who misread the coded questionnaire during the first data entry might make the same mistake during the verifying process (Zikmund 2003). In addition, errors were checked through analysing "frequencies" and "descriptive" to find unusual values as described by Pallant 2007).



#### **4.4.6 Data analysis**

Data analysis is a process of summarising large quantities of raw data so that the result can be interpreted (Zikmund 2003). Activities involved in data analysis may include categorising or separating out the components or relevant parts of the whole data set to make the data easily manageable, rearranging, ordering, or manipulating data to provide descriptive information that answers questions posed in the problem definition (Zikmund 2003). The purpose of data analysis is to summarise the completed observations in such a manner that they yield answers to the research questions (Selltiz, Wrightsman & Cook 1976).

Quantitative data collected from the mail survey were edited, coded, and input into SPSS for Windows software package (version 15.0). A wide range of statistical techniques would be applied to examine and explain the answers received. Details of data analysis and techniques used can be found in the next chapter.

#### **4.4.7 Control of biases**

Biases of various sources in business research may jeopardise the reliability and validity of the research and therefore need to be properly examined and controlled (Alreck & Settle 1995; Cavana *et al.* 2001; Haire *et al.* 2003). Two categories of biases, namely, instrumentation biases and respondent error have been frequently discussed. Instrumentation biases occur when research instruments are not appropriately designed. Biases associated with research instrumentation include such errors as unstated criteria, inapplicable questions, example containment, over-demanding recall, over-generalisation, over-specificity, over-emphasis, wording ambiguity, double barrelled questions, leading questions and loaded questions. As discussed earlier in this chapter, attention was paid to the various aspects of instrument design to avoid any possible biases. Care was taken to ensure that questions were relevant to the industry and sectors, in which the survey was conducted, and the wording of questions was idiomatically equivalent to the

terminology or the 'language' used in the industry. Effort was made to simplify questions to avoid ambiguity, or leading, loaded, and double-barrelled questions. In short, every effort has been made in the design stage to keep the instrumentation biases to the minimum.

There are two disadvantages associated with survey research, namely, non-response error and response bias (Zikmund 2003). Non-response error refers to statistical differences between a survey that includes only those who responded and a survey that also includes those who failed to respond (Zikmund 2003). Non-response error is hard to identify and avoid as long as there are non-responses in a survey. For a mail survey, 100 per cent of the response rate is rare to achieve. However, to reduce any possible non-response error, considerable effort such as visits, follow-up letters and emails, and phone calls, was made to increase the response rate. In addition, it is suggested that inspection should be done to determine possible biases in response patterns by comparing the demographics of the sample with the demographics of the target population (Zikmund 2003). It was found that the demographics of this research sample were very representative to the target population and in fact the responses received were corresponding to the demographic pattern shown in the sample. It is therefore acknowledged that, while non-response error existed in surveys where 100 per cent of response rate was not achieved, such an error had been reduced to the lowest possible level in this research.

A response bias occurs when respondents consciously or unconsciously misrepresent the truth (Zikmund 2003). There are different types of response biases including acquiescence bias, extremity bias, interview bias, auspices bias, and social desirability bias. Purposes of deliberately misrepresenting answers may vary, but include factors such as to appear intelligent, to conceal personal information, and to avoid embarrassment. Unconscious misrepresentation can arise from the question format, question content, or other question or instrument related issues. To control response biases, the survey questionnaire was designed in a way that did not pose any challenge to respondents and avoided asking for any sensitive information.

Furthermore, attention was paid to the sequence, clarification and organisation of questions as well as the layout and presentation of the whole questionnaire in order to remove any stimulus for unconscious misrepresentation. A combination of effort made at different stages of the research survey ensured that the data collected for this research were reliable and valid.

## **4.5 Summary**

This chapter has presented the research design and methodology of this study with justification. The conceptual framework has been developed and discussed based on the literature review conducted in chapters 2 and 3, which includes three main variables, that is, human mobility in the shipping industry, organisational knowledge base, and effective knowledge management practices. The examination of the relationships between these three variables yielded three primary research questions for the study, which are further framed into relevant hypotheses.

Mail survey was utilised as the primary data collection method for the research due to financial and time constraints for the researcher to be personally present in China where the survey was carried out. Detailed discussion was given to the design of the survey instrument due not only to the sheer importance of survey instrument in collecting data and in answering research questions that were elaborated earlier, but also to the need to translate the instrument into another language in order for the survey to be conducted in a country where English is not the official language. In designing the survey instrument, examination was given to details such as types of questions to include and their order, wording and coding of questions, grouping and overall length of the questionnaire, structure and layout, forward and backward translation, and the pre-test of the survey instrument to ensure that the data collected were reliable and valid.

Sampling design and sample size are imperative to establish the representativeness of the sample for generalisation. Probability sampling method was adopted after a

comparison of different methods. The sample size was determined upon careful calculations which were based on three factors and one adjustment, that is, the variance or heterogeneity of the population, the magnitude of error, the confidence level, and adjustment of population size. The attained sample size is consistent with samples sizes for the different sizes of population at a 95% confidence level suggested in the literature.

To secure a high response rate, attention was paid to the administration of the questionnaire survey, including choosing strategic locations in China and arrangement of survey administrators, preparation of different formats (electronic formats such as Word and PDF, and printed copies) of the questionnaire for the convenience of respondents. Different options were provided for the return of completed questionnaires.

Due consideration was given to the process of data editing, coding, categorising and entering, as well as bias control. In short, the research framework presented, the methodology justified, and the data collection process explained in this chapter laid a firm foundation for the analysis, interpretation, and report of data in the next chapter.

## **CHAPTER 5: ORGANISATION KNOWLEDGE BASE AND KNOWLEDGE MANAGEMENT PRACTICES IN THE SHIPPING INDUSTRY**

### **5.1 Introduction**

The purpose of this chapter is to provide data analyses on three research questions discussed in the previous chapter. The first part of the analyses is on demographic information which provides independent variables for the first research question. The analyses of the first question comprise two parts with the first part relating to the overall perceived importance of the proposed 14 knowledge components in the OKB in the shipping industry, and the second being the perceptions of the OKB according to demographic variables. The next analyses are concerned with the perceived effects of human mobility on the OKB, whether and to what extent such perceptions can be predicted by the current workforce stability of the respective organisations. The last part of the analyses is to explore the perceptions of effective knowledge transfer practices in the shipping industry and whether they are affected by current management practices, with a focus on knowledge management related practices and the use of information technology. To get the best understanding of issues contained in the three research questions, various techniques are applied in the process of data analyses. These statistical techniques include *t*-test, ANOVA, Pearson's correlation, factor analysis and multiple regression. A discussion on the appropriateness of the use of statistical techniques including the examination of assumptions is provided prior to each analysis.

### **5.2 Selection of statistical techniques**

Parametric statistics and nonparametric statistics are two major groupings of statistical procedures. It is suggested that parametric statistics should be used when the data are interval- or ratio-scaled and the sample size is large (Zikmund 2003). Parametric statistics are based on the assumption that the data in the study are drawn

from populations with normal distribution. When such an assumption is not made, or when data are nominal or ordinal scale, nonparametric methods are appropriate (Zikmund 2003). It is clear that the two criteria, sample size and measurement scale, need to be checked against when deciding what statistical techniques are to be used for the study.

It is argued that nonparametric statistics are most appropriate when sample sizes are small. This is because when sample sizes become large (for example larger than 100), the sample means will follow that normal distribution even if the respective variable is not distributed normally in the population (StatSoft 2008). As discussed earlier, parametric methods are appropriate when the population and/or sample have a normal distribution. This is the case when the sample size is large. As for this research, the sample size is 275, which is large enough to employ parametric statistical methods in order to obtain meaningful results.

The other criterion is the measurement scale. When data are either nominal or ordinal, it is inappropriate to use parametric statistical methods (Zikmund 2003). When data are ordinal, more consideration should be given to whether the data measured are categorical or continuous, as commonly data are assumed to be at intervals when they are continuous. The measurement scale, the Likert scale, used in this study, is commonly used with interval procedures, provided the scale item has at least 5 or preferably 7 categories. Although Likert scales are ordinal, it is commonplace to be assumed as interval data in their use in statistical procedures, especially in contemporary social science (Garson 2008). This study employs five-point Likert scales in sections A to E of the questionnaire. It is argued that there are equal distances between each category, for example, the distance between 2 and 3 equals the distance between 4 and 5. These scales appear to measure continuous, interval data, thus parametrical statistical methods should be utilised.

### **5.3 Information on demographic variables**

Demographic variables are used to collect demographic information of the respondents such as business and operation sectors, fleet size, and work experiences. This information will be used to analyse any potential difference across demographic factors of perceptions or viewpoints towards statements sent in the questionnaire. Three demographic variables were designed to answer the first research question. These three variables are discussed as follows.

- **Business sector**

As discussed in chapter four, there are two defined business sectors in the target population (i.e. Ship Owner and Ship Manager) and in fact, the shipping directory has been organised under these two sectors, although obvious discrepancies on entries were found during the survey.

Ship owners are those who possess ships of their own (not just managing ships for other companies in whatever contract form). Apart from managing their own ships, these companies are also sometimes involved in manning or even managing ships of others. When a ship owner is involved in multiple business sectors, it is considered as a ship owner and is given a numerical value of 1.

The other business sector in the World Shipping Directory is the Ship Manager. Ship management includes such activities as crew management, technical management, and commercial management. In the real world there might be different levels of involvement in these activities, that is, some companies might include only one or two of these activities. When a company involves only crew management, it is normally registered as a manning company. For this reason, the business sector in the questionnaire was provided with three options: ship owner, manning company, and ship manager. It was not surprising when multiple sectors were ticked as a company might involve two or more business sectors. However, for the purpose of data

analysis, manning companies were re-categorised into ship manager with a numerical value of 2.

- Fleet size

Fleet size may be determined either by the number of ships or by the total dead weight tonnage (DWT). Both options were given in the questionnaire to cross check the accuracy of this information. An initial inspection found that there was a high consistency between these two options, for example, when '5-10 ships' (pre-coded as 2) in F.4 was chosen, a corresponding DWT of '50,000 – 100,000' (pre-coded as 2) in F.5 would be ticked. For ease of analysis, DWT was adopted to represent fleet size. Furthermore, to conduct a meaningful analysis and for statistics purposes, the pre-coded six fleet sizes were collapsed into three categories, small (less than 100,000), medium (100,001-1,000,000), and large (over 1,000,000) and were given numerical values of 1, 2, and 3 respectively.

- Work experience

Instead of asking for the respondents' experience (in years) generally, the questionnaire was designed to collect experience information in terms of offshore and onshore considering different perspectives of respondents towards seafarer related statements in the questionnaire. The total work experience (the sum of onshore and offshore experiences) was categorised into three groups with an equal percentiles through SPSS (v.15):  $\leq 9$  (coded as 1), 10-16 (coded as 2), and  $\geq 17$  (coded as 3).

Table 5.1 provides information on the respondents' demographic variables, that is, business sector, fleet size, and total work experience. For the business sector, 56% (93) respondents were ship owners, and 44% (73) were ship managers. This representation is quite different from the mailing list (Appendix IX) where there were only 25 listed ship managers (9.1%) among the total population of 275. A close look at the World Shipping Directory found that many companies, although registered as ship owners, were actually involved in crew management only, or more broadly ship



management services. In fact, some ships appeared several times under different company names, illustrating that among 912 registered ship owners, many were ship managers. In terms of fleet size, there were 51 companies having a total DWT of less than 100,000, 40 between 100,001 to 1,000,000, and 75 over 1,000,000, accounting for 30.7%, 24.1%, and 45.2% respectively. As mentioned earlier, two types of experiences were asked in the questionnaire. Among the 166 respondents, 23 did not put any value in either the onshore experience or offshore experience. These were treated as missing value in the analysis. When only one of the two values was given, the other missing one was treated as 0. An equal percentile data collapsing technique brought two cut points, 9 and 16, that is, there were equal percentages of respondents with work experiences of 9 years or less, between 10 to 16 years, and 17 years or more. The other information on work experience was the offshore or onboard experience. Excluding the missing value, 108 respondents reported different levels of seafaring experience and 35 had never worked on a ship, representing 75.5% and 24.5% respectively. Another illustration of the demographic information is given in figure 5.1, 5.2, and 5.3.

**Table 5.1 Respondents' demographic information**

		Frequency	Percentage	Valid percentage
<b>Business sector</b>	Ship owner	93	56.0	56.0
	Ship manager	73	44.0	44.0
<b>Total</b>		<b>166</b>	<b>100.0</b>	<b>100.0</b>
<b>Fleet size (DWT)</b>	Small	51	30.7	30.7
	Medium	40	24.1	24.1
	Large	75	45.2	45.2
<b>Total</b>		<b>166</b>	<b>100.0</b>	<b>100.0</b>
<b>Work experience (years)</b>	≤ 9	48	28.9	33.6
	10-16	48	28.9	33.6
	≥ 17	47	28.3	32.9
	Missing value	23	13.9	
<b>Total</b>		<b>166</b>	<b>100.0</b>	<b>100.0</b>
<b>Onboard experience</b>	Yes	108	65.1	75.5
	No	35	21.1	24.5
	Missing value	23	13.9	
<b>Total</b>		<b>100</b>	<b>100.0</b>	<b>100.0</b>

\* Small=Less than 100,000 DWT; Medium=100,001-1,000,000 DWT; Large=over 1,000,000 DWT

Figure 5.1 Respondents' business sector

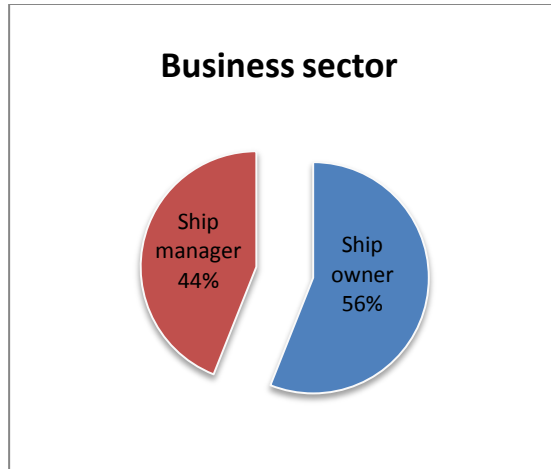


Figure 5.2 Respondents' fleet size

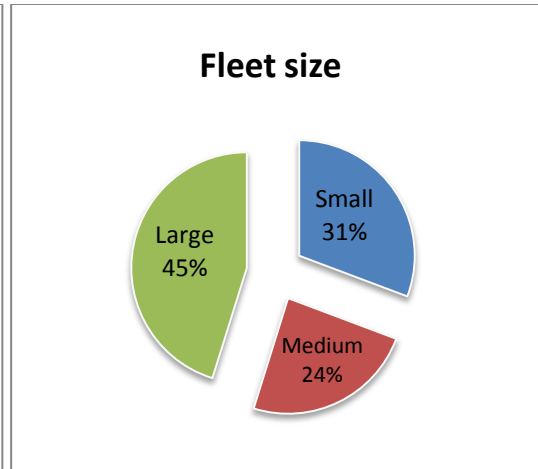


Figure 5.3 Respondents' work experience

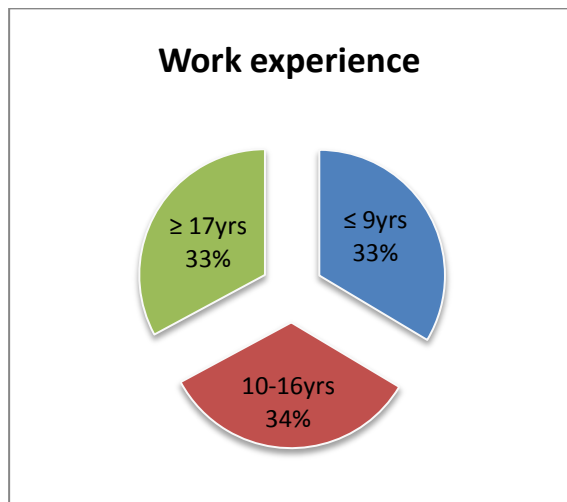
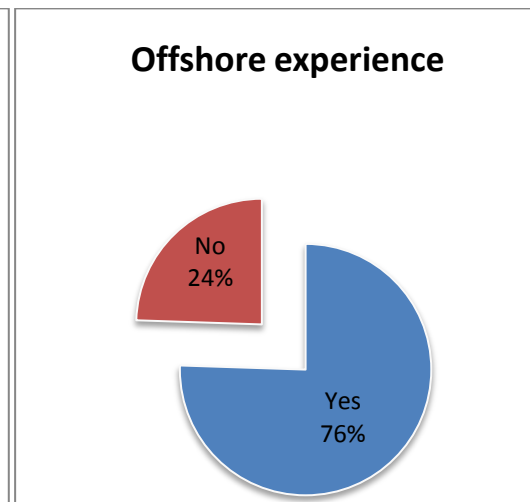


Figure 5.4 Respondents' onboard experience



Cross-tabulation allows the inspection of differences among groups and makes comparison. Therefore it provides more insights into the structure of demographic variables, allowing more comprehensive interpretation of the data obtained. Table 5.2 illustrates a cross tabulation of three demographic variables, that is, business sector, fleet size, and total work experience. It is clear that after cross tabulation, all three variables are inter-related. Firstly, the business sector divides all respondents into two big groups. Then three subgroups are formed according to fleet size within each business sector. For each subgroup, there are respective numbers of respondents under three categories of the total work experience.

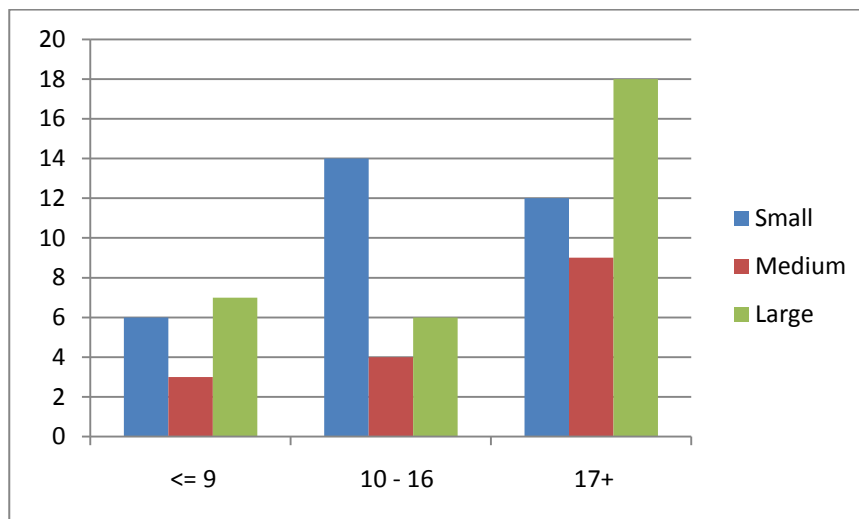
**Table 5.2 Cross-tabulation of demographic data (business sector, fleet size, total work experience)**

Business Sectors	Fleet size	Frequency & Percentage	Total experiences (years)			
			<= 9	10 - 16	17+	Total
Ship Owner	Small	Count	6	14	12	32
		% within Total experiences	37.5%	58.3%	30.8%	40.5%
		% of Total	7.6%	17.7%	15.2%	40.5%
	Medium	Count	3	4	9	16
		% within Total experiences	18.8%	16.7%	23.1%	20.3%
		% of Total	3.8%	5.1%	11.4%	20.3%
	Large	Count	7	6	18	31
		% within Total experiences	43.8%	25.0%	46.2%	39.2%
		% of Total	8.9%	7.6%	22.8%	39.2%
	Total	Count	16	24	39	79
		% within Total experiences	100.0%	100.0%	100.0%	100.0%
		% of Total	20.3%	30.4%	49.4%	100.0%
Ship Manager	Small	Count	4	9	1	14
		% within Total experiences	12.5%	37.5%	12.5%	21.9%
		% of Total	6.3%	14.1%	1.6%	21.9%
	Medium	Count	7	8	3	18
		% within Total experiences	21.9%	33.3%	37.5%	28.1%
		% of Total	10.9%	12.5%	4.7%	28.1%
	Large	Count	21	7	4	32
		% within Total experiences	65.6%	29.2%	50.0%	50.0%
		% of Total	32.8%	10.9%	6.3%	50.0%
	Total	Count	32	24	8	64
		% within Total experiences	100.0%	100.0%	100.0%	100.0%
		% of Total	50.0%	37.5%	12.5%	100.0%

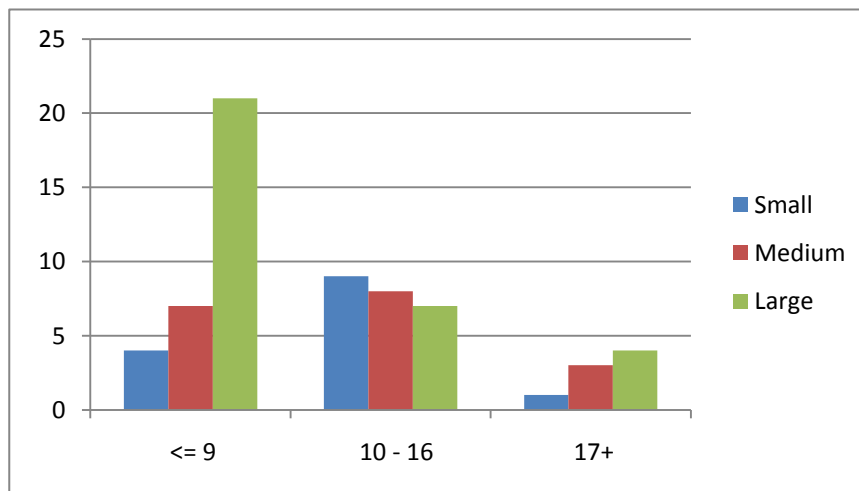
Table 5.2 provides several indications that are of interest. Firstly, among 79 ship owners, 31 are from large companies, 16 from medium ship owners, and 32 from small ones, accounting for 39.2%, 20.3%, and 40.5% respectively. About 80% of respondents in the ship owner sector have more than 10 years of experience. Comparing the three groups, large ship owners have the highest number (18) of respondents who reported 17 years or more work experience. Furthermore, of 64 ship managers, 50% are from large companies, with medium and small companies representing 28.1% and 21.9% respectively. In the ship manager sector, a half of the respondents (32, 50%) has 9 years or less work experience, and surprisingly, 65.6% of these 32 respondents are from large companies. There are only 12.5% of respondents having 17 years or more work experience in ship manager sector. Finally, when comparing ship owners and ship managers, the number of respondents with long work experience (17 years or more) in ship owner sector far exceeds that of in ship manager, a comparison of 49.4% and 12.5%. Extensive work experience is even

more evident in large companies. For example, of the 39 respondents who have 17 years or more work experience, 46.2% are from large ship owners. It should be noted that a cross-tabulation of the business sector, fleet size and offshore work experience generates a similar pattern of distribution indicating that the distribution of offshore work experience coincides with that of total experience (details of the cross-tabulation – offshore experience – can be found in Appendix X). The results of cross-tabulation are further illustrated by column charts in figure 5.5 and 5.6.

**Figure 5.5 Ship owners by fleet size and work experience**



**Figure 5.6 Ship managers by fleet size and work experience**



## 5.4 Knowledge components in the OKB

### 5.4.1 Reliability analysis on measurement scales

Reliability is the degree to which measures are free from error and therefore yield consistent results (Zikmund 2003). Threats to reliability come from both the subject and the observer, namely, subject error and bias, and observer error and bias (Robson 2002). Repeatability and internal consistency are two dimensions underlying the concept of reliability. While repeatability is to address measurement stability by administering the same scale to the same respondents at two separate times, internal consistency refers to the degree to which the items that make up the scale measure the same underlying construct. One of the most commonly used indicators of internal consistency is Cronbach's alpha coefficient. It is suggested that while the alpha value of above 0.6 is acceptable, ideally, it should be above 0.7 (DeVellis 2003). The closer the alpha is to 1, the greater the internal consistency of items in the measurement scale.

**Table 5.3 Codes of 14 components of the organisational knowledge base**

Code	Factor
OKB01	Personal academic qualifications, such as university degrees
OKB02	Organisational culture
OKB03	Electronic Data Interchange (EDI)
OKB04	Personal problem solving capability
OKB05	Information storage and retrieval systems, such as databases
OKB06	Personal work attitudes
OKB07	Organisation's external relationships
OKB08	Intellectual property, such as patents, copyrights, trademarks, registered design, and brands
OKB09	Personal work experience
OKB10	Information communication technologies, such as intranet including email, Bulletin Board System (BSB), and e-forum
OKB11	Personal professional qualifications, such as certificates of competence
OKB12	Organisational image
OKB13	Organisational process manuals, for example, written instructions, and operational procedures
OKB14	Personal innovation ability

The coding detail of 14 components of organisational knowledge base (OKB) is provided in table 5.3. These codes will be used throughout the data analysis. A SPSS analysis of the reliability of this 14-item scale generates a Cronbach's alpha coefficient value of 0.799, indicating that the survey instrument is reliable to measure the perception of knowledge components in an OKB in the shipping industry. Further details of the reliability analysis can be found in table 5.4. Variables in table 5.4 are arranged according to the sixth column, 'Cronbach's alpha if item deleted', in descending order. This column indicates the overall scale's alpha if the variable in the first column is deleted from the scale. The fourth column, 'Corrected item – total correction', shows the correlations between each variable (knowledge component) and the sum of all other variables.

**Table 5.4 Reliability analysis of scale measuring the organizational knowledge base**

<b>Alpha = .799</b>					
Variable	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
OKB09	54.20	27.009	.145	.208	.808
OKB01	54.44	25.945	.268	.186	.800
OKB06	53.66	26.589	.299	.302	.796
OKB04	53.91	26.058	.329	.244	.794
OKB14	54.17	25.515	.333	.222	.794
OKB11	54.18	25.543	.353	.215	.792
OKB13	54.22	24.862	.472	.286	.783
OKB05	54.17	24.262	.482	.454	.782
OKB10	54.52	24.178	.484	.432	.781
OKB02	53.89	24.800	.524	.384	.780
OKB07	54.20	24.212	.533	.412	.778
OKB08	54.23	23.757	.522	.364	.778
OKB12	54.01	24.339	.543	.435	.777
OKB03	53.91	23.257	.567	.498	.773

A close look at the sixth column in table 5.4 finds that the first two alpha values are greater than the overall alpha of the scale, meaning that if these two items were deleted from the scale, the overall alpha would have been larger than the current value of 0.799, that is, the scale would have been more reliable. A further investigation to the original data reveals that there are two cases (116 and 117)

reporting ‘not at all important’ to ‘personal work experience’, and one case (115) responding the same to ‘personal academic qualifications’. It is suggested that a removal of the item should be considered if the overall alpha is less than 0.7 (Pallant, 2007). In the present case, although the overall alpha would be slightly increased (from .799 to .808 and .800 if OKB09 and OKB01 were deleted respectively), the overall alpha of the scale is well above 0.7. Therefore these two items will remain in the scale.

#### **5.4.2 Perceptions of knowledge components of the OKB**

An earlier examination of reliability reveals that the scale used in the data collection is reliable and internally consistent to measure the underlying construct, that is, the OKB. Once this is established, the section explores the general perceptions of respondents towards 14 proposed items as components of an OKB, without considering possible differences when demographic variables are introduced. Descriptive analyses (descriptives and frequencies) are carried out to examine the respondents’ perceptions of 14 knowledge components of the OKB. Descriptives (table 5.5), such as mean, standard deviation, skewness and kurtosis, provide a general descriptive profile about the variables. Frequencies, on the other hand, showing the percentage of each response value for each variable, provide more specific and quantitative information on how each component is perceived by respondents.

Standard deviation is a quantitative index of a distribution’s spread or variability. It is used to measure the distance of the individual observation from the mean score. The standard deviation of the 14 knowledge components, as illustrated in table 5.5, is lower than 1, with the lowest of 0.549 and the highest of 0.844. The skewness value provides an indication of the symmetry of the distribution. Negative skewness values indicate a clustering of scores at the high end, that is, respondents tend to perceive the 14 knowledge components as important or very important. This is corresponding to the mean scores in the second column of table 5.5 where 12 out of 14 mean scores are

above 4. Kurtosis, on the other hand, provides information about the ‘peakedness’ of the distribution. Positive kurtosis values indicate that the distribution is rather peaked with long thin tails. Negative kurtosis values, however, indicate a relatively flat distribution with many cases in the two extremes. A kurtosis value between  $\pm 1.0$  is considered excellent for most psychometric purposes, and a value between  $\pm 2.0$  is in many cases acceptable (Georgge & Mallery 2003). It is found from table 5.5 that the kurtosis value of OKB06 is above 2, and OKB09 is above 3. Further normality assessments of the distribution, using Histogram and Boxplot, find that there is an outlier (case 29) in OKB06, and three outliers (cases 116, 117, and 163) in OKB09. No extreme point is found from either case.

**Table 5.5 Perceptions of the proposed 14 knowledge components of the OKB**

Knowledge component	Mean	Std. Deviation	Skewness	Kurtosis	Rank
OKB06	4.65	0.549	-1.512	2.623	1
OKB02	4.42	0.644	-0.943	1.067	2
OKB04	4.40	0.632	-0.868	1.110	3
OKB12	4.30	0.700	-0.708	0.141	4
OKB05	4.14	0.781	-0.569	-0.265	5
OKB14	4.14	0.746	-0.763	1.186	6
OKB11	4.13	0.710	-0.608	0.513	7
OKB09	4.11	0.708	-1.099	3.520	8
OKB07	4.11	0.730	-0.265	-0.780	9
OKB13	4.10	0.690	-0.577	0.711	10
OKB08	4.08	0.816	-0.551	-0.307	11
OKB03	4.06	0.844	-0.544	-0.420	12
OKB01	3.87	0.756	-0.636	0.505	13
OKB10	3.79	0.792	-0.492	0.026	14

To determine if these four outliers’ scores are genuine not just errors, a checking back to original questionnaires was conducted. The inspection showed that all four scores were genuine. For outliers, some suggest removing all extreme outliers from the data file, while others suggest changing the value to a less extreme value, thus including the case in the analysis but not allowing the score to distort the statistics (Tabachnick & Fidell 2007). However, such data manipulations may compromise the generalisability of the research (Tabachnick & Fidell 2007). Furthermore, as



explained earlier, none of the four outliers falls within the extreme range (points that extend more than three box-lengths from the edge of the box in a Boxplot normality assessment). Moreover, the descriptives for normality of distribution (tables 5.6 and 5.7) indicate that the values of 5% Trimmed Mean are very similar to the mean values in both cases (4.70 and 4.65 in OKB06; 4.16 and 4.11 in OKB09). This means that the inclusion of these four outliers does not affect the overall statistics. Therefore all cases are retained.

**Table 5.6 Descriptives for normality of distribution (OKB06)**

		Statistic	Std. Error
Personal work attitudes	<b>Mean</b>	<b>4.65</b>	.043
	95% Confidence Interval for Mean	4.57	
	Lower Bound	4.73	
	Upper Bound		
	<b>5% Trimmed Mean</b>	<b>4.70</b>	
	Median	5.00	
	Variance	.301	
	Std. Deviation	.549	
	Minimum	2	
	Maximum	5	
	Range	3	
	Interquartile Range	1	
	Skewness	-1.512	.188
	Kurtosis	2.623	.375

**Table 5.7 Descriptives for normality of distribution (OKB09)**

		Statistic	Std. Error
Personal work experience	<b>Mean</b>	<b>4.11</b>	.055
	95% Confidence Interval for Mean	4.01	
	Lower Bound	4.22	
	Upper Bound		
	<b>5% Trimmed Mean</b>	<b>4.16</b>	
	Median	4.00	
	Variance	.502	
	Std. Deviation	.708	
	Minimum	1	
	Maximum	5	
	Range	4	
	Interquartile Range	1	
	Skewness	-1.099	.188
	Kurtosis	3.520	.375

**Table 5.8 Perceived importance of knowledge components in an OKB**

Knowledge components	Percentage of total respondents						Rank
	Not all important	Not important	Unsure	Important	Very important	Important & Very important	
OKB06		0.6	1.8	29.5	68.1	97.6	1
OKB04		1.2	4.2	47.6	47.0	94.6	2
OKB02		1.2	4.8	44.6	49.4	94.0	3
OKB12		1.2	10.2	45.8	42.8	88.6	4
OKB09	1.2	0.6	10.8	60.2	27.1	87.3	5
OKB11		2.4	12.0	55.4	30.1	85.5	6
OKB13		2.4	12.0	59.0	26.5	85.5	7
OKB14	0.6	1.1	14.5	51.2	32.5	83.7	8
OKB05		2.4	16.9	44.6	36.1	80.7	9
OKB07		0.6	19.9	47.6	31.9	79.5	10
OKB08		3.6	18.7	44.0	33.7	77.7	11
OKB01		6.0	17.5	59.6	16.9	76.5	12
OKB03		4.2	19.9	41.6	34.3	75.9	13
OKB10		7.2	22.3	54.8	15.7	70.5	14

Table 5.5 indicates that the mean scores of 12 knowledge components are all above the midpoint of the scale (3 as unsure - a neutral score), revealing that all of them are accepted and perceived as components of an OKB. Among the 14 mean scores, 12 are above 4. The two lowest scores are 3.79 and 3.87, which are very close to 4, that is, a perception of 'important'. A frequency table of observation on each item reveals more insight into the perceived importance of each knowledge component in an OKB. Table 5.8 indicates that 97.6% of respondents consider *personal work attitude* (OKB06) as important or very important part of an OKB, followed by *personal problem solving capability* (OKB04) (94.6%) and *organisational culture* (OKB02) (94.0%). *Organisational image* (OKB12) is ranked the 4<sup>th</sup> with 88.6% respondents perceiving it as an important or very important. *Personal work experience* (OKB09) and *professional qualifications* (OKB11) are ranked the 5<sup>th</sup> and 6<sup>th</sup> with percentages of 87.3% and 85.5% respectively. Two information technologies related components received two lowest percentages, with *information communication technologies, such as intranet including email, bulletin board system, and e-forum* (OKB10), having the lowest percentage of 70.5% and *electronic data exchange (EDI)* (OKB03) 75.9% as

the second lowest. 76.5% respondents perceive *personal academic qualification, such as university degrees (OKB01)* as important or very important, being ranked the 12<sup>th</sup>, the third lowest score. *Intellectual property, such as patents, copyrights, trademarks, registered design, and brands (OKB08)*, and *organisation's external relationships (OKB07)* are ranked the 11<sup>th</sup> and 10<sup>th</sup> with percentages of 77.7% and 79.5% respectively.

### **5.4.3 Perceptions of the OKB according to demographic variables**

The earlier section discussed the general perceptions of respondents (166 in total) of the 14 knowledge components of the OKB. This section examines whether such perceptions vary from demographic variables. Three independent variables (business sector, fleet size, and total experience) are investigated to compare the mean scores of different groups under these three independent variables. Two different types of analyses are conducted. A *t*-test examines whether there is a statistically significant difference between two business sectors regarding knowledge components in an OKB. Two one-way ANOVA analyses are carried out to investigate whether there are any statistically significant differences among different groups of the fleet size and the total work experience for their perceptions of the importance of each knowledge component in an OKB. The comparisons of mean scores through one *t*-test and two one-way ANOVA analyses among groups of business sectors, fleet sizes, and total work experiences are expected to shed light on whether perceptions of the importance of each knowledge component vary according to demographic variables.

#### **5.4.3.1 Perceptions of OKB according to the business sector**

As discussed earlier, there are two groups under the business sector, ship owners and ship managers. Historically, there are significant differences between ship owners and ship managers in China in terms of employment methods especially the employment of onboard personnel. Many ship owners maintain their own onboard workforce as opposed to mainly contracted personnel by ship managers. Although all knowledge components are accepted generally, it is interesting to find whether there is any

difference between these two groups. A *t*-test is employed to examine whether the mean scores of these two groups significantly differ from each other. Table 5.9 presents the results of the *t*-test of differences between two groups.

**Table 5.9 A *t*-test of OKB by the business sector**

OKB	Mean		Mean Difference	t	Sig. (2-tailed)	95% CI		Eta squared
	SO	SM				Upper	Lower	
OKB01	3.91	3.82	0.092	0.778	0.438	-0.142	0.326	0.004
OKB02	4.41	4.44	-0.030	-0.295	0.769	-0.229	0.170	0.001
OKB03	4.11	4.00	0.108	0.814	0.417	-0.153	0.368	0.004
OKB04	4.44	4.36	0.085	0.856	0.393	-0.111	0.280	0.004
OKB05	4.17	4.11	0.062	0.511	0.610	-0.179	0.304	0.002
OKB06	4.61	4.70	-0.086	-0.999	0.319	-0.255	0.084	0.006
OKB07	4.17	4.03	0.145	1.269	0.206	-0.080	0.370	0.010
OKB08	4.04	4.12	-0.080	-0.628	0.531	-0.333	0.172	0.002
OKB09	4.17	4.04	0.131	1.183	0.238	-0.088	0.349	0.008
OKB10	3.97	3.56	0.406	3.301	<b>0.001</b>	0.163	0.649	<b>0.062</b>
OKB11	4.14	4.12	0.016	0.148	0.882	-0.203	0.236	0.000
OKB12	4.29	4.32	-0.025	-0.225	0.822	-0.242	0.192	0.000
OKB13	4.24	3.92	0.319	3.028	<b>0.003</b>	0.111	0.527	<b>0.053</b>
OKB14	4.30	3.93	0.370	3.290	<b>0.001</b>	0.148	0.591	<b>0.062</b>

Note: 1) Sample size  $N_1 = 93$ ;  $N_2 = 73$ ; 2) Degree of freedom:  $N_1 + N_2 - 2 = 93 + 73 - 2 = 164$   
 3)  $p < 0.05$

Table 5.9 provides the mean scores of the ship owners (SO) and the ship managers (SM) in columns two and three, with the mean difference in the fourth column. The *t* value and 2-tailed significance value (*p*) are presented in columns five and six. The table also provides the 95% confidence interval of the difference (CI) in column seven and eight. While the 2-tailed significance provides an indication of whether the difference between two groups is statistically significant, it does not tell the degree to which the two variables are associated with one another. Effect size statistics provide an indication of the magnitude of the differences between the groups. Values of eta squared is therefore calculated and presented in the last column to further investigate the magnitude of the differences between the two groups. The formula used for the calculation of eta squared is as follows:

$$\text{Eta squared} = \frac{t^2}{t^2 + (N_1 + N_2 - 2)}$$

Where t value is obtained from column 5 of the table 5.9;

$N_1$  is the number of respondents from groups one, that is, ship owners;

$N_2$  is the number of respondents from groups two, that is, ship managers.

The guidelines for interpreting the eta squared value, as proposed by Cohen (1988), are:

0.01 = small effect;

0.06 = moderate effect;

0.14 = large effect.

It can be seen from table 5.9 that among 14 knowledge components of the OKB, there are only three components – *information communication technologies such as intranet including email, bulletin board system, and e-forum (OKB10), organisational process manuals, for example, written instructions, and operational procedures (OKB13), personal innovation ability (OKB14)* – in which the difference between ship owners and ship managers is statistically significant. For OKB10, the mean score for ship owners is 3.97 ( $SD = 0.67$ ) and 3.56 ( $SD = 0.85$ ) for ship managers;  $t(138) = 3.30$ ,  $p = 0.00$  (two-tailed). The magnitude of the differences in the means (mean difference = 0.41, 95% CI: 0.16 to 0.65) is moderate (eta squared = 0.06), that is, 6 per cent of the variance in OKB10 is explained by the business sector. With regard to OKB13, there is also a significant difference in scores for ship owners ( $M = 4.24$ ,  $SD = 0.63$ ) and ship managers,  $M = 3.92$ ,  $SD = 0.72$ ;  $t(164) = 3.03$ ,  $p = 0.00$  (two-tailed). The magnitude of the differences in the means (mean difference = 0.32, 95% CI: 0.11 to 0.53) is moderate (eta squared = 0.05). The third component found significant difference in scores is OKB14, with ship owner  $M = 4.30$ ,  $SD = 0.75$  and ship managers  $M = 3.93$ ,  $SD = 0.69$ ;  $t(159) = 3.29$ ,  $p = 0.00$  (two-tailed). 6 per cent (eta squared = 0.06) of the variance in OKB14 is explained by the business sector and the magnitude of the differences in the means is considered moderate (mean difference = 0.37, 95% CI: 0.15 to 0.59).

#### 5.4.3.2 Perceptions of the OKB according to the total work experience

This section aims to investigate whether respondents' perceptions of the importance of 14 knowledge components in an OKB differ from the respondents' work experience. As discussed previously, the respondents' total work experience (both offshore and onshore) has been collapsed into three groups for statistic purposes. These three groups are:  $\leq 9$ , 10 – 16, and  $\geq 17$ , years of total work experience. One-way ANOVA is used to determine whether there are any significant differences among three groups of respondents in their perceptions of the importance of each knowledge component in an OKB, and specifically, which of the groups differ. Two steps of statistical analyses are conducted to achieve the set purposes. The first step is to conduct an ANOVA analysis to find whether there are significant differences in the mean scores on each knowledge component across the three groups. Then post-hoc tests are carried out as the second step to determine where these differences lie.

A one-way between-groups analysis of variance is conducted first to explore the impact of total work experience on perceptions of the importance of each knowledge component in an OKB. Respondents are divided into three groups according to their years of work experience both offshore and onshore (Group 1: 9yrs of less; Group 2: 10 to 16yrs; Group 3: 17yrs and above). Statistically significant differences are found at the  $p < 0.05$  level in scores of four knowledge components for the three groups as highlighted in table 5.10: OKB03,  $F(2, 140) = 5.38, p = 0.01$ ; OKB06,  $F(2, 140) = 4.04, p = 0.02$ ; OKB10,  $F(2, 140) = 5.74, p = 0.00$ ; and OKB11,  $F(2, 140) = 5.79, p = 0.00$ . To determine the strength of actual differences in mean scores between groups, values of eta squared are calculated and provided in the last column of table 5.10. The value of eta squared equals the sum of squares between-groups divided by the total sum of squares. It can be seen from table 5.10 that the eta squared values of the four components (OKB03, 06, 10, and 11) are 0.07, 0.05, 0.08, and 0.08 respectively, which means 7 (or 5, 8, and 8) per cent of variance in OKB03 (or 06, 10, and 11) is explained by the total work experience. According to Cohen's (1988) guideline, the effect sizes of the total work experience in these four knowledge components are considered moderate.

**Table 5.10 ANOVA – OKB by total work experience**

Variable	Sum of mean squares			Mean Square		F	Sig.	Eta squared
	Between Groups	Within Group	Total	Between Groups	Within Group			
OKB01	2.522	75.394	77.916	1.261	0.539	2.342	0.100	0.03
OKB02	0.061	62.219	62.280	0.031	0.444	0.069	0.934	0.00
OKB03	7.270	94.618	101.888	3.635	0.676	5.379	<b>0.006</b>	0.07
OKB04	1.244	57.035	58.280	0.622	0.407	1.527	0.221	0.02
OKB05	2.103	88.051	90.154	1.052	0.629	1.672	0.192	0.02
OKB06	2.487	43.121	45.608	1.243	0.308	4.037	<b>0.020</b>	0.05
OKB07	1.763	75.538	77.301	0.882	0.540	1.634	0.199	0.02
OKB08	0.931	99.894	100.825	0.466	0.714	0.652	0.522	0.01
OKB09	0.730	72.249	72.979	0.365	0.516	0.707	0.495	0.01
OKB10	6.848	83.586	90.434	3.424	0.597	5.735	<b>0.004</b>	0.08
OKB11	5.513	66.697	72.210	2.756	0.476	5.786	<b>0.004</b>	0.08
OKB12	0.190	74.621	74.811	0.095	0.533	0.178	0.837	0.00
OKB13	1.402	68.151	69.552	0.701	0.487	1.440	0.240	0.02
OKB14	0.193	76.437	76.629	0.096	0.546	0.177	0.838	0.00

Note: 1) Sample size = 143; Number of groups = 3; 2) Degree of freedom between groups = 2; degree of freedom within groups = 140; 3)  $p < 0.05$

While ANOVA identified that there are four knowledge components, of which perceptions of importance are significantly different across three groups, it does not reveal where these differences lie. Post-hoc tests using Tukey HSD are therefore conducted to explore which of the groups differ. The results of the Post-hoc tests are presented in table 5.11.

For OKB03, *electronic data interchange*, post-hoc comparisons using the Tukey HSD test indicate that the mean score for Group 1 is significantly different from Group 2 (Mean difference = 0.54). Group 3 does not differ significantly from either Group 1 or 3 (Mean difference = 0.36 or 0.19). With regard to OKB06, *personal work attitudes*, no significant difference is found between Group 3 and Group 1 or 2 (Mean difference = 0.27 or 0.03). There is however a significant difference between Group 1 and Group 2 (Mean difference = 0.29). Regarding *information communication technologies, such as intranet including email, bulletin board system and e-forum*, Group 1 differs significantly from both Groups 2 and 3 (Mean

differences = 0.48 and 0.45). No significant difference is found between Groups 2 and 3 (Mean difference = 0.03). Finally, *personal professional qualifications such as certificates of competency* (OKB11), a significant difference is found between Groups 1 and 2 (Mean difference = 0.48). Group 3 does not differ significantly from either Group 1 or 2 (Mean difference = 0.25 or 0.23).

**Table 5.11 Post-hoc tests (Tukey HSD) – OKB by total work experience**

Variable	(I) TTL WEXP	(J) TTL WEXP	Mean Dif (I-J)	Sig.	95% CI	
					Upper	Lower
OKB03	1 <= 9	2 10 - 16	0.542	<b>0.004</b>	0.14	0.94
		3 17+	0.356	0.091	-0.04	0.76
	2 10 - 16	1 <= 9	-0.542	<b>0.004</b>	-0.94	-0.14
		3 17+	-0.186	0.515	-0.59	0.21
	3 17+	1 <= 9	-0.356	0.091	-0.76	0.04
		2 10 - 16	0.186	0.515	-0.21	0.59
OKB06	1 <= 9	2 10 - 16	-0.292	<b>0.030</b>	-0.56	-0.02
		3 17+	-0.265	0.056	-0.53	0.01
	2 10 - 16	1 <= 9	0.292	<b>0.030</b>	0.02	0.56
		3 17+	0.027	0.969	-0.24	0.30
	3 17+	1 <= 9	0.265	0.056	-0.01	0.53
		2 10 - 16	-0.027	0.969	-0.30	0.24
OKB10	1 <= 9	2 10 - 16	0.479	<b>0.008</b>	0.11	0.85
		3 17+	0.445	<b>0.016</b>	0.07	0.82
	2 10 - 16	1 <= 9	-0.479	<b>0.008</b>	-0.85	-0.11
		3 17+	-0.034	0.975	-0.41	0.34
	3 17+	1 <= 9	-0.445	<b>0.016</b>	-0.82	-0.07
		2 10 - 16	0.034	0.975	-0.34	0.41
OKB11	1 <= 9	2 10 - 16	0.479	<b>0.003</b>	0.15	0.81
		3 17+	0.248	0.191	-0.09	0.58
	2 10 - 16	1 <= 9	-0.479	<b>0.003</b>	-0.81	-0.15
		3 17+	-0.231	0.235	-0.57	0.10
	3 17+	1 <= 9	-0.248	0.191	-0.58	0.09
		2 10 - 16	0.231	0.235	-0.10	0.57

\*\*\*  $p < 0.05$

#### 5.4.3.3 Perceptions of the OKB according to the fleet size

This section aims to explore whether the respondents' perceptions of the importance of each knowledge component in an OKB differ according to fleet size. Similar to the



analysis of total work experience, a one-way ANOVA is utilised to determine whether there are statistically significant differences among the three groups of respondents in their perceptions of the importance of each knowledge component. If items were found significantly different ( $p < 0.05$ ), a second step of post-hoc tests is then followed to find out exactly which of the groups differ.

**Table 5.12 ANOVA – OKB by fleet size**

OKB	Sum of mean squares			Mean Square		F	Sig.	Eta squared
	Between Groups	Within Group	Total	Between Groups	Within Group			
OKB01	0.358	93.985	94.343	0.179	0.577	0.311	0.733	0.00
OKB02	0.329	68.153	68.482	0.165	0.418	0.394	0.675	0.00
OKB03	2.071	115.327	117.398	1.035	0.708	1.463	0.235	0.02
OKB04	0.005	65.953	65.958	0.002	0.405	0.006	0.994	0.00
OKB05	3.608	96.922	100.530	1.804	0.595	3.034	0.051	0.04
OKB06	0.256	49.479	49.735	0.128	0.304	0.422	0.656	0.01
OKB07	4.746	83.302	88.048	2.373	0.511	4.643	<b>0.011</b>	0.05
OKB08	0.117	109.865	109.982	0.058	0.674	0.087	0.917	0.00
OKB09	4.527	78.298	82.825	2.263	0.480	4.712	<b>0.010</b>	0.05
OKB10	1.348	102.273	103.620	0.674	0.627	1.074	0.344	0.01
OKB11	0.535	82.549	83.084	0.268	0.506	0.528	0.591	0.01
OKB12	0.845	80.095	80.940	0.422	0.491	0.860	0.425	0.01
OKB13	1.057	77.401	78.458	0.528	0.475	1.113	0.331	0.01
OKB14	0.155	91.658	91.813	0.077	0.562	0.138	0.871	0.00

Note: 1) Sample size = 143; Number of groups = 3; 2) Degree of freedom between groups = 2; degree of freedom within groups = 140; 3)  $p < 0.05$

Table 5.12 presents the results of the ANOVA, where mean squares and their respective sums are given under categories of between-groups and within-group. F and p values are provided in column 7 and 8 of the table. The last column gives eta squared values to explore the effect size of differences, especially those with significant differences. It can be seen from the table that significant differences at  $p < 0.05$  are found in two components, *organisation's external relationships* (OKB07),  $F(2, 140) = 4.64$ ,  $p = 0.01$ ; and *personal work experience* (OKB09),  $F(2, 140) = 4.71$ ,  $p = 0.01$ . Despite reaching statistical significance, the actual differences in mean scores between the groups are moderate in both cases. The effect sizes of these two

cases, calculated using eta squared, are the same (0.05).

To further explore where these differences lie, post-hoc tests are conducted using Tukey HSD. Table 5.13 is the result of the post-hoc tests of the two knowledge components. With regard to *organisation's external relationships*, post-hoc comparisons indicate that the mean score for Group 1 ( $M = 4.35$ ,  $SD = 0.63$ ) is significantly different from Group 3 ( $M = 3.96$ ,  $SD = 0.78$ ). Group 2 ( $M = 4.08$ ,  $SD = 0.69$ ) does not differ significantly from either Group 1 or 3. Where personal work experience is concerned, a significant difference is found between Group 2 ( $M = 4.35$ ,  $SD = 0.70$ ) and Group 3 ( $M = 3.95$ ,  $SD = 0.66$ ). There is no significant difference Group 1 ( $M = 4.18$ ,  $SD = 0.74$ ) and the other two groups.

**Table 5.13 Post-hoc tests (Tukey HSD) – OKB by fleet size**

OKB	(I) FLDWT	(J) FLDWT	Mean Dif (I-J)	Sig.	95% CI	
					Upper	Lower
OKB07	1 Small	2 Medium	0.278	0.16	-0.08	0.64
		3 Large	0.393	<b>0.01</b>	0.09	0.70
	2 Medium	1 Small	-0.278	0.16	-0.64	0.08
		3 Large	0.115	0.69	-0.22	0.45
	3 Large	1 Small	-0.393	<b>0.01</b>	-0.70	-0.09
		2 Medium	-0.115	0.69	-0.45	0.22
OKB09	1 Small	2 Medium	-0.174	0.46	-0.52	0.17
		3 Large	0.230	0.16	-0.07	0.53
	2 Medium	1 Small	0.174	0.46	-0.17	0.52
		3 Large	0.403	<b>0.01</b>	0.08	0.72
	3 Large	1 Small	-0.230	0.16	-0.53	0.07
		2 Medium	-0.403	<b>0.01</b>	-0.72	-0.08

## 5.5 The effects of the human mobility on the OKB

### 5.5.1 Reliability analysis on measurement scales

Similar to the reliability analysis conducted for the measurement of the OKB, an analysis is carried out to examine the reliability of the current scale in measuring the

perceived effects of human mobility on the OKB. Table 5.14 provides the coding details of this scale. A SPSS analysis of the reliability of this 15-item scale generates a Cronbach's alpha coefficient value of 0.700, indicating that the survey instrument is reliable to measure the perceived effects of human mobility on the OKB in the shipping industry (table 5.15).

**Table 5.14 Codes of perceived effects of human mobility on the OKB**

Code	Variable
MOB01	Intake of graduates from Maritime Education Institutions (MEI) has a positive effect on the OKB
MOB02	The intake of lecturers from MEI increases the OKB
MOB03	The inflow of management staff increases the receiving organisation's OKB
MOB04	The inflow of officers increases the receiving organisation's OKB
MOB05	The inflow of ratings increases the receiving organisation's OKB
MOB06	The OKB is negatively affected when management staff leave the organisation
MOB07	The OKB is negatively affected when officers leave the organisation
MOB08	The outflow of ratings has a negative effect on the OKB
MOB09	The movement of management staff has a stronger effect on the OKB than that of seafarers
MOB10	The movement of officers has a stronger effect on the OKB than that of ratings
MOB11	Movement of personnel within the shipping industry does not affect the overall knowledge base of the industry
MOB12	Further education or training of personnel has a positive effect on the knowledge base of the whole industry
MOB13	The knowledge base of the shipping industry is negatively affected when personnel leave for positions outside the shipping industry
MOB14	Shipping organisations benefit from the overall improvement of the knowledge base of the shipping industry
MOB15	Compared with the personnel movement within the maritime industry, the impact is greater when personnel move to non-maritime industries, or into retirement

A close look at the sixth column, Cronbach's alpha if item deleted, in table 5.15 finds no value exceeds the overall alpha value of 0.700, indicating all the 15 items contribute to the overall reliability of this scale. Therefore no further step is required to investigate the original data set.

**Table 5.15 Reliability analysis of scale measuring perceived effects of human mobility on the OKB**

Alpha = .700					
Variable	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
MOB01	52.14	19.409	.403	.401	.644
MOB02	52.22	18.974	.450	.462	.637
MOB03	52.07	20.486	.265	.396	.662
MOB04	51.99	20.242	.434	.332	.647
MOB05	53.15	20.698	.144	.481	.682
MOB06	52.50	19.124	.446	.399	.638
MOB07	52.44	19.593	.411	.354	.644
MOB08	53.35	20.411	.178	.539	.677
MOB09	52.23	21.017	.132	.247	.681
MOB10	51.97	20.502	.339	.342	.655
MOB11	52.79	20.070	.175	.144	.681
MOB12	51.81	20.844	.295	.295	.660
MOB13	52.55	20.176	.289	.225	.659
MOB14	51.91	20.980	.238	.352	.666
MOB15	52.55	19.836	.280	.207	.661

### 5.5.2 Perceived effects of human mobility on the OKB

This section explores the respondents' general perceptions of the effects of human mobility on the OKB without considering possible differences when variables of workforce stability are introduced. Descriptive analyses are conducted to examine the perceived effects of various levels of mobility on the OKB. While descriptives such as mean, standard deviation, skewness and kurtosis, provide a general descriptive profile of the variables, frequencies reveal more information on the extent of acceptance of each variables.

An examination of skewness and kurtosis in table 5.16 finds no abnormality in data distribution across all 15 items. However, two mean values, *the inflow of ratings increases the receiving organisation's OKB* (MOB05), and *the outflow of ratings has a negative effect on the OKB* (MOB08), are lower than the midpoint of the scale (3 as

unsure – a neutral score), revealing that these two statements are rejected. While the rejection of these two statements is not surprising considering the low profile ratings have in a shipping organisation, the range of mean values (4.31 – 2.77) demands more information to be explored.

**Table 5.16 Perceived effects of human mobility on the OKB**

Mobility factor	Mean	Std. Deviation	Skewness	Kurtosis	Rank
MOB12	4.31	0.547	0.027	-0.615	1
MOB14	4.21	0.591	-0.089	-0.384	2
MOB10	4.15	0.579	-0.207	0.721	3
MOB04	4.13	0.534	0.116	0.299	4
MOB03	4.05	0.690	-0.183	-0.509	5
MOB01	3.98	0.746	-0.669	0.658	6
MOB02	3.90	0.776	-0.451	0.013	7
MOB09	3.89	0.797	-0.663	0.708	8
MOB07	3.68	0.697	-0.343	0.098	9
MOB06	3.62	0.751	-0.289	-0.156	10
MOB13	3.57	0.733	-0.512	0.435	11
MOB15	3.57	0.834	-0.562	0.561	12
MOB11	3.33	0.993	-0.256	-1.157	13
MOB05	<b>2.97</b>	0.877	-0.050	0.323	14
MOB08	<b>2.77</b>	0.885	-0.329	-0.079	15

A frequency table of observation (table 5.17) on each statement reveals more insight into the perceived effects of human mobility on the OKB. It is indicated that 95.7% of respondents consider that *further education and personnel training have a positive effect on the OKB* (MOB12), and 90.9% believe that *shipping organisations benefit from the overall improvement of knowledge base of the shipping industry* (MOB14). While inflow of personnel is predicted to have a positive effect on the OKB, the perceived effects vary significantly with the inflow of officers ranked the highest (91.6%), followed by the intake of graduates (80.7%), management staff (80.1%), lecturers (74.1%), and ratings the lowest (22.9%). Perceived negative effects as a result of personnel outflow are ranked lower compared with positive effects, with the outflow of the officers having 64.4% of agreement, followed by management staff (60.2%), and ratings the lowest (17.5%). In addition, 74.7% of respondents consider *the movement of management staff has a stronger effect on the OKB than that of*

seafarers (MOB09), and 91.0% perceive that *the movement of officers has a stronger effect on the OKB than that of ratings* (MOB10). These perceptions coincide with the ranking of perceived effects discussed in this section. With regard to the cross industry personnel movements, there is a mix of perceptions towards the effects brought by different levels of human mobility. Less than 60 per cent (58.4%) of respondents agree that *the knowledge base of the shipping industry is negatively affected when personnel leave for positions outside the shipping industry* (MOB13). 57.8% acknowledge that *compared with the personnel movement within the maritime industry, the impact is greater when personnel move to non-maritime industries, or into retirement* (MOB15). Regarding intra-industry movement, 54.8% of respondents suggest that the overall knowledge base of the industry is not affected when the personnel movement occurs within the shipping industry (MOB11).

**Table 5.17 Perceived effects of human mobility (frequencies)**

Mobility	Percentage of total respondents						Rank
	Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Agree & Strongly agree	
MOB12			4.2	60.8	34.9	95.7	1
MOB04			8.4	69.9	21.7	91.6	2
MOB10		0.6	8.4	66.3	24.7	91.0	3
MOB14			9.0	60.8	30.1	90.9	4
MOB01		4.8	14.5	59.0	21.7	80.7	5
MOB03		0.6	19.3	54.2	25.9	80.1	6
MOB09	0.6	4.8	19.9	54.8	19.9	74.7	7
MOB02		4.8	21.1	53.6	20.5	74.1	8
MOB07		4.8	30.7	56.0	8.4	64.4	9
MOB06		7.2	32.5	51.2	9.0	60.2	10
MOB13	0.6	6.6	34.3	52.4	6.0	58.4	11
MOB15	1.8	7.2	33.1	48.2	9.6	57.8	12
MOB11	0.6	28.3	16.3	47.0	7.8	54.8	13
MOB05	<b>5.4</b>	<b>19.3</b>	52.4	18.7	4.2	<b>22.9</b>	14
MOB08	<b>10.2</b>	<b>21.1</b>	51.2	16.3	1.2	<b>17.5</b>	15

### 5.5.3 Perceived effects of human mobility on the OKB according to current workforce stability

The earlier section explored the overall perceived effects of human mobility on the OKB in the shipping industry without identifying any underlying factors that might contribute to such perceptions regarding various levels of personnel movements. The purpose of this section is to examine whether and to what extent such perceptions can be predicted by the real workforce status of the shipping organisation. This is achieved through two steps. The first is to summarise the variables (independent) in section B.3 of the survey instrument through a factor analysis. The second is to conduct a multiple regression analysis to determine whether perceived effects can be predicted and to what extent they are explained by the independent variables derived from the first step. It should be noted that when organising the total perceived effects of human mobility, two aggregate scores are used. The first score is the total perceived effects of human mobility on the OKB within the industry (*total perceived effects of intra-industry mobility* – *tintramob*), and the other one is the total perceived effects when personnel movements cross industry boundaries (*total perceived effects of inter-industry mobility* – *tintermob*). This arrangement corresponds to the division of two sub-sections in the survey instrument.

#### 5.5.3.1 Factor analysis of current workforce status

In section B.3 of the survey instrument, respondents were asked to provide information regarding personnel turnover of their respective organisations and their attitudes towards the current workforce situation. Initially there were 12 items in the section. It is possible, through statistical techniques, to reduce a large number of related variables to a more manageable number. Factor analysis is one of these statistical techniques and will be used to reduce this 12-item scale to a smaller one. Furthermore, the principal components analysis (PCA) is adopted due to reasons addressed by Stevens (1996) and Tabachnick and Fidell (2007).

There are certain steps to follow in order to conduct a meaningful factor analysis. These include: 1) assessment of the suitability of the data for factor analysis; 2) factor

extraction; and 3) factor rotation and interpretation. The suitability of data mainly concerns the sample size. While some authors (for example Tabachnick and Fidell, 2007) suggest that a sample size of 150 is sufficient if there are several high loading marker variables, others (for example Nunnally 1978) argue that it is not the overall sample size that is of concern – rather, the ratio of subjects to items. It is suggested that while a 10 to 1 ratio is preferable, five cases for each item are adequate in most cases (Tabachnick & Fidell 2007). There are 166 cases in the current data set, meeting the requirement of 150 sample size and a preferable ratio of 10 to 1 (12 items require 120 cases). The other issue related to the suitability of data is the strength of the inter-correlations among the items. There should be evidence of coefficients greater than 0.3 in the correlation matrix. The strength of the inter-correlations can be further assessed by Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. Bartlett's test of sphericity should be significant ( $p < .05$ ) for the factor analysis to be considered appropriate and the KMO index is greater than 0.6 for a good factor analysis.

Factor extraction involves determining the smallest number of factors that can be used to best represent the interrelations among the set of variables. The final extraction should achieve a balance between a simple solution with as few factors as possible and the need to explain as much of the variance in the original data set as possible. Techniques available to assist in the decision concerning the number of factors to retain include Kaiser's criterion, scree test, and parallel analysis. Among these three, parallel analysis has been shown to be the most accurate in identifying the correct number of factors to retain with Kaiser's criterion and scree test tending to overestimate the number of components (Zwick & Velicer 1986). All three techniques are applied in the following factor analysis.

The final step involves what rotation approach to use and how to interpret the factors derived from the analysis. While there are two main approaches, orthogonal and oblique, with certain differences in terms of easiness to interpret, these two approaches often result in very similar solutions (Tabachnick & Fidell 2007). This



research thus applies Direct Oblimin, an oblique approach, when using SPSS for factor analysis.

To verify the suitability of data set for factor analysis, KMO and Bartlett's test are requested from SPSS. The result (table 5.18) shows that the KMO value is 0.642, which is greater than 0.6, and Bartlett's test is significant ( $p = 0.000$ ), therefore factor analysis is appropriate.

**Table 5.18 KMO and Bartlett's Test (workforce)**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.642
Bartlett's Test of Sphericity	Approx. Chi-Square	362.614
	df	66
	Sig.	.000

**Table 5.19 Total Variance Explained (workforce)**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings(a)
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
1	<b>2.519</b>	20.989	<b>20.989</b>	2.519	20.989	20.989	2.256
2	<b>1.860</b>	15.503	<b>36.492</b>	1.860	15.503	36.492	2.011
3	<b>1.589</b>	13.242	<b>49.734</b>	1.589	13.242	49.734	1.596
4	<b>1.149</b>	9.578	<b>59.312</b>	1.149	9.578	59.312	1.122
5	<b>1.037</b>	8.640	<b>67.952</b>	1.037	8.640	67.952	1.440
6	.768	6.401	74.352				
7	.671	5.594	79.946				
8	.644	5.363	85.309				
9	.526	4.383	89.692				
10	.506	4.220	93.913				
11	.395	3.288	97.201				
12	.336	2.799	100.000				

To determine how many factors to extract, two pieces of information provided by SPSS are consulted. The first one is **Total Variance Explained** table (table 5.19). Using Kaiser's criterion, components with eigenvalues of above 1 are to be further examined. There are five components in table 5.19 recording eigenvalues above 1 (2.519, 1.860, 1.589, 1.149, and 1.037), explaining a total of 67.95 per cent of the

variance. It is obvious that using Kaiser's criterion generated too many components. A further look at the second piece of information, the Screeplot, provided by SPSS (Appendix X) finds that there is an elbow-shape change at the point 4 indicating that only components above this point should be retained. This results in a 3-factor extraction which explains 49.73 per cent of the variance.

To further assist in the decision to retain the right number of components, a third methods is consulted, that is, parallel analysis. Using Monte Carlo PCA for Parallel Analysis (12 variables, 166 cases, and 100 replications), the average eigenvalues for 100 randomly generated samples are calculated (table 5.20). These values are systematically compared with those obtained in SPSS (table 5.19) under the corresponding rank. When the value in table 5.19 is larger than the criterion value from parallel analysis, the component is retained. This comparison results in the first 3 components to be retained (table 5.21).

**Table 5.20 Monte Carlo PCA for Parallel Analysis (workforce)**

```

Number of variables: 12
Number of subjects: 166
Number of replications: 100

+++++
Eigenvalue #          Random Eigenvalue          Standard Dev
+++++
      1              1.4522              .0602
      2              1.3336              .0507
      3              1.2430              .0406
      4              1.1560              .0365
      5              1.0794              .0320
      6              1.0137              .0329
      7              0.9551              .0289
      8              0.8879              .0304
      9              0.8260              .0309
     10              0.7623              .0346
     11              0.6882              .0332
     12              0.6026              .0443
+++++

Monte Carlo PCA for Parallel Analysis
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```

**Table 5.21 Comparison of eigenvalues (workforce)**

Component number	Actual eigenvalue from PCA (SPASS)	Criterion value from parallel analysis	decision
1	<b>2.519</b>	<b>1.4522</b>	<b>Accept</b>
2	<b>1.860</b>	<b>1.3336</b>	<b>Accept</b>
3	<b>1.589</b>	<b>1.2430</b>	<b>Accept</b>
4	1.149	1.1560	Reject
5	1.037	1.0794	Reject

The decision for retaining 3 components is fed back into the SPSS as an extraction request to generate a three-factor solution. This three-factor solution explains a total of 49.73% of the variance, with Component 1 contributing 20.99%, Component 2 contributing 15.50%, and Component 3 contributing 13.24%. To aid in the interpretation of these three components, Oblimin Rotation is performed generating two tables of loadings, the Pattern Matrix and the Structure Matrix. Table 5.22 presents these two matrices along with Commonalities. The rotated solution reveals the presence of a simple structure with two components (1 & 2) showing a number of strong loadings and all variables loading substantially on only one of the three components. Moreover, the correlations among these three factors are very weak (table 5.23). The correlations of Component 1 have  $r$  values of 0.09 and 0.04 with Components 2 and 3, while the correlation between Components 2 and 3 is 0.08. This result further supports the simple structure of three-factor solution in both pattern and structure matrices.

Looking into table 5.22, the first factor consists of four items, namely *high turnover affects organisational performance* (B.3.7) and *shipping operations* (B.3.8), *the need to reduce personnel turnover* (B.3.10), and *the preference for a stable workforce* (B.3.12). This factor is labelled as ***total preference for a stable workforce*** (tprefwork) as one of three independent variables for the multiple regression analysis of perceived effects of mobility on the OKB. Factor 2 is labelled as ***total turnover pattern*** (tturpatt) and comprised three pairs of comparisons (seafarers vs. shore-based – B.3.3; officers vs. ratings – B. 3.4; and higher rank officers vs. other seafarers – B.3.5). The third factor reflects the general level of workforce stability and optimism towards personnel turnover in the shipping industry and is given a variable name of

**total stability and optimism** (tstaopt). This factor includes five items initially: *entire workforce* (B.3.1), *shore-based positions* (B.3.2), *high turnover is normal* (B.3.9), *turnover is not an issue provided there are enough people to recruit* (B.3.11); and *seafarers are contract-based* (B.3.6). A close look at B.3.6 finds that the pattern and structure coefficients of this item are very low (0.293 and 0.291) with an even lower commonality (0.09). After careful examination, it is decided that this item does not fit into any of these three factors and it is thus dropped.

**Table 5.22 Pattern and Structure Matrices for PCA with Oblimin Rotation of three-factor solution of workforce status**

Item	Pattern coefficients			Structure coefficients			Comm.
	Component			Component			
	1	2	3	1	2	3	
B.3.7	<b>0.795</b>	0.004	0.060	<b>0.798</b>	0.083	0.092	0.641
B.3.8	<b>0.756</b>	0.061	-0.089	<b>0.758</b>	0.125	-0.054	0.586
B.3.10	<b>0.678</b>	-0.048	-0.122	<b>0.669</b>	0.005	-0.099	0.466
B.3.12	<b>0.622</b>	0.081	0.278	<b>0.640</b>	0.162	0.309	0.497
B.3.4	0.047	<b>0.853</b>	-0.002	0.127	<b>0.858</b>	0.072	0.738
B.3.5	-0.022	<b>0.839</b>	-0.205	0.049	<b>0.820</b>	-0.136	0.715
B.3.3	0.007	<b>0.703</b>	0.146	0.079	<b>0.716</b>	0.205	0.534
B.3.1	0.259	-0.076	<b>0.693</b>	0.279	0.006	<b>0.696</b>	0.554
B.3.9	-0.300	0.042	<b>0.623</b>	-0.272	0.066	<b>0.615</b>	0.467
B.3.11	-0.226	0.014	<b>0.523</b>	-0.204	0.036	<b>0.515</b>	0.316
B.3.2	0.143	0.211	<b>0.519</b>	0.183	0.267	<b>0.543</b>	0.364
B.3.6	0.054	-0.060	<b>0.293</b>	0.060	-0.031	<b>0.291</b>	0.090

**Table 5.23 Component correlation matrix (PCA and Oblimin with Kaiser normalisation)**

Component	1	2	3
1	1.000	.093	.039
2	.093	1.000	.083
3	.039	.083	1.000

### 5.5.3.2 Predictability of three factors on the perceived effects of human mobility on the OKB

While section 5.5.2 presents an overall picture of perceived effects on the OKB as a result of different levels of personnel movement, it does not explain whether such

perceptions are in fact influenced, or can be predicted, by the current workforce status of the respondent's organisation. To explore how respondents' perceptions might be affected, multiple regression analysis, more specifically standard multiple regression, is applied to evaluate the predictive power of each of the three factors derived from the previous factor analysis and the predictability as a group.

A thorough examination of assumptions for multiple regression is conducted to ensure the appropriate use of this technique. These assumptions include sample size, multicollinearity and singularity, outliers, normality, linearity, homoscedasticity, and independence of residuals. As for the sample size, about 15 cases per predictor are needed for reliable equation (Stevens 1996), or  $N > 50 + 8m$ , where  $m$  is the number of independent variables (Tabachnick & Fidell 2007). There are only three independent variables involving the multiple regression analysis. The requirement of the sample size is met in both situations.

The multicollinearity and singularity can be examined through the correlations between variables (table 5.24). While there should be at least some relationship between the independent and dependent variables (preferably above 0.3), a high correlation (above 0.7) between each of the independent variables may be problematic. It can be seen from table 5.24 that the correlations between 3 independent variables and the dependent variable are 0.349, 0.199, and 0.216 respectively. These values are considered acceptable. Correlations between each of the independent variables are 0.138, 0.098, and 0.038, much lower than 0.7; therefore all variables will be retained. No violation is found to both multicollinearity and singularity.

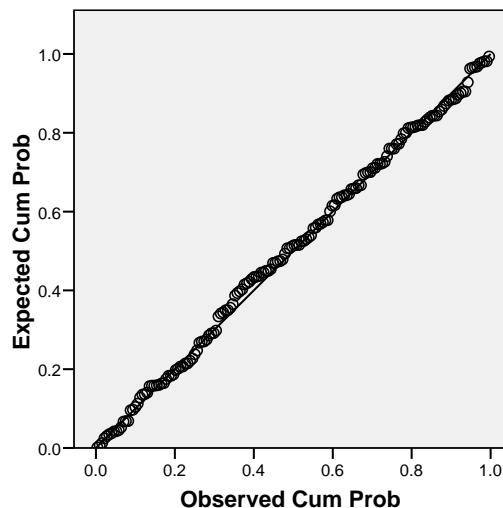
Two pieces of information generated by SPSS, the Normal Probability Plot (P-P) of the Regression Standardised Residual and the Scatterplot, can be used to check any possible outliers, normality, linearity, homoscedasticity, and independence of residuals. In the Normal P-P Plot (figure 5.7), points lie in a reasonably straight diagonal line from bottom left to top right indicating a good linear relationship and

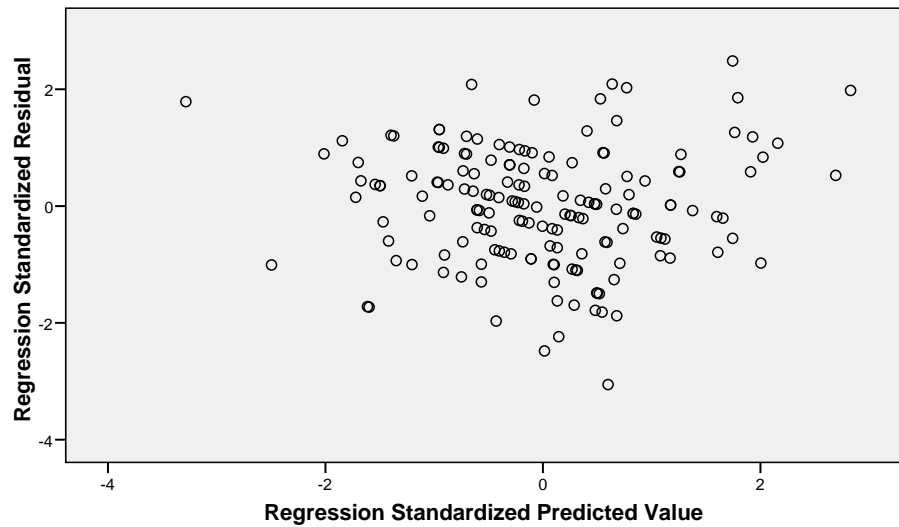
no major deviations from normality. Furthermore, in the Scatterplot of the standardised residuals (figure 5.8), residuals are rectangularly distributed, with most of the scores concentrated in the centre (between 2 and -2), showing there is no violation to homoscedasticity. The Scatterplot also helps to detect outliers. Points that have a standardised residual of more than 3.3 or less than -3.3 are considered outliers (Tabachnick & Fidell 2007). There is only one case which has a standardised residual slightly less than -3 (low middle). From the Casewise Diagnostics, it is found that the exact standardised residual is -3.055 which is within the normal range. A second check of Mahalanobis distance finds the case has a value of 15.46, lower than the critical value of 16.27 (3 independent variables). Therefore the case should not be considered as an outlier.

**Table 5.24 Correlations between variables (MOB)**

		tintramob	tprefwork	tturpatt	tstaopt
Pearson Correlation	tintramob	1.000	.349	.199	.216
	tprefwork	.349	1.000	.138	.038
	tturpatt	.199	.138	1.000	.098
	tstaopt	.216	.038	.098	1.000
Sig. (1-tailed)	tintramob	.	.000	.005	.003
	tprefwork	.000	.	.038	.313
	tturpatt	.005	.038	.	.104
	tstaopt	.003	.313	.104	.

**Figure 5.7 Normal P-P Plot of regression standardised residual (tintramob)**



**Figure 5.8 Scatterplot (dependent variable: tintramob)**

A thorough check of assumptions finds no violation for this multiple regression analysis. The next step is to find out to what extent perceived effects of mobility within the shipping industry can be predicted or explained by the current workforce status and the respondents' attitudes towards the stability of their workforces. From table 5.25, it can be found that the model as a whole (3 independent variables) explains 18.1 per cent of the variance in perceived effects of mobility on the OKB [R Square = 0.181,  $F(3, 162) = 11.90$ ,  $p < 0.0005$ ] (tables 5.25 and 5.26). Therefore the model reaches statistical significance. When comparing the contribution of each independent variable in table 5.27, the total preferred workforce has the largest beta coefficient of 0.323, making the strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model is controlled. The second largest contribution is made by the total workforce stability and optimism towards the current workforce status (beta = 0.191) with the total turnover pattern contributing the least with a beta value of 0.135.

**Table 5.25 Model Summary (tintramob)**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.425(a)	.181	.165	3.294

a Predictors: (Constant), tstaopt, tprefwork, tturpatt

b Dependent Variable: tintramob

**Table 5.26 ANOVA (tintramob)**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	387.263	3	129.088	11.900	.000(a)
	Residual	1757.267	162	10.847		
	Total	2144.530	165			

a Predictors: (Constant), tstaopt, tprefwork, tturpatt

b Dependent Variable: tintramob

**Table 5.27 Coefficients (intramob)**

Factor	Unstandardized Coefficients		Std. Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tol.	VIF
Constant	22.008	2.559		8.602	0.000					
tprefwork	0.535	0.119	0.323	4.492	0.000	0.349	0.333	0.319	0.980	1.020
tturpatt	0.209	0.112	0.135	1.876	0.062	0.199	0.146	0.133	0.972	1.029
tstaopt	0.282	0.106	0.191	2.666	0.008	0.216	0.205	0.190	0.990	1.010

A further look into the significance values in table 5.27 finds that both *tprefwork* and *tstaopt* are making a significant unique contribution to the prediction of the perceived effects of mobility within the shipping industry (beta = 0.323,  $p < 0.001$ ; beta = 0.191,  $p < 0.01$ ). *Tturpatt*, however, has a  $p$  value of slightly more than 0.05 and is not considered making a significant unique contribution to the dependent variable (beta = 0.135,  $p = 0.06$ ).

## 5.6 Effective knowledge transfer practices

### 5.6.1 Reliability analysis on measurement scales

The measurement scale of effective knowledge management practices is subject to a reliability analysis before any other statistical analyses are conducted to evaluate if items within the scale are measuring the same thing. The coding details of this scale are provided in table 5.28.



**Table 5.28 Codes of effective knowledge transfer practices**

<b>Code</b>	<b>Variable</b>
EKT01	Learning and sharing environment enhances knowledge flows within the organisation
EKT02	Accessibility of data storage and retrieval systems through information technology facilitates knowledge transfer
EKT03	Knowledge transfer is encouraged when an organisation commits resources to related activities
EKT04	Information technology is effective in facilitating the transfer of explicit knowledge, for instance written instructions or manuals
EKT05	Knowledge transfer is facilitated when there is mutual trust between employees and their senior managers
EKT06	Knowledge flow is enhanced when there is a high level of collaboration among individuals across departments.
EKT07	Availability of communication-related technology such as email, video conferencing, bulletin boards, and discussion forum enables effective knowledge transfer among participants
EKT08	Organisational culture that tolerates failure fosters confidence to share experiences
EKT09	Information technology by itself is ineffective in transferring experiential knowledge, for example, the diagnosis of a problem
EKT10	Knowledge transfer is facilitated in organisational culture where collective efforts are valued
EKT11	Organisational culture that nourishes horizontal communication enhances a high level of collaboration among individuals across departments
EKT12	Knowledge transfer can be facilitated by properly recognising active learning and sharing behaviours
EKT13	Organisational culture that advocates equity among departments reduces the tendency of knowledge protection therefore increasing the likelihood of knowledge transfer within the organisation
EKT14	Communication-related technology such as email, video conferencing, e-directories, bulletin boards, and discussion forums helps build up personal relationship through easy communication

A SPSS analysis of the reliability of this 14-item scale generates a Cronbach's alpha coefficient value of 0.849, which is a rather high alpha value, showing that the survey instrument is very reliable to measure effective knowledge transfer practices in the shipping industry (table 5.29). A close look at the sixth column, Cronbach's alpha if item deleted finds one value (EKT09, 0.853) is greater than the overall alpha value of 0.849, which means the scale would be more reliable if this item is deleted. A further investigation of the original survey instrument and data set reveals that this is a reverse-scored item and that all necessary steps have been taken to ensure the

consistency of the scale. With regard to the decision to remove an item from a scale, it is suggested that a removal should be considered if the overall alpha is less than 0.7 (Pallant, 2007). For this present case, the overall alpha is well above 0.7 and in fact the increase is very marginal if EKT09 is deleted, thus the item will be retained in the scale.

**Table 5.29 Reliability analysis of scale measuring effective knowledge transfer practices**

Alpha = .849					
Variable	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
EKT01	52.46	21.971	.477	.412	.804
EKT02	52.62	21.182	.558	.464	.798
EKT03	52.61	21.826	.454	.463	.805
EKT04	52.78	20.692	.681	.521	.790
EKT05	52.57	21.205	.532	.480	.799
EKT06	52.50	21.839	.501	.522	.803
EKT07	52.75	21.172	.634	.513	.794
EKT08	52.73	21.602	.354	.341	.814
EKT09	54.27	23.093	.053	.179	.853
EKT10	52.81	21.001	.562	.473	.797
EKT11	52.76	21.881	.589	.492	.799
EKT12	52.68	21.261	.604	.445	.796
EKT13	52.73	21.396	.409	.334	.809
EKT14	52.99	21.909	.331	.258	.815

### 5.6.2 Perceptions of effective knowledge transfer practices

Table 5.30 provides an overall picture of perceptions of respondents on the 14 proposed effective knowledge transfer (EKT) practices. Mean scores of all 14 items exceed the midpoint of 3 indicating an overall acceptance of the statements. Among the 14 proposed EKT practices, 12 of them achieve scores more than 4 (4.40 – 4.05). It should be noted that scores for EKT09, *information technology by itself is ineffective in transferring experiential knowledge*, have been reversed (3.40). When this mean score is greater than 3, the true perception is that information technology by itself is effective in transferring experiential knowledge.

**Table 5.30 Perceptions of effective knowledge transfer practices**

Effective knowledge transfer	Mean	Std. Deviation	Skewness	Kurtosis	Rank
EKT01	4.40	0.539	-0.078	-1.052	1
EKT06	4.37	0.543	-0.031	-0.896	2
EKT05	4.30	0.627	-1.074	4.222	3
EKT03	4.25	0.590	-0.127	-0.478	4
EKT02	4.25	0.607	-0.838	3.887	5
EKT12	4.19	0.557	0.044	-0.109	6
EKT13	4.13	0.726	-1.072	3.088	7
EKT08	4.13	0.759	-0.648	0.662	8
EKT07	4.12	0.548	0.066	0.200	9
EKT11	4.11	0.467	0.364	1.264	10
EKT04	4.08	0.587	-0.197	0.642	11
EKT10	4.05	0.635	-0.188	0.021	12
EKT14	3.87	0.723	-0.193	-0.240	13
EKT09 (Rev)	3.40	1.026	-0.657	-0.204	14

More details can be revealed through table 5.31, where the percentage of each score is presented. 8 out of 14 items receive more than 90 per cent of acceptance among all respondents, with the first one being *learning and sharing environment* (97.6%), followed by *a high level of collaboration among individuals across departments* (97.0%), and *mutual trust between employees and their senior managers* (95.1%). The remaining 5 items that receive over 90 per cent acceptance are: *horizontal communication* (94.0%), *data storage and retrieval systems* (93.9%), *learning and sharing behaviours recognised* (92.2%), *resource commitment* (92.1%), and *availability of communication-related technology* (90.4%). Three information technology related items receive relatively low scores with *IT is effective in transferring experiential knowledge* (reversed) ranked the lowest (56.6%), *strengthening of personal relationship through communication-related technologies* the second lowest (71.7%), and *IT is effective in transferring explicit knowledge* the ninth (88.0%). The remaining three culture-initiated practices, *equity among departments*, *collectivism*, and *tolerance of failures*, are ranked between the 10<sup>th</sup> to the 12<sup>th</sup> with the percentage of agreement at 86.7%, 83.7%, and 81.3% respectively.

**Table 5.31 Perceptions on the proposed effective knowledge transfer practices**

Effective Knowledge Transfer	Percentage of total respondents						Rank
	Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Agree & Strongly agree	
EKT01			2.4	54.8	42.8	97.6	1
EKT06			3.0	57.2	39.8	97.0	2
EKT05	0.6	0.6	3.6	58.4	36.7	95.1	3
EKT11			6.0	77.1	16.9	94.0	4
EKT02	0.6		5.4	62.0	31.9	93.9	5
EKT12			7.8	65.7	26.5	92.2	6
EKT03			7.8	59.0	33.1	92.1	7
EKT07			9.6	68.7	21.7	90.4	8
EKT04		0.6	11.4	66.9	21.1	88.0	9
EKT13	1.2	0.6	11.4	57.2	29.5	86.7	10
EKT10		0.6	15.7	61.4	22.3	83.7	11
EKT08	0.6	0.6	17.5	47.6	33.7	81.3	12
EKT14		2.4	25.9	53.6	18.1	71.7	13
EKT09 (Rev)	5.4	15.1	22.9	46.7	9.0	56.6	14

### 5.6.3 Perceptions of EKT according to current management practices

While descriptive information provides an aggregate of perceptions of effective knowledge transfer practices among all 166 respondents, it does not tell whether such perceptions vary from specific conditions in respondents' organisations, especially existing management practices. The aim of this section is to explore whether and to what extent perceptions of EKT can be predicted by current management practices employed by the respondents' organisations. Similar to section 5.5.3, the examination consists of two steps. The first step is to reduce the number of independent variables as specified in the second part of section D (D10-D32) of the survey instrument by using a factor analysis. Once the independent variables are reduced to a smaller and more manageable number, a multiple regression analysis is conducted as a second step to determine whether there are underlying relationships between the perceptions of EKT and current management practices. The dependent variable in this analysis is the *total perceptions of effective knowledge transfer* (E.9 reversed). As discussed earlier, the Cronbach's alpha of this scale is 0.849 and considered very reliable for the

measurement of effective knowledge transfer.

### 5.6.3.1 Factor analysis of current management practices

In the second part of section D (D10 – D32) of the survey instrument, respondents were asked to provide information in relation to current management practices of their respective organisations. Questions cover a wide range of management practices such as recruitment and retention, monetary and non-monetary incentives, resource commitment, formal and informal networking, and applications of information technologies. The factor analysis is to reduce the number of these independent variables from 23 to a smaller more manageable one.

While no repetition is made in this section to justify the use and to explain the procedures of factor analysis, a brief examination of assumptions is given prior to any further analysis. Firstly, the number of valid cases (166) returned from the survey meets the requirements of an overall sample size of 150+ and a ratio of at least five cases for each of the independent variables ( $23 \times 5 = 115$ ). Next, there should be evidence of coefficients greater than 0.3 spread across the correlation matrix. An inspection of the initial analysis confirms the presence of these values. Finally, the strength of the inter-correlations is further assessed by Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. These two values are presented in table 5.32. The KMO index is 0.754, greater than the suggested minimum value of 0.6, and Bartlett's test of sphericity is significant ( $p = 0.000$ ), indicating the suitability of a factor analysis.

**Table 5.32 KMO and Bartlett's Test (management practices)**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.754
Bartlett's Test of Sphericity	Approx. Chi-Square	1371.976
	df	253
	Sig.	.000

The analysis once again adopts the principal components analysis (PCA) technique, and applies Direct Oblimin as rotation approach. A SPSS factor analysis of the 23 independent variables finds 7 components with eigenvalues above 1 (5.698, 2.293, 1.849, 1.502, 1.334, 1.183, and 1.009), explaining 64.64 per cent of the variance (table 5.333). Using Kaiser's criterion of retaining components with eigenvalues above 1 generates too many components. Further information is required to decide how many components should be retained.

**Table 5.33 Total Variance Explained (management practices)**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings(a)
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	<b>5.698</b>	24.772	<b>24.772</b>	5.698	24.772	24.772	3.351
2	<b>2.293</b>	9.970	<b>34.742</b>	2.293	9.970	34.742	2.912
3	<b>1.849</b>	8.037	<b>42.780</b>	1.849	8.037	42.780	2.617
4	<b>1.502</b>	6.530	<b>49.310</b>	1.502	6.530	49.310	2.307
5	<b>1.334</b>	5.799	<b>55.109</b>	1.334	5.799	55.109	2.393
6	<b>1.183</b>	5.143	<b>60.251</b>	1.183	5.143	60.251	2.201
7	<b>1.009</b>	4.388	<b>64.639</b>	1.009	4.388	64.639	2.908
8	.957	4.161	68.800				
9	.883	3.838	72.638				
10	.803	3.492	76.130				
11	.684	2.973	79.103				
12	.671	2.919	82.022				
13	.640	2.784	84.806				
14	.534	2.321	87.126				
15	.486	2.113	89.240				
16	.444	1.932	91.172				
17	.425	1.850	93.022				
18	.371	1.615	94.637				
19	.318	1.384	96.021				
20	.304	1.322	97.343				
21	.277	1.204	98.547				
22	.182	.791	99.338				
23	.152	.662	100.000				

The second piece of information given by SPSS is the Screeplot (Appendix XI). The first elbow-shape change is at point 2 and the second at point 4, giving options of a one- or three- component extraction solution. To further assist the decision to extract

the right number of components, a third and more rigorous technique is applied, that is, a parallel analysis. Relevant information (numbers of variables - 23, cases - 166, and replications - 100) is input into Monte Carlo's parallel analysis program, generating a table of random eigenvalues (table 5.34). These values are compared with those in table 5.33 systematically under the corresponding rank. The component is retained when the value in table 5.33 is greater than the corresponding average eigenvalue in table 5.34. The parallel analysis results in the first four components being retained (table 5.35).

**Table 5.34 Monte Carlo PCA for Parallel Analysis (management practices)**

Number of variables: 23  
Number of subjects: 166  
Number of replications: 100

+++++		
Eigenvalue #	Random Eigenvalue	Standard Dev
+++++		
1	<b>1.7398</b>	.0772
2	<b>1.6145</b>	.0566
3	<b>1.5217</b>	.0401
4	<b>1.4350</b>	.0390
5	1.3642	.0370
6	1.2928	.0353
7	1.2273	.0292
8	1.1691	.0306
9	1.1120	.0241
10	1.0586	.0259
11	1.0054	.0272
12	0.9565	.0284
13	0.9078	.0273
14	0.8617	.0230
15	0.8169	.0231
16	0.7728	.0245
17	0.7275	.0255
18	0.6847	.0239
19	0.6401	.0238
20	0.5966	.0240
21	0.5528	.0275
22	0.5038	.0273
23	0.4385	.0325
+++++		

Monte Carlo PCA for Parallel Analysis  
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**Table 5.35 Comparison of eigenvalues (management practices)**

Component number	Actual eigenvalue from PCA (SPASS)	Criterion value from parallel analysis	decision
1	<b>5.698</b>	<b>1.7398</b>	<b>Accept</b>
2	<b>2.293</b>	<b>1.6145</b>	<b>Accept</b>
3	<b>1.849</b>	<b>1.5217</b>	<b>Accept</b>
4	<b>1.502</b>	<b>1.4350</b>	<b>Accept</b>
5	1.334	1.3642	Reject
6	1.183	1.2928	Reject
7	1.009	1.2273	Reject

The 4-component extraction decision is fed back into the SPSS as a request to generate a four-factor extraction solution. This solution explains a total of 49.31% of the variance, with four components contributing 24.77%, 9.97%, 8.04%, and 6.53% respectively. To aid in the interpretation of this four-factor solution, Oblimin rotation is performed generating two tables of loadings, the Pattern Matrix and the Structure Matrix. These two matrices of loadings are presented along with Commonalities of each item in table 5.36.

The results of two matrices with the four-factor solution indicate that a majority of items is loaded highly on one factor only. This initial loading and grouping (as highlighted) provides an overall structure of this solution with the first factor being a networking and resource commitment, the second monetary incentives, the third overall recruitment and retention attitudes, and the fourth non-monetary incentives.

An inspection into table 5.36 finds the presence of both negative and positive loadings on the same factor and strong loadings on multiple factors as highlighted in both matrices. To refine the factors obtained, an approach suggested by Pett, Lackey and Sullivan (2003) is applied. Firstly, two negatively loaded items, *we fully pay for employee training* (D.23), and *we provide onboard-to-onshore career paths for our staff* (D.17), are together with three other positively loaded items on factor 2. An examination of this factor with all five items reveals that the underlying measurement is monetary incentives provided to attract and retain employees. Under a high salary package, expenses involved personal development such as training, are covered by



individuals and this is well explained by D.25, *our employees take care of their own training needs*. The stronger monetary incentives are applied, the higher the tendency is for individuals to pay for their own personal development. Similar to D.17, when personal development is left to individuals, it is less likely that there will be designed career paths as a means of attracting and retaining personnel. Thus the scores of these two items will be reversed.

**Table 5.36 Pattern and Structure Matrices for PCA with Oblimin Rotation of four-factor solution of current management practices**

Item	Pattern coefficients				structure coefficients				Comm.
	Component				Component				
	1	2	3	4	1	2	3	4	
D.28	<b>0.750</b>	0.003	0.012	-0.051	<b>0.732</b>	-0.122	-0.075	0.183	0.539
D.20	<b>0.745</b>	0.222	-0.072	-0.025	<b>0.708</b>	0.092	-0.144	0.209	0.553
D.21	<b>0.692</b>	0.080	-0.155	0.074	<b>0.720</b>	-0.048	-0.235	0.297	0.553
D.26	<b>0.676</b>	-0.055	-0.003	-0.241	<b>0.610</b>	-0.167	-0.077	-0.029	0.429
D.29	<b>0.513</b>	0.071	0.054	0.120	<b>0.532</b>	-0.012	-0.007	0.278	0.305
D.24	<b>0.506</b>	<b>-0.465</b>	0.006	-0.100	<b>0.552</b>	<b>-0.549</b>	-0.083	0.061	0.528
D.30	<b>0.456</b>	-0.200	0.028	0.124	<b>0.525</b>	-0.275	-0.046	0.266	0.326
D.18	<b>0.404</b>	-0.232	-0.073	<b>0.399</b>	<b>0.577</b>	-0.308	-0.155	<b>0.530</b>	0.528
D.27	<b>0.361</b>	-0.109	0.012	0.243	<b>0.454</b>	-0.170	-0.049	0.356	0.269
D.25	0.206	<b>0.643</b>	0.348	-0.085	0.030	<b>0.634</b>	0.373	-0.039	0.547
D.23	0.087	<b>-0.622</b>	-0.075	0.344	0.308	<b>-0.644</b>	-0.145	0.378	0.568
D.14	0.270	<b>0.531</b>	-0.196	<b>0.455</b>	0.346	<b>0.469</b>	-0.210	<b>0.545</b>	0.631
D.17	0.348	<b>-0.488</b>	0.092	0.045	0.434	<b>-0.540</b>	0.014	0.153	0.422
D.13	0.306	<b>0.483</b>	-0.196	<b>0.467</b>	0.394	<b>0.415</b>	-0.218	<b>0.569</b>	0.630
D.12	-0.070	-0.026	<b>0.839</b>	-0.208	-0.231	0.047	<b>0.854</b>	-0.266	0.787
D.11	-0.027	0.103	<b>0.781</b>	-0.137	-0.180	0.164	<b>0.798</b>	-0.180	0.670
D.31	-0.207	0.282	<b>0.400</b>	0.301	-0.208	0.344	<b>0.432</b>	0.218	0.379
D.10	0.167	-0.148	<b>0.344</b>	0.259	0.232	-0.153	<b>0.303</b>	0.297	<b>0.242</b>
D.16	-0.090	0.074	-0.120	<b>0.747</b>	0.145	0.077	-0.136	<b>0.724</b>	0.550
D.15	-0.012	-0.118	-0.191	<b>0.745</b>	0.263	-0.134	-0.230	<b>0.750</b>	0.616
D.22	-0.049	-0.015	0.299	<b>0.521</b>	0.082	0.011	0.281	<b>0.493</b>	0.337
D.19	0.271	-0.264	-0.140	<b>0.518</b>	0.494	-0.322	-0.214	<b>0.610</b>	0.565
D.32	<b>0.359</b>	0.055	0.022	<b>0.398</b>	<b>0.471</b>	-0.006	-0.034	<b>0.509</b>	0.370

Because there is no item with weak loading ( $< 0.3$ ) on all factors, the second step is to find strong loadings ( $> 0.4$ ) on multiple factors. An inspection finds that there are 5

items of concern (D.24, D.18, D.14, D.13, and D.32). It is suggested that multiple loaded items should be placed with the best fitting factor conceptually (Pett *et al.* 2003). D.24, *we partially pay for employee training*, is related to monetary incentives and should be grouped into (with a reversed score) factor 2. Similarly, D.14, *we provide higher salary to attract new employees*, and D.13, *we provide higher salary to retain our current staff*, although highly loaded on factor 4 as well (0.545, 0.569), are monetary incentives and thus remain on factor 2. D.18, *we support personal development*, has a similar loadings on both factor 1 and 4. Conceptually, it is clearly a non-monetary incentive and should be moved to factor 4. Finally, D.32, *onboard crew have free access to internet*, has similar loading on both factor 1 and 4. As internet access is considered related to resource commitment, it is thus grouped with factor 1.

To investigate the internal consistency of these groupings under each factor as discussed earlier, an alpha coefficient for each factor is conducted, especially information on whether alpha is negatively affected by the deletion of items. The result of the reliability analyses of four scales (factors) is provided in table 5.37. The alpha coefficients of factors 1 and 2 are 0.780 and 0.580, with no item being found negatively affecting the overall alpha values. In factors 3 and 4, however, alpha coefficients would have been increased if items are deleted, that is, the alpha would have been increased if D.31 and D.10 are deleted in factor 3, and if D.22 is deleted in factor 4. Further examination finds that D.10, *employee retention is very important to our operations*, and D.31, *only senior managers have access to these documents*, do not fit well in factor 3 (a total recruitment and retention scale). The deletion of these two items does not conceptually affect this scale. The alpha coefficient is increased from 0.527 to 0.818 after the deletion. In a similar way, D.22, *we source out our training tasks*, does not contribute to the improvement of factor 4. It is not conceptually vital to the scale and its deletion in fact increases the overall reliability of this scale from 0.714 to 0.762. Summarised information of these four factors is provided in table 5.38 with the number of items in each factor and their relevant alpha coefficients.

**Table 5.37 Result of reliability analyses of four factors**

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
<b>Factor 1 alpha = 0.780</b>					
D.28	21.922	17.091	0.578	0.354	0.739
D.20	22.277	15.741	0.555	0.407	0.740
D.21	22.566	16.393	0.555	0.376	0.740
D.26	22.910	17.586	0.456	0.227	0.757
D.29	21.867	18.249	0.434	0.197	0.761
D.30	21.880	18.131	0.444	0.217	0.759
D.27	22.259	17.648	0.403	0.228	0.766
D.32	23.367	16.840	0.435	0.208	0.763
<b>Factor 2 alpha = 0.580</b>					
D.24 (Rev)	14.398	6.980	0.373	0.266	0.517
D.23 (Rev)	14.578	6.900	0.393	0.284	0.507
D.17 (Rev)	14.620	8.213	0.267	0.150	0.563
D.25	14.392	6.918	0.392	0.200	0.508
D.14	13.964	7.962	0.266	0.562	0.563
D.13	14.042	8.101	0.235	0.571	0.575
<b>Factor 3 alpha = 0.527</b>					
D.12	9.922	2.739	0.634	0.521	0.197
D.11	9.928	3.207	0.500	0.485	0.350
D.10	8.837	5.446	0.096	0.033	0.632
D.31	10.277	4.129	0.205	0.069	0.617
<b>Factor 4 alpha = 0.714</b>					
D.18	13.982	5.036	0.475	0.402	0.640
D.16	14.120	4.907	0.464	0.373	0.642
D.15	14.084	4.587	0.621	0.467	0.579
D.22	14.313	5.259	0.218	0.065	0.762
D.19	14.102	4.577	0.563	0.475	0.599
<b>Factor 3 (D.10, D.31 deleted) alpha = 0.818</b>					
D.12	3.066	1.093	0.693	0.480	
D.11	3.060	1.015	0.693	0.480	
<b>Factor 4 (D.22 deleted) alpha = 0.762</b>					
D.18	10.645	3.406	0.506	0.400	0.733
D.16	10.783	3.298	0.491	0.373	0.743
D.15	10.747	3.111	0.622	0.449	0.672
D.19	10.765	2.957	0.628	0.475	0.667

**Table 5.38 Reliability results after the deletion and reassignment of items**

Factor	Before		After		
	Number of item	Alpha	Number of item	Alpha	Gain in alpha
1	8	0.780	8	0.780	0.000
2	6	0.580	6	0.580	0.000
3	4	0.527	2	0.818	0.291
4	5	0.714	4	0.762	0.048

**Table 5.39 Interpretation of factors**

Factor	Interpretation	Items included	alpha
1	Networking and resource commitment	D.28, D.20, D.21, D.26, D.29, D.30, D.27, D.32	0.780
2	Monetary incentives	D.24(Rev), D.25, D.23(Rev), D.14, D.17(Rev), D.13	0.580
3	Total recruitment and retention	D.11, D.12	0.818
4	Non-monetary incentives	D.18, D.16, D.15, D.19	0.762

The earlier discussion on the deletion and reassignment of items leads to a new structure of the four-factor solution as indicated in table 5.39. Factor 1(*networking and resource commitment*) includes eight items related to the formal and informal networking and organisational commitment on resources towards these activities. The second factor contains six monetary incentives that an organisation applies to attract new staff and retain current employees, and is named as *monetary incentives*. Only two items retained for factor 3 (*total recruitment and retention*) reflect the overall approach an organisation has on the issues of employee attraction and retention. Factor 4, named as *non-monetary incentives*, consists of five items that are non-monetary in nature as opposed to those in factor 2. These four factors are used for a multiple regression analysis to explore whether they can predict the perceptions of EKT discussed earlier.

### 5.6.3.2 Predictability of four factors solution on the perceptions of EKT

The purpose of this section is to explore if perceptions of EKT can be predicted by four factors (current management practices) as obtained from the factor analysis. A standard multiple regress analysis is conducted to determine if the four-factor

solution model as a whole predicts the perceptions of EKT in the respondents' organisations and how each factor contributes to the predictability of this model. Following the process discussed in section 5.5.3.2, an examination of multicollinearity and singularity, outliers, normality, linearity, homoscedasticity, and independence of residuals is conducted. The Normal Probability Plot (P-P) of the Regression Standardised Residual and the Scatterplot are included in Appendix XII. No violation is found to the above mentioned assumptions, although the P-P is slightly off the middle line.

The result of the multiple regression analysis is presented in tables 5.40-42. The four-factor model explains 5.4 per cent of the variance in perceptions of effective knowledge transfer practices ( $R^2 = 0.054$ ),  $F(4, 161) = 2.30$ ,  $p = 0.061$  (tables 5.40 and 5.41). The model thus only explains a low percentage of the total variance and does not reach statistical significance. Further, looking into four factors individually, the standardised coefficients (beta) of the four factors are 0.067, -0.148, 0.108, and 0.133 with their respective statistical significance values ( $p$ ) of 0.464, 0.057, 0.196, and 0.154. Once again, no factor is found making a significant unique contribution to the prediction of the perceptions of EKT within the shipping industry

**Table 5.40 Model Summary (tekst e.9 deleted)**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.233(a)	.054	.031	4.70574

a Predictors: (Constant), non monetary incentives, monetary incentives, total recruitment and retention, networking and resource commitment

b Dependent Variable: total effective knowledge transfer e9 deleted

**Table 5.41 ANOVA (tekst e.9 deleted)**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	203.927	4	50.982	2.302	.061(a)
	Residual	3565.181	161	22.144		
	Total	3769.108	165			

a Predictors: (Constant), non monetary incentives, monetary incentives, total recruitment and retention, networking and resource commitment

b Dependent Variable: total effective knowledge transfer e9 deleted

**Table 5.42 Coefficients (tekst e.9 deleted)**

Factor	Unstandardized Coefficients		Std. Coefficients			Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tol.	VIF
Constant	50.795	4.059		12.514	0.000					
Factor 1	0.068	0.093	0.067	0.735	0.464	0.127	0.058	0.056	0.712	1.404
Factor 2	-0.224	0.117	-0.148	-1.914	0.057	-0.160	-0.149	-0.147	0.978	1.023
Factor 3	0.273	0.210	0.108	1.298	0.196	0.027	0.102	0.099	0.853	1.172
Factor 4	0.278	0.194	0.133	1.432	0.154	0.142	0.112	0.110	0.676	1.479

### 5.6.3.3 Perceptions of EKT according to current KM practices

The earlier section examined the predictability of management practices (as a four-factor solution) on the perceptions of EKT. This section aims to explore more specifically the effects of knowledge management practices on the perceptions of the respondents towards EKT. Two sets of independent variables, knowledge management department (D.1)/chief knowledge officer (D.2), and current communication (D.8.4)/preferred communication (D.9.4), are used for analyses. In the second part of section D of the survey instrument, respondents were asked about whether their organisations had a knowledge management department (KMD) and if there was a designated person (e.g. chief knowledge office – CKO) responsible for the management of organisational knowledge. These two independent variables are used to investigate whether there is a significant difference in the perceptions of EKT for organisations that have KMD or CKO and organisations that do not (referred as group 1 for *yes* and group 2 for *no*). Two separate *t*-tests are conducted to compare the differences of means scores between these two groups. The results are provided in tables 5.43 and 5.44.

Table 5.43 presents the result of an independent-samples *t*-test by CKO. The 2<sup>nd</sup> and 3<sup>rd</sup> columns are means scores of these two groups, followed by *t* value and degree of freedom. The 2-tailed significance value (*p*) is provided in column six. The 95% confidence interval of the difference (CI) is given in column seven. While 2-tailed significance provides an indication of whether the difference between two groups is

statistically significant, it does not tell the magnitude of the difference. An eta squared value is therefore calculated and provided in the last column. The calculation of the eta squared is followed the formula discussed in section 5.4.3.1 of this chapter.

**Table 5.43 A t-test of EKT by CKO**

EKT	Mean		t	df	Sig. (2-tailed)	95% CI		Eta squared
	Yes	No				Upper	Lower	
EKT01	4.38	4.43	-0.492	164	0.624	-0.207	0.124	0.001
EKT02	4.30	4.21	1.032	164	0.304	-0.082	0.262	0.006
EKT03	4.29	4.21	0.853	164	0.395	-0.103	0.259	0.004
EKT04	4.22	3.95	3.140	164	<b>0.002</b>	0.101	0.441	<b>0.057</b>
EKT05	4.36	4.26	1.086	164	0.279	-0.080	0.276	0.007
EKT06	4.40	4.34	0.685	164	0.494	-0.109	0.225	0.003
EKT07	4.26	3.98	3.404	163	<b>0.001</b>	0.118	0.444	<b>0.066</b>
EKT08	4.22	4.06	1.413	164	0.160	-0.063	0.380	0.012
EKT10	4.20	3.91	3.035	164	<b>0.003</b>	0.100	0.471	<b>0.053</b>
EKT11	4.15	4.06	1.229	163	0.221	-0.054	0.231	0.009
EKT12	4.26	4.11	1.665	164	0.098	-0.027	0.313	0.017
EKT13	4.20	4.11	0.842	164	0.401	-0.115	0.285	0.004
EKT14	4.01	3.73	2.590	162	<b>0.010</b>	0.068	0.505	<b>0.039</b>
EKT09(Rev)	3.43	3.36	0.424	164	0.672	-0.248	0.383	0.001

**Table 5.44 A t-test of EKT by KMD**

EKT	Mean		t	df	Sig. (2-tailed)	95% CI		Eta squared
	Yes	No				Upper	Lower	
EKT01	4.40	4.41	-0.083	164	0.934	-0.173	0.159	0.000
EKT02	4.29	4.23	0.630	164	0.530	-0.117	0.227	0.002
EKT03	4.23	4.28	-0.589	164	0.557	-0.235	0.127	0.002
EKT04	4.16	4.02	1.579	164	0.116	-0.035	0.313	0.015
EKT05	4.28	4.35	-0.817	164	0.415	-0.252	0.105	0.004
EKT06	4.35	4.38	-0.399	164	0.690	-0.201	0.133	0.001
EKT07	4.23	4.02	2.393	158	<b>0.018</b>	0.035	0.368	<b>0.034</b>
EKT08	4.21	4.08	1.167	164	0.245	-0.091	0.353	0.008
EKT10	4.18	3.95	2.331	164	<b>0.021</b>	0.034	0.409	<b>0.032</b>
EKT11	4.11	4.10	0.108	164	0.914	-0.136	0.152	0.000
EKT12	4.28	4.10	1.986	164	<b>0.049</b>	0.001	0.340	<b>0.023</b>
EKT13	4.21	4.10	1.067	164	0.288	-0.092	0.307	0.007
EKT14	3.95	3.80	1.323	164	0.188	-0.073	0.368	0.011
EKT09(Rev)	3.41	3.38	0.180	164	0.857	-0.287	0.344	0.000

It can be seen from table 5.43 that there are four items – *IT is effective in facilitating the transfer of explicit knowledge* (EKT04), *availability of communication-related technology enables effective knowledge transfer* (EKT07), *knowledge transfer is facilitated in organisational culture where collective efforts are valued* (EKT10), *communication-related technology helps build up personal relationship through easy communication* (EKT14) – in which the difference between two groups is statistically significant. For EKT04, the mean score for *yes* is 4.22 ( $SD = 0.495$ ), and 3.95 ( $SD = 0.614$ ) for *no*, with  $t(164) = 3.140$ ,  $p < 0.01$  (two-tailed), and the magnitude of differences in the means (CI: 0.101 to 0.441) is moderate (eta squared = 0.057) (Cohen 1988). Mean scores for EKT07 are 4.26 ( $SD = 0.535$ ) and 3.98 ( $SD = 0.527$ ),  $t(163) = 3.404$ ,  $p < 0.01$ , and the magnitude of differences in the means (CI: 0.118 to 0.444) is moderate (eta squared = 0.066). For EKT10, the magnitude of differences in the means (CI: 0.100 to 0.470) is moderate (eta squared = 0.053) with mean scores of 4.20 ( $SD = 0.549$ ) and 3.91 ( $SD = 0.660$ ),  $t(164) = 3.035$ ,  $p < 0.01$ . Although statistically significant, the effect size of the differences in the means of EKT14 is small (eta squared = 0.039) with mean scores of 4.01 ( $SD = 0.694$ ) and 3.73 ( $SD = 0.729$ ),  $t(162) = 2.590$ ,  $p < 0.05$ .

The results of the  $t$ -test of EKT by KMD are presented in table 5.44. It reveals that there are three items, EKT07 and EKT10 as discussed earlier and EKT12, *knowledge transfer can be facilitated by properly recognising active learning and sharing behaviours*, reach statistic significance. However, the magnitudes of differences in the means of these three items are small (eta squared = 0.034, 0.032, and 0.023 for EKT07, EKT10, and EKT12 respectively), with mean scores of 4.23 and 4.02 for EKT07, 4.18 and 3.95 for EKT10, and 4.28 and 4.10 for EKT12.

The other set of variables used to explore the perceptions of EKT is current communication/preferred communication between offshore and on-shore management. This is to specifically identify any possible relationships between the use of technology and perceived effectiveness of information communication related practices as the means of knowledge transfer. In section D of the survey instrument,



respondents were asked to provide information on the current communication methods and preferred methods of communication (D.8.4 and D.9.4) in their daily management process. These two independent variables are used to examine whether there is a relationship between the level of technology used or preferred, and the perceptions of technology being the effective means of knowledge transfer. The total perceptions of technology related items in section E consist of EKT02, EKT04, EKT07, EKT09 (rev), and EKT14. This dependent variable is named as the total perceptions of ICT in the analyses. Two separate Pearson's correlation analyses are conducted with a preliminary analysis performed to ensure that there is no violation of the assumptions of normality, linearity and homoscedasticity. The results are presented in tables 5.45 and 5.46.

**Table 5.45 Correlations (total perceptions of ICT – current)**

		Total ICT	Internet (current)
Total ICT	Pearson Correlation	1	.254**
	Sig. (2-tailed)		.001
	N	166	166
Internet (current)	Pearson Correlation	.254**	1
	Sig. (2-tailed)	.001	
	N	166	166

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Table 5.46 Correlations (total perceptions of ICT – preferred)**

		Total ICT	Internet (preferred)
Total ICT	Pearson Correlation	1	.295**
	Sig. (2-tailed)		.000
	N	166	166
Internet (preferred)	Pearson Correlation	.295**	1
	Sig. (2-tailed)	.000	
	N	166	166

\*\* Correlation is significant at the 0.01 level (2-tailed).

From table 5.45, it can be found that there is a small positive correlation between the total perceptions of ICT and the current methods of communication,  $r = 0.25$ ,  $n = 166$ ,  $p < 0.005$ . The correlation between the total perceptions of ICT and the preferred communication methods is high reaching medium level using Cohen's (1988) guidelines,  $r = 0.30$ ,  $n = 166$ ,  $p < 0.0005$ .

## **5.7 Summary**

The chapter starts with the selection of statistical techniques, followed by various data analyses for the relevant research question. Among the two major groupings of statistical procedures, parametric statistics are chosen due to data collected for this research were interval-scaled, drawn from populations with a normal distribution and a large sample size. Apart from descriptive and reliability analyses, five statistical techniques are applied including *t*-tests, ANOVA, Pearson's correlation, factor analysis, and multiple regression.

Demographic information, such as business sector, fleet size and work experience, is analysed through cross-tabulation. Demographic information provides background information on the respondents involved in the survey. The analyses generate two groups in the business sector, three groups in both fleet size and work experience. These groups are used as independent variables (demographic variables) for the comparative analyses of the first research question.

A frequency analysis reveals that there is a high level of perceived importance for the proposed 14 knowledge components in an OKB with the highest mean score of 4.65 (OKB06) and the lowest 3.79 (OKB10). When demographic variables are introduced, it is found, through a *t*-test, that the mean scores of three items are statistically significantly different ( $p < 0.05$ ) between ship owners and ship managers. More specifically, ship owners perceived these three components more important than ship managers. The calculations of eta squared indicate that the magnitude of the differences between groups for these three items is moderate. The ANOVA by total work experience finds four items significantly different between groups. Further post-hoc tests reveal that respondents with less than 9 years of work experience perceived differently from those with 10 to 16 years of experience on items OKB03, OKB06, OKB10, and OKB11, while respondents with more than 17 years work experience perceived differently from those with less than 9 years on item OKB10. The ANOVA followed by post-hoc tests of fleet size finds two items perceived

differently between three fleet sizes. Specifically, large fleet perceived OKB07 more important than small fleet, but less important of OKB09 than medium fleet.

The overall frequency analysis of the perceived effects of human mobility on the OKB results in the rejection of two ratings-related items with mean scores below middle point 3 (MOB05: 2.97, MOB08: 2.77). To examine whether perceived effects can be predicted by the current workforce stability, a multiple regression is conducted, which includes two steps. The first step is to simplify the independent variables, that is, the current workforce stability. This is achieved through factor analysis and parallel analysis. Three factors, *total preference for a stable workforce* (*tprefwork*), *total turnover pattern* (*tturpatt*), and *total stability and optimism* (*tstaopt*), are obtained as the result of the factor analysis and are used as independent variables for the multiple regression. It is found that the three-factor solution explains 18.1 per cent of the variance in the perceived effects of mobility on the OKB ( $R^2 = 0.181$ ,  $p < 0.001$ ) reaching statistic significance. Individually, both *tprefwork* and *tstaopt* make a significantly unique contribution to the prediction of the perceived effects of mobility within the shipping industry (beta = 0.323,  $p < 0.001$ ; beta = 0.191,  $p < 0.01$ ).

The analysis of perceptions of effective knowledge management practices results in an overall acceptance of all 14 statements with the highest mean score being 4.40 and the lowest 3.40. Using the four factors, *networking and resource commitment*, *monetary incentives*, *total recruitment and retention*, and *non-monetary incentives* (independent variables), generated from factor analysis, a multiple regression analysis is conducted to explore whether perceptions of EKT vary according to current management practices. It is found that only 5.4 per cent of variance in the perceptions of EKT can be explained by this four-factor solution model with no significant difference statistically. Individually, there is no single factor making a significantly unique contribution to the prediction of perceptions of EKT in the shipping industry. Further data analyses are carried out to determine if there is any difference between those that have established a knowledge management department

(KMD) or have had a designated person responsible for knowledge management (CKO) and those that have not, and whether there is a correlation between ICT related perceptions and the current/preferred means of communication. Two *t*-tests are conducted and it is found that there are significant differences between two groups of KMD on items EKT04, EKT07, EKT10, and EKT14 ( $p < 0.05$ ). Three items, EKT07, EKT10, and EKT12, were perceived significantly different between two groups of CKO, although the magnitude of differences in mean scores is small (eta squared = 0.034, 0.032, and 0.023). The analyses of the correlation between ICT related perceptions and the current/preferred methods of communication reveal that there is a small positive correlation between total perceptions of ICT and current methods of communication ( $r = 0.25$ ,  $p < 0.005$ ). The correlation between total perceptions of ICT and preferred communication methods reaches the medium level ( $r = 0.30$ ,  $p < 0.005$ ).

This chapter provides an objective view of issues associated with three research questions through various statistical analyses. The next chapter will discuss these findings and relate to a literature review conducted in chapters two and three wherever necessary, particularly in the context of the shipping industry.

## CHAPTER 6: DISCUSSIONS OF FINDINGS

### 6.1 Introduction

This chapter discusses findings from data analyses that were conducted in the last chapter. Three primary research questions together with their relevant subsidiary research questions and hypotheses are addressed. Discussions of findings are linked to the literature review in chapters two and three wherever appropriate. Results of data analyses provided in the discussions are organised according to the conceptual frameworks developed earlier.

### 6.2 Discussions of findings from the first research question

The first research question is elaborated in chapter four as:

*How is an organisational knowledge base described in the shipping industry?*

To answer this question, two hypotheses are formulated:

**Hypothesis 1:** *Organisational knowledge base is a construct of 14 identified components associated with 4 groups of knowledge: individual explicit, individual tacit, organisational explicit and organisational tacit.*

**Hypothesis 2:** *The perceived importance of knowledge components in an OKB varies according to the observer's business sector, fleet size, and work experience.*

#### 6.2.1 Components of an OKB in the shipping industry (H1)

As discussed in chapter five, there is an overall acceptance of 14 proposed knowledge components in an OKB with the highest mean score being 4.65 and the

lowest 3.79. A summary of mean score with ranks is provided in table 6.1. It can be found (from tables 5.5, 5.8, and 6.1) that the ranks of mean scores and importance percentages of the top 3 are very consistent with *personal work attitudes* being ranked the first in both tables, *personal problem solving capability* the second in importance percentage and third in mean score, and *organisational culture* the third in importance and the second in mean score. On the other end of the ranking, the three ranked lowest have the same pattern, with *information communication technologies, such as intranet including email, bulletin board system, and e-forum* the lowest in both tables, *electronic data interchange* the second lowest in importance percentage and the third lowest in mean score, and *personal academic qualifications such as university degrees* the third lowest in importance percentage and the second lowest in mean score.

**Table 6.1 Knowledge components in four dimensions ranked by mean scores**

Group	Factor	Mean	Rank
<b>Individual explicit</b>	Personal academic qualifications, such as university degrees	3.87	13
<b>Individual tacit</b>	Personal work attitudes	4.65	1
	Personal problem solving capability	4.40	3
	Personal innovation ability	4.14	6
	Personal professional qualifications, such as certificates of competence	4.13	7
	Personal work experience	4.11	8
<b>Organisational explicit</b>	Organisational process manuals, for example, written instructions, and operational procedures	4.10	10
	Information storage and retrieval systems, such as databases	4.14	5
	Intellectual property, such as patents, copyrights, trademarks, registered design, and brands	4.08	11
	Electronic Data Interchange (EDI)	4.06	12
	Information communication technologies, such as intranet including email, Bulletin Board System (BSB), and e-forum	3.79	14
<b>Organisational tacit</b>	Organisational culture	4.42	2
	Organisational image	4.30	4
	Organisation's external relationships	4.11	9

Personal work attitudes are considered an important indicator of the future success of an organisation (Hurst 1995). Work attitudes are a reflection of an employee's overall satisfaction with the job and commitment to the organisation. In the shipping industry, especially onboard environment where hierarchy is important to daily operations, personal work attitudes directly contribute to the productivity and effectiveness of complex onboard operations and therefore safe shipping. In China, work attitudes have been emphasised even more in the shipping industry due not only to the implications for safe shipping, but also to the fact that work attitudes are becoming one of the major obstacles for Chinese seafarers to compete globally. Reports from ship owners and manning companies overseas indicate that work attitudes are the major concern when they employ Chinese seafarers. It is interesting to note that language or communication ability used to be the first priority when choosing Chinese personnel. Ship owners have now come to realise that, although language ability is an important part of daily operations, it can be significantly improved through effective training. Work attitudes, however, are very difficult to change once they are formed. Because personal work attitudes are directly related to personal commitment to the organisation and to personal career goals as well, it makes sense for an organisation to employ those who have a high commitment to a seafaring career and to the employer. From a knowledge management perspective, work attitudes have great impacts on willingness to share personal knowledge and on learning from others. Thus, it is not surprising that this component is ranked the highest in both tables.

Problem solving capability is a personal working attribute that all employers appreciate. In the shipping industry in particular, due to the remoteness and highly independent nature of the working environment, personnel are expected to work independently and to solve problems in areas of their own responsibilities. Job descriptions of onboard positions are clearly defined and each person is highly accountable to what has been assigned. Furthermore, any incident on a ship can potentially lead to disastrous consequences. Most onboard operations are of a routine nature. However, from time to time there are cases or emergencies such as machine

breakdowns or manoeuvring in a complex situation, where problem diagnosis and solving capabilities are critical to avoid dire consequences. High problem solving capability is attained through real world practices and logical reasoning and is accumulated through various work experiences. It is therefore an important part of the build-up of organisational knowledge assets.

As shared basic assumptions (Schein 1992), organisational culture is formulated and evolving over time through personnel contributions and on the other hand, affects individual behaviours, values and beliefs. Culture, either at the corporate level, or in a small working group, provides underlying rules that people can follow. This is even more relevant in the shipping industry, particularly in complex situations where these underlying rules can ease confusion and simplify the decision-making process. Furthermore, people tend to be proactive and more efficient in an environment where they perceive that they are valued and supported. In a shipping environment, the working culture on a ship can make a considerable difference to the people working in such an environment and will impact on the individuals' commitment to the organisation and even to their seafaring career. It is obvious that organisational culture is both a component of OKB and a facilitator of knowledge transfer.

Although all 14 knowledge components are confirmed as part of an OKB, they do vary in terms of mean scores and importance percentages. Two components have mean scores lower than 4 (OKB10, 3.79; OKB01, 3.87). As a part of organisational explicit knowledge, information communication technologies such as intranet, email system, bulletin board system, and e-forum, are considered common practices of daily operations. While they are an indispensable part of the organisational infrastructure, their importance has been significantly reduced due to readily available technologies and the fact that these functions are highly imitable. Furthermore, from the knowledge management perspective, communication focused technologies themselves are more useful in facilitating knowledge activities such as knowledge sharing and transfer, but less relevant as knowledge assets by themselves. Electronic Data Exchange (EDI), which is ranked the second lowest in importance



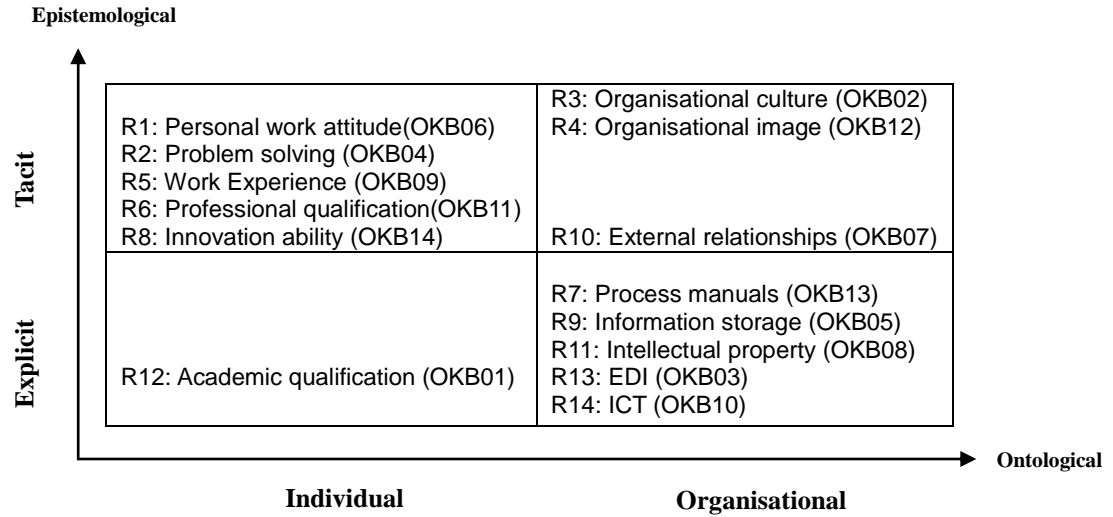
percentage and the third lowest in the mean score, shares the same situation as information technology. The reducing importance of EDI is compounded by the fast and reliable internet access and highly customerised databases that prevail in today's business environment. When security and reliability are assured, the internet is a much preferred way of transmitting data and other information.

Personal academic qualifications are ranked the third lowest in importance percentage and the second lowest in the mean score. While academic qualifications are good indicators of academic achievement or level of explicit knowledge acquisition, they need to be activated and materialised in the real working environment. It is commonly accepted that high academic achievement does not always guarantee work performance. The knowledge assimilation process (for example the SECI mode from Nonaka & Takeuchi 1995) suggests that explicit knowledge needs to be internalised through validation and implementation in the practical world in order to become an integral part of personal knowledge. In the shipping industry, graduates have to undertake up to 12 months of internship or cadetship before they can carry duties alone. The purpose of the process is to apply what they have learned to real situations and validate or sometimes modify their prior knowledge. Thus, it is understandable that academic qualifications are ranked lower than professional qualifications in both tables.

If the ranking in table 5.8 is combined with figure 2.7 in chapter two, a new OKB matrix can be obtained which can generate more meaningful information on the composition of the OKB. Figure 6.1 is a new OKB matrix with ranked knowledge components in it. The top 6 components all fall into the tacit knowledge category. This is not surprising, for it is tacit knowledge, difficult to articulate and imitate, that provides a firm competitive advantage. Explicit knowledge, on the other hand, although an important part of an OKB, tends to be temporal to the firm. This is reflected in the matrix by the fact that the four lowest ranked components are all explicit in nature. It should be noted that between the two types of personal qualifications, professional qualifications are much preferred to academic ones.

Information technologies related components are ranked low as elaborated earlier in this section.

**Figure 6.1 Ranked knowledge components in an OKB Matrix**



Source: Author

### 6.2.2 Perceived importance according to demographic variables (H2)

While there is an overall acceptance of 14 proposed knowledge components for an OKB, the perceived importance of some components varies according to three demographic variables. The results of analyses are presented in table 6.2 where two or more colours in a row indicate there are statistically significant differences in mean scores between or among groups. More specifically, the mean scores of the red colour are higher than those of green.

A *t*-test of the business sector finds that ship owners perceived *ICT, such as intranet including email, BBS, and e-forum, organisational process manuals, e.g. written instructions and operational procedures, and personal innovation ability* to be more important than ship managers do. When compared among groups of work experience (ANOVA), respondents with 9 years or less of total work experience (including both on- and off- shore) perceived *electronic data exchange* as more important than those with 10 to 16 years of work experience. In terms of *ICT, such as intranet including*

*email, BBS, and e-forum*, this group of respondents perceived it as more important than both respondents with 10 to 16 years of work experience and those with more than 17 years. However, the middle group (10-16) perceived *personal work attitudes* as more important than less experienced respondents. No significant difference is found between respondents with 10 to 16 years of work experience and those with more than 17 years across all components. An ANOVA followed by post-hoc tests finds that large shipping organisations perceived as less important the organisation's external relationships than did small organisations. The same group also perceived personal work experience as less important than medium organisations.

**Table 6.2 Comparisons of mean scores among groups**

Knowledge components	Groups		
Business sector			
	SO	SM	
ICT, such as intranet, including email, BBS, and e-forum			
Organisational process manuals, e.g. written instructions and operational procedures			
Personal innovation ability			
Total work experience			
	<= 9	10-16	17+
Electronic Data Interchange (EDI)			
Personal work attitudes			
ICT, such as intranet, including email, BBS, and e-forum			
Personal professional qualifications, such as certificates of competence			
Fleet size			
	Small	Medium	Large
Organisation's external relationships			
Personal work experience			

Note: 1) SO = Ship owners, SM = Ship Managers

2) Fleet size: Small=Less than 100,000 DWT; Medium=100,001-1,000,000 DWT;

Large=over 1,000,000 DWT

### 6.3 Discussions of findings from the second research question

The second research question aims to investigate the effects of high human mobility on the OKB and whether there is any relationship between respondents' perceived effects and the current workforce stability of their respective organisations. The second question is therefore worded as follows:

***How are the effects of human mobility on the organisational knowledge base perceived?***

Two subsidiary research questions are contained:

***SRO2.1: What are the effects of human mobility on the OKB?***

***SRO2.2: How well can perceived effects of human mobility on the OKB be predicted by the current workforce stability?***

The first subsidiary question can be answered through three hypotheses:

***Hypothesis 2a: There is a positive relationship between the inflow of personnel and the OKB.***

***Hypothesis 2b: There is a negative relationship between the outflow of personnel and the OKB.***

***Hypothesis 3: The effects of mobility on the OKB differ with different movement patterns.***

#### 6.3.1 The perceived effects of human mobility on the OKB (H2, H3)

According to the discussion of personnel mobility in the shipping industry (figure 3.3), there are five groups of personnel included in the inflow mobility, that is, graduates, lecturers of MEI, management staff, officers, and ratings. It is hypothesised (H2a) that there is a positive relationship between the inflow of

personnel and the OKB. Out of five projected relationships, four are empirically confirmed and one is rejected. Table 6.3 presents the summary of the findings with the third column being the total percentage of 'agree' and 'strongly agree', and the fourth column representing mean scores of each statement. The last column indicates the overall tendency of agreement with the mean score of 'A' being between 3 and 4, and 'SA' over 4. It is found that the inflows of *officers*, *management staff*, *graduates*, and *lecturers* are considered as having positive effects on the OKB. Among these, the inflow of officers has the highest level of consensus, while the inflow of lecturers receives the lowest. This can be explained by the fact that insufficient supply of qualified seafarers is the core of the skill shortage in the shipping industry. It was estimated that there was a shortage of 33,000 officers in 2005 and the figure would reach 46,000 by 2010 (BIMCO 2005). In contrast, ratings have been greatly oversupplied (224,000 in 2005 and 255,000 by 2010) (BIMCO 2005). The movement of lecturers from MEI to the shipping industry is only limited to a very small scale and in most cases, such movement is mainly for teaching and research purposes. H2a can therefore be accepted with modification.

As regards the outflow movements, it is hypothesised that there is a negative relationship between personnel outflow and the OKB. It should be noted that the effects of outflow are assessed from the perspective of the releasing organisation only. The net effects of such movements may depend not only on the direction of movements, but also the destinations, which will be discussed later. Among the three groups (*management staff*, *officers*, and *ratings*) involved in outflow movements, ratings are not considered as having an impact on the OKB. This again can be explained by the fact that there has been a considerable oversupply of ratings worldwide and the fact that ratings are at the bottom of the onboard hierarchy as discussed in chapter three. While the outflows of management staff and officers negatively affect the OKB, the level of consensus (as percentage of agreement) and mean scores are lower than inflow mobility. Due to the prevailing high mobility in the shipping industry, fewer efforts are being made to retain qualified personnel than to attract new ones. In fact, a high percentage of respondents claimed that they were

used to such high mobility, an issue which will be dealt with in the next section. Thus Ha2 can also be accepted with modification.

**Table 6.3 Effects of mobility with mean scores and percentage of agreement**

<b>Movement</b>	<b>Factor</b>	<b>Per.</b>	<b>Mean</b>	<b>Att.</b>
<b>Inflow</b>	Intake of graduates from Maritime Education Institutions (MEI) has a positive effect on the OKB	80.7	3.98	<b>A</b>
	The intake of lecturers from MEI increases the OKB	74.1	3.90	<b>A</b>
	The inflow of management staff increases the receiving organisation's OKB	80.1	4.05	<b>SA</b>
	The inflow of officers increases the receiving organisation's OKB	91.6	4.13	<b>SA</b>
	The inflow of ratings increases the receiving organisation's OKB	<b>22.9</b>	<b>2.97</b>	<b>D</b>
<b>Outflow</b>	The OKB is negatively affected when management staff leave the organisation	60.2	3.62	<b>A</b>
	The OKB is negatively affected when officers leave the organisation	64.4	3.68	<b>A</b>
	The outflow of ratings has a negative effect on the OKB	<b>17.5</b>	<b>2.77</b>	<b>D</b>
<b>Movement pattern</b>	The movement of management staff has a stronger effect on the OKB than that of seafarers	74.7	3.89	<b>A</b>
	The movement of officers has a stronger effect on the OKB than that of ratings	91.0	4.15	<b>SA</b>
	Movement of personnel within the shipping industry does not affect the overall knowledge base of the industry	54.8	3.33	<b>A</b>
	Further education or training of personnel has a positive effect on the knowledge base of the whole industry	95.7	4.31	<b>SA</b>
	The knowledge base of the shipping industry is negatively affected when personnel leave for positions outside the shipping industry	58.4	3.57	<b>A</b>
	Shipping organisations benefit from the overall improvement of the knowledge base of the shipping industry	90.9	4.21	<b>SA</b>
	Compared with the personnel movement within the maritime industry, the impact is greater when personnel move to non-maritime industries, or into retirement	57.8	3.57	<b>A</b>

Note: 1) Per. = percentage of agreement, i.e. the total percentage of 'agree' and 'strongly agree';  
 2) Att. = attitude, where SA (mean scores > 4); A (3 < mean scores < 4); D (mean scores < 3)

Apart from different groups of personnel involved in movements, there are movement patterns that might contribute to the different effects on the OKB. This comes to the third hypothesis where the effects of mobility differ between different movement patterns. As explained the chapter three, personnel movements occur at different levels which include intra-industry movement, inter-industry (within the shipping industry), inter-industry (maritime industry), and inter-industry (non-maritime industry). From table 3.6, it can be found that the effects of staff movements are greater than those of seafarers (including both officers and ratings), and movements of officers have stronger impacts on the OKB than those of ratings. Moreover, further education and training (a temporary movement from the industry to MEI), is confirmed (with 95.7% of consensus) as having positive impacts on the OKB. When the overall knowledge base of the industry is improved, all organisations benefit from it. This is consistent with respondents' attitudes towards intra-industry personnel movements. However, when the movements occur at inter-industry level, it is found that the shipping industry as a whole suffers from the loss of skills and expertise as a result of such cross-industry movements. More specifically, the impact is greater when the movements are towards non-maritime industries or retirement. This confirmation is a reflection of the one-way movement of its personnel in the shipping industry where many skilled people give up their shipping careers for occupations that are completely irrelevant to their experiences. In summary, the effects of human mobility on the OKB do differ between different movement patterns. H3 is therefore accepted.

### **6.3.2 The perceived effects by current workforce stability (SRQ2.2)**

The second subsidiary research question aims to explore whether the perceived effects of personnel mobility on the OKB can be predicted by the current workforce stability of respective shipping organisations. A factor analysis results in a three-factor solution for current workforce stability, which includes *total preference for a stable workforce* (tprefwork), *total turnover pattern* (tturpatt), and *total stability and optimism* (tstaopt). These three factors are then used as independent variables in a

multiple regression analysis with the dependent variable being *total intra-industry mobility* (tintramob). It should be noted that the independent variable only contains personnel movements within the shipping industry (MOB01-10), and inter-industry movements (MOB11-15) are not included. The results of the multiple regression is provided in tables 6.4 and 6.5.

**Table 6.4 Predictability of current workforce stability (as a model)**

Model		Sum of Squares	df	R Square	F	Sig.
1	Regression	387.263	3	.181	11.900	.000
	Residual	1757.267	162			
	Total	2144.530	165			

**Table 6.5 Predictability of current workforce stability (by individual factor)**

Factor	Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	Beta			Zero-order	Partial	Part	Tolerance	VIF
(Constant)		8.602	0.000					
tprefwork	<b>0.323</b>	4.492	<b>0.000</b>	0.349	0.333	0.319	0.980	1.020
tturpatt	0.135	1.876	0.062	0.199	0.146	0.133	0.972	1.029
tstaopt	<b>0.191</b>	2.666	<b>0.008</b>	0.216	0.205	0.190	0.990	1.010

The three-factor solution as a whole explains 18.1% of variance of mean scores in the perceived effects of mobility on the OKB [R Square = 0.181,  $F(3, 162) = 11.90$ ] (table 6.4). The model also reaches statistic significance ( $p < 0.0005$ ). While there is no similar data available for comparison (within the shipping industry), the confirmation is obvious that current workforce stability such as overall turnover levels, a preferred workforce, and optimism about recruitment in respondents' organisations, to some extent predicts the perceived effects of mobility on the OKB. When respondents' organisations have a higher turnover and prefer a more stable workforce, the overall perceived effects of mobility on the OKB will be greater.

Two of the three factors make a unique contribution to the prediction of the perceived effects of mobility within the shipping industry (table 6.5). The first factor is *total stability and optimism* which includes *the entire workforce, shore-based positions,*



*high turnover as a normal situation, and turnover as not being an issue provided there are enough people to recruit.* When the entire workforce and shore-based positions are stable, high turnover is considered normal and not an issue if there are enough people to recruit. In this case the perceived effects of personnel movements on the OKB are lower. For organisations that have the capability to maintain a stable workforce and the confidence to recruit more people when necessary, personnel movements are not a major concern. The second factor making a unique contribution is labelled as ***total preference for a stable workforce*** which includes *the effects of high turnover on organisational performance and shipping operations, the need to reduce personnel turnover, and the preference for a stable workforce.* The multiple regression finds that there is a positive relationship between the total preference for a stable workforce and the perceived effects of mobility on the OKB. The more respondents consider that organisational performance and shipping operations are affected by high turnover, and that a stable workforce is preferred, the greater the perceived effects of mobility on the OKB.

## **6.4 Discussions of findings from the third research question**

Given the prevailing high mobility and the associated effects on the OKB, it is essential to explore effective means to manage knowledge assets in shipping organisations. While there are various management practices in place, the identification of specific knowledge-transfer practices may provide insight for organisations to manage knowledge strategically. The third research question is therefore worded as follows:

***What are the effective knowledge transfer practices in the context of the shipping industry?***

This is again a two-step task. The first step is to investigate the perceived effective knowledge transfer practices, which is hypothesised as follows:

***Hypothesis 4:*** *Effective knowledge transfer practices in the shipping industry consist of 14 factors involving 3 groups of management practices: organisational culture (6), leadership (3), and technology (5).*

The second step aims to determine whether such perceptions can be predicted by existing management practices adopted in the respective shipping organisation. This is framed as a subsidiary question of the third research question:

***SRO3.2:*** *Can perceived effectiveness of knowledge transfer practices be predicted by existing management practices in a shipping organisation?*

#### **6.4.1 The effective knowledge transfer practices (H4)**

An examination of literature in chapter three finds that EKT consists of practices from three groups: culture, leadership, and technology, as indicated in figure 3.10. In total, there are 14 items included in this three-group framework for EKT (6 in culture, 3 in leadership; and 5 in technology). While each item contributes in a different way, the framework should explain the overall EKT practices in the context of the shipping industry. Two tasks need to be undertaken. One is confirmation of the three-group framework that is attained from the literature review, and the other is examination of the perceived effectiveness of each item as a management practice to be conducted in daily operations.

A reliability analysis of the scale of EKT results in an alpha value of 0.849 showing a high reliability of this scale as the measurement of EKT practices. Further analyses of the percentage of agreement and mean scores are summarised in table 6.6. It is clear that there is an overall high level of consensus about EKT practices. 12 out of 14 items have mean scores over 4, demonstrating a strong agreement. Each group has items with both a high percentage of agreement and high mean scores and no item has been dropped. Thus the conclusion can be drawn that the three-group framework for EKT is confirmed.

**Table 6.6 EKT practices with mean scores and percentage of agreement**

Group	Factor	Per.	Mean	Att.
<b>Culture</b>	Knowledge flow is enhanced when there is a high level of collaboration among individuals across departments.	97.0	4.37	SA
	Knowledge transfer is facilitated when there is mutual trust between employees and their senior managers	95.1	4.30	SA
	Organisational culture that nourishes horizontal communication enhances a high level of collaboration among individuals across departments	94.0	4.11	SA
	Organisational culture that advocates equity among departments reduces the tendency of knowledge protection therefore increasing the likelihood of knowledge transfer within the organisation	86.7	4.13	SA
	Knowledge transfer is facilitated in organisational culture where collective efforts are valued	83.7	4.05	SA
	Organisational culture that tolerates failures fosters confidence to share experiences	81.3	4.13	SA
<b>Leadership</b>	A learning and sharing environment enhances knowledge flows within the organisation	97.6	4.40	SA
	Knowledge transfer can be facilitated by properly recognising active learning and sharing behaviours	92.2	4.19	SA
	Knowledge transfer is encouraged when an organisation commits resources to related activities	92.1	4.25	SA
<b>Technology</b>	Accessibility of data storage and retrieval systems through information technology facilitates knowledge transfer	93.9	4.25	SA
	Availability of communication-related technology such as email, video conferencing, and BBS, enables effective knowledge transfer among participants	90.4	4.12	SA
	Information technology is effective in facilitating the transfer of explicit knowledge, for instance written instructions or manuals	88.0	4.08	SA
	Communication-related technology such as email, video conferencing, e-directories, and BBS, helps build up personal relationship through easy communication	71.7	3.87	A
	Information technology by itself is ineffective in transferring experiential knowledge, for example, the diagnosis of a problem (Rev.)	56.6	3.40	A

Note: 1) Per. = percentage of agreement, i.e. the total percentage of 'agree' and 'strongly agree';

2) Att. = attitude, where SA (mean scores > 4); A (3 < mean score < 4)

Looking into each group, it is found that *collaboration among individuals across departments*, *mutual trust between employees and their senior managers*, and *horizontal communication* in the culture group have a very high level of agreement. In the shipping industry, a high level of collaboration among individuals across departments (both on- and off- shore) is not only a matter of efficiency, but a matter of safety. A lack of such collaboration may lead to dire consequences. As discussed in chapter three, the knowledge flow tends to be stronger when there are fewer overlaps in terms of the knowledge areas that participants possess. As a management practice, such cross-department collaboration helps to bridge knowledge gaps between departments and to gain understanding and appreciation of what others are doing. Furthermore, a lack of genuine employment links (in chapter three) and the eroding loyalty in the shipping industry make mutual trust even more critical in daily operations. The uncertainty between employees and senior managers will impede knowledge sharing at all levels. Moreover, horizontal communication is essential for individuals to build up trust and understanding, therefore a requisite for collaboration and knowledge sharing.

Compared with cross-department collaboration, mutual trust, and horizontal communication, *equity among departments*, *collectivism*, and *tolerance of failures* are of lesser concern (levels of agreement of these three are lower than 90%). Equity among departments can be achieved through top management and involves fewer people. Therefore there is a sense of control from senior managers. As for collective efforts, the workplace structure in the shipping industry, especially onboard structure, leaves little space for individualism. Performance (efficiency, productivity, safety etc.) is dependent on the efforts of all members of the hierarchy. Moreover, while a failure might be one way of learning, it proves very expensive (sometimes unbearable) in the shipping industry, especially where shipping operations are concerned. However, tolerance of mistakes is a good way of encouraging people to share their mistakes and to learn from their experiences.

In the group of leadership criteria, *Learning and sharing environment*, *proper recognition*, and *resource commitment* received a high level of percentage of agreement. Individuals learn for different reasons, for example, personal development such as a promotion or a better job. While learning has its roots in self motivation, sharing needs to be stimulated and orchestrated by top management. An environment of learning and sharing creates an atmosphere where people are motivated to learn and willing to share. It is by learning and sharing that knowledge is transferred among all participants. Furthermore, proper recognition of learning and sharing behaviours is an official acknowledgement and appreciation of efforts being made by participants, and is a very important signal given to all staff within an organisation with regard to knowledge transfer activities. People are encouraged to learn and share when such efforts are valued by top management. Finally, knowledge transfer involves complex processes where resources are required to undertake relevant activities. These resources might be required in different forms. They are essential for knowledge transfer related activities to take place. In addition, resources provide physical evidence of support given by the senior management team.

The role of technology in facilitating knowledge transfer has been in debate for a long time and in fact knowledge management is sometimes considered the same as information management (refer to chapter three for detailed discussion). In the context of the shipping industry, information technology serves two functions, one being the means through which knowledge is transferred, the other being a facilitator where technology provides a medium for people to build up trust through effective communication. Because shipping operations consist of two physically separated parts (on- and off- shore), the accessibility of information varies according to the physical location of the operation. For both cases, storage and retrieval systems are believed to be important for knowledge transfer, which in this case, is individual knowledge acquisition. More specifically, these systems are more effective in transferring explicit knowledge. Furthermore, information technology as a means of communication is vital for people working onboard where chances of face-to-face contact with onshore personnel are limited. A sense of being in touch through IT

facilitated communication is critical to maintain a reasonable level of trust for knowledge sharing to take place. With regard to the rule of IT in facilitating tacit knowledge transfer, 56.6% of respondents considered it effective. Compared with other items in the scale, this statement received the lowest percentage of consensus and the lowest mean score. It is not surprising because the effectiveness of IT in transferring tacit knowledge has been problematic in the discussion of the literature (refer to chapter three). In the shipping industry, a majority of knowledge is experiential and is therefore tacit in nature. The effective transfer of tacit knowledge not only requires facilitation of IT, but more importantly a supportive organisational culture and strong leadership.

#### **6.4.2 The perceived EKT by existing management practices (SRQ3.2)**

The investigation of the predictability of existing management practices on the perceived EKT is conducted through a multiple regression analysis. A four-factor solution is adopted through careful factor analyses. It provides independent variables for the examination of the predictability. The results show that the four-factor solution as a model explains only 5.4% of variance in mean scores of perceived EKT and no statistical significance is found [ $R^2 = 0.054$ ,  $F(4, 161) = 2.3$ ,  $p = 0.061$ ] at  $p < 0.05$  confidence level (table 6.7). Individually, none of the four factors (*networking and resource commitment*, *monetary incentives*, *total recruitment and retention*, and *non-monetary incentives*) makes a significantly unique contribution to the prediction of perceived EKT (table 6.8). This can partly be explained by the fact that knowledge management is still a new concept to many in the shipping industry and that there is yet a link to be established between conventional management practices and practices that are strategically designed for knowledge management. The results of the multiple regression analyses reveal that regardless of the management practices being employed, there is a consistent view toward EKT practices.

**Table 6.7 Predictability of existing management practices (as a model)**

Model		Sum of Squares	df	R Square	F	Sig.
1	Regression	203.927	4	.054	2.302	.061
	Residual	3565.181	161			
	Total	3769.108	165			

**Table 6.8 Predictability of existing management practices (by individual factor)**

Factor	Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	Beta			Zero-order	Partial	Part	Tolerance	VIF
(Constant)		12.514	0.000					
Factor 1	0.067	0.735	0.464	0.127	0.058	0.056	0.712	1.404
Factor 2	-0.148	-1.914	0.057	-0.160	-0.149	-0.147	0.978	1.023
Factor 3	0.108	1.298	0.196	0.027	0.102	0.099	0.853	1.172
Factor 4	0.133	1.432	0.154	0.142	0.112	0.110	0.676	1.479

While no relationship is found between perceived EKT and existing management practices as a whole, analyses were conducted in chapter six to investigate more specifically the relationships between the perceived EKT and the establishment of a knowledge department (KMD) and the availability of a designated person (e.g. CKO) responsible for knowledge management. The results of two *t*-tests are summarised in table 6.9 where the mean scores with red colours are significantly higher than those of green ones.

It is found that in terms of the designation of a person to manage knowledge assets, four out of fourteen items reach statistical significance in differences of mean scores. The directions of such relationships are consistent in that organisations that have a designated CKO perceived more effective than those do not, of *IT in facilitating the transfer of explicit knowledge*, *the availability of IT in enabling knowledge transfer*, *IT for trust building*, and *collectivism*. The rational explanation of these differences is that organisations which have a designated person have already reaped the benefits of having their knowledge assets strategically managed. Where a knowledge management department is concerned, three items are identified as having significant

differences in mean scores. Organisations that have established their KMD perceived *the availability of IT in enabling knowledge transfer, collectivism and the recognition of learning and sharing behaviours*, as more effective than those that have not yet established their KMD. It should be noted that items included in the CKO are more technology-related. This is because for many organisations, knowledge management practices start from using technologies, then gradually progress into strategic levels.

**Table 6.9 Comparison of mean scores (CKO & KMD)**

EKT practice	Groups	
	YES	NO
<b>CKO</b>		
Information technology is effective in facilitating the transfer of explicit knowledge, for instance written instructions or manuals		
Availability of communication-related technology such as email, video conferencing, and BBS enables effective knowledge transfer among participants		
Knowledge transfer is facilitated in organisational culture where collective efforts are valued		
Communication-related technology such as email, video conferencing, and BBS helps build up personal relationship through easy communication		
<b>KMD</b>	YES	NO
Availability of communication-related technology such as email, video conferencing, and BBS enables effective knowledge transfer among participants		
Knowledge transfer is facilitated in organisational culture where collective efforts are valued		
Knowledge transfer can be facilitated by properly recognising active learning and sharing behaviours		

Due to a high predictability of CKO and KMD on perceptions of ICT related practices, further analyses were conducted to specifically identify any possible relationships between the use of technology and the perceived effectiveness of ICT related practices as a means of knowledge transfer. The results of two Pearson's correlation analyses are presented in tables 5.45 and 5.46. The analyses find that there is a medium level of positive correlation between preferred communication methods and the total perceptions of ICT ( $r = 0.30$ ,  $n = 166$ ,  $p < 0.0005$ ) and a small positive correlation between current means of communication and the total perceptions of ICT ( $r = 0.25$ ,  $n = 166$ ,  $p < 0.005$ ). The results reveal that when the level of use of ICT as a means or a preferred means of communication is higher, ICT related practices are considered more effective for knowledge transfer.



Unlike most onshore industries, the shipping industry is characterised as a combination of two spatially separated operations. While the use of ICT onshore may not differ from any other industry, its offshore operations are hardly integrated into this newly developed ICT-centred system. This is evident from this survey in that only 50.6% of respondents claim that all their ships have internet access; 31.3% reply that only modern ships have such access; and 18.1% acknowledge that none of their ships has internet access (Appendix XIII). The lack of access is attributed to the *high cost involved in the usage* (81.9%) and initial installation (table 6.10). A majority of respondents do not consider *a lack of interest from onboard crew* (75.9%), *the busy life/schedule onboard* (73.5%), and *a lack of justifiable benefits* (69.3%), as valid reasons for not installing onboard internet access facilities. With regard to onshore facilities, 38% of respondents admit that there is no database or similar in their organisations and the view as to who should have access to such a database varies significantly (table 6.10). Only one statement, *staff in different departments have access to their relevant part of the database*, reaches a high level of consensus (85.6%) indicating a compromised solution for the access of the organisational database.

**Table 6.10 Onboard internet access and shore-based database**

Factors	Per. A, SA	Per. D, SD
<b>What are the main reasons for not installing onboard internet access facilities?</b>		
The initial installation costs are too high	49.4	20.5
The usage is too expensive	81.9	9.6
Most crew onboard are not interested	7.2	75.9
Crewmembers are too busy to surf on the internet	8.4	73.5
There are no justifiable benefits of installing internet access facilities onboard	10.2	69.3
<b>Who should have access to the database?</b>		
All staff within the organisation	34.3	44.5
Only senior managers	25.9	12.0
Staff in different departments have access to their relevant part of the database	85.6	3.6
Only staff from information/knowledge department can access the database	34.9	36.1
Access to the database is approved by senior managers on a case basis	54.2	16.9

Note: 1) Per. A, SA = percentage of 'agree' and 'strongly agree' (mean scores > 3);

2) Per. D, SD = percentage of 'disagree' and 'strongly disagree' (mean scores < 3)

Given the mixed level of the use of ICT in the shipping industry and the fact that ICT related practices are perceived as higher in terms of effectiveness in knowledge transfer by those who consider ICT as the preferred means of communication, much potential can be exploited to facilitate knowledge transfer by making the best use of available technology. For shipping organisations, the decision to invest in ICT will, to a greater extent, depend on the measureable benefits to be derived from effective knowledge management practices.

## **6.5 Summary**

This chapter addressed three primary research questions which are further framed by five hypotheses and three subsidiary research questions. In relation to the first hypothesis, it is confirmed that an OKB is a construct of 14 identified knowledge components associated with four groups of knowledge: individual explicit, individual tacit, organisational explicit and organisational tacit. Among 14 knowledge components, tacit knowledge was perceived as more important than explicit knowledge. This result is consistent with the view that tacit knowledge, which is difficult to articulate and imitate, provides a firm competitive advantage. In contrast, information technology related components are ranked the lowest among explicit knowledge due to their imitable nature. The second hypothesis is accepted in that perceived importance of knowledge components do vary according to business sector, fleet size, and total work experience.

With regard to the second primary research question, it is found that there are relationships between personnel movement and the OKB. While the inflow of personnel has a positive effect on the OKB, the outflow impacts negatively on the OKB. However, it is found that among the different levels of movements, the movements of ratings are not considered as having an impact on the OKB. This is explained by the excessive supply of ratings worldwide. Furthermore, the effects of mobility on the OKB differ with different movement patterns, for example, intra- vs. inter- industry. The result reveals that the impact is greater when personnel move

across industries especially across the boundary of the maritime industry. Moreover, the perceived effects of mobility can be explained by current workforce stability. When organisations have a high level of workforce stability and have the confidence to recruit qualified personnel, the perceived effects of mobility on the OKB are lower. On the other hand, organisations that consider high turnover as affecting performance and that prefer a stable workforce perceive the effects of mobility on the OKB as higher.

The third primary research question is further framed by a hypothesis and a subsidiary research question. It is found that the 14-item scale is very reliable and that all 14 proposed practices are accepted as effective knowledge transfer practices in the shipping industry. The result also confirms the conceptual framework developed earlier of effective knowledge transfer, which consists of organisational culture, leadership, and technology. Current management practices, however, do not explain variances in the perceived effectiveness of EKT. Nevertheless, knowledge management specific practices such as the establishment of a KMD, and designation of a CKO, do predict the perceived effectiveness of EKT. Organisations that have established KMD or have had CKO perceive ICT related practices more effective in transferring knowledge. Further investigation of ICT related practices and current/preferred means of communication indicates that there are correlations between the two. The higher the level of ICT that has been used or preferred, the more effective these ICT related practices are perceived to be.

The final chapter discusses the purpose and contribution of the research, highlights the major findings, suggests limitations of the research and proposes directions for future research.

## **CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS**

### **7.1 Introduction**

The purpose of this concluding chapter is four-fold, firstly, to summarise main findings from three research questions; secondly, to discuss potential limitations of the study; thirdly, to explain the contribution of the study; and finally, to identify areas for future research. The chapter begins with a discussion on the contribution of the study, followed by a summary of results. The summary only highlights the main points from the findings discussed in chapter six. The potential limitations of the study are next explained. All studies are limited one way or another, reflecting the conscious trade-offs made by researchers to ensure that the study is completed within defined parameters. Finally, the chapter concludes by suggesting areas for future research.

### **7.2 Summary of results**

First of all, an OKB comprises fourteen knowledge components from four groups of knowledge: individual explicit, individual tacit, organisational explicit and organisational tacit. It is found that tacit knowledge is considered much more important at both individual and organisational levels. Among tacit knowledge, personal work attitudes were ranked the most important component. This finding is consistent with the recent concerns from shipping organisations in China in relation to the competitiveness of seafarers in the world labour market. It is accepted that while language used to be the main weakness of Chinese seafarers, the linguistic ability can be considerably improved through effective training. Personal work attitudes however can hardly change once they are formed. The importance of work attitudes are also related to safe shipping and in fact to the willingness of individuals learning and sharing of other types of knowledge.

Among organisational tacit knowledge, organisational culture was ranked higher than other knowledge components. This is not surprising because organisational culture is not only a knowledge component of the OKB, but also a facilitator of knowledge sharing and transfer. Many shipping organisations in China are newly established (less than 15 years). A strong organisational culture is vital for shipping organisations to bring people together and act in a productive way to survive in a competitive environment.

On the other hand, all information communication technology (ICT) related components were ranked low. The readily available ICT makes this knowledge extremely vulnerable to imitation, and therefore, would hardly be a competitive advantage. The advancement of ICT also makes the traditional way of information transfer, for example EDI, obsolete when all tracking and tracing, information sharing can be achieved through real time online access. While the possession of ICT does not guarantee competitive advantage, the lack of it makes an organisation less competitive especially when considering ICT as a means of facilitating knowledge transfer.

While there is an overall acceptance of the concept of the OKB and its composition, the perceived importance of some of the knowledge components do vary according to demographic variables. In the past fifteen years, the shipping industry in China has experienced tremendous development along with the fast growing international trade as the result of rapid economic development, especially since 2001 when China joined WTO. The emergence of professional ship managers is a part of the development. In comparison to traditional, well established ship owners, ship managers considered ICT related infrastructure and organisational process manuals less important. For newly established companies, ICT has been built in and become an indispensable part of their operations from their early stages of development, and therefore the importance of it might be under appreciated. In relation to process manuals, ship owners have a tradition of keeping everything recorded partly due to the requirements of international conventions, and to the tradition of passing instructions and procedures through written means within well established shipping

companies. With the ready availability of ICT, many of these manuals have been transformed into electronic forms, which become part of the organisational database.

In addition, large shipping companies consider the organisation's external relationships less important compared with small ones. Large fleets and great capacity bring large companies a strong bargaining power. The initiation and maintenance of external relationships are most likely carried out by the weaker party when a business is concerned. However, fierce competition and eroding profit margins will demand more cooperation across the industry regardless of the fleet size especially when facing competition in a global scale. Moreover, there is a need for shipping organisations to initiate and maintain a good relationship with stakeholders to improve the image of the industry in the community, in order for the industry to attract the younger generation and to retain current experienced personnel.

The findings from the second research question suggest that except in the case of ratings, personnel movements do affect the OKB. The inflow of personnel has a positive contribution to the OKB of the receiving organisation. On the other hand, the OKB will be adversely affected when an outflow occurs. Individuals are knowledge carriers. Knowledge flows occur when individuals move. Within the shipping industry the movements of personnel do not affect the overall knowledge base of the industry. However, for a particular shipping organisation, the effects of such movements will depend on the net flow and on the mechanisms that are being employed by the organisation to mitigate any adverse effects. As discussed earlier, the shipping industry as a whole is characterised by a one-way movement. The loss of skilled personnel in the shipping industry to other industries will eventually spread on to individual organisations within the industry and this will have a negative impact on the OKB. The impact is compounded when such movements occur across the broad maritime industry.

Additionally, the perceived effects of personnel movements on the OKB differ from the current stability of the workforce of the relevant organisation. The workforce stability in the shipping industry in China varies significantly among shipping

organisations. Those that have been experiencing a high turnover and have difficulties in recruitment consider the impact of personnel movements greater than those that have a stable workforce. These organisations also are concerned with the effects of high mobility on their daily operations and organisational performance. Furthermore, due to the prevalence of the high mobility in the shipping industry, many simply choose to passively accept the reality. Such an attitude may lead to lower mean scores of the perceived effects of human mobility on the OKB, which means that the effects incurred by personnel movements might have been underestimated. The implication to management is to objectively evaluate the impact and adopt knowledge management strategies accordingly.

The third research question explored effective knowledge transfer practices given the high mobility in the shipping industry in China and the effects of high mobility on the OKB. The results indicate that EKT consists of fourteen items from three groups: culture, leadership, and technology. This result is consistent with the framework identified from the literature review in chapter three. Among these EKT practices, collaboration among individuals across departments is ranked high as an effective means of the knowledge transfer practice. In the shipping industry, there have been clear boundaries between departments due to different functions they play. In comparison with collaboration within the same function area, there are much more potential benefits by collaborating across departments. This is because the strength of knowledge flows is greater when participants come from different knowledge areas and the knowledge of the recipient and deliverer is complementary to each other.

Moreover, mutual trust between employees and senior managers has been stressed as an important facilitator of knowledge transfer. Workforce stability in China was not a big problem fifteen years ago due to a mutual commitment between shipping organisations and their employees in the form of long-term employment contracts. Nowadays loyalty is eroding as a result of high personnel mobility and the lack of a genuine employment link as discussed earlier. Mutual trust becomes the first priority if any knowledge transfer were to happen. Corresponding to this is the learning and sharing environment that needs to be nourished through strong leadership. Unless

senior managers take the initiative, knowledge transfer will not flourish throughout the organisation. This is especially true when considering that collectivism and leadership have been traditionally and culturally standard practices in China.

Furthermore, ICT related practices are not only knowledge components of the OKB, but also facilitators contributing to the knowledge transfer process. Such contributions come from two levels. The first level is the ICT as a means of knowledge storage or repository directly involved in the knowledge transfer process. The second level is the trust building process facilitated by ICT given the spatial differences of shipping operations within a shipping organisation. Although ICT hardly provides competitive advantages because of its high imitability, the proper use of the technology will effectively facilitate knowledge transfer which in turn, would create a competitive edge for the organisation.

It is also found from the third research question that management practices being currently employed in shipping organisations do not affect the perceived effectiveness of EKT. This means that the proposed EKT practices are independent of any possible pre-assumptions respondents might have from their management experience in their respective organisations. The results can also be explained that for many organisations in China, shipping in particular, knowledge management is still a new concept and the practical application is yet to be investigated. Although the EKT as a whole cannot be explained by current management practices, a correlation exists between the ICT related elements in the EKT and the level of ICT application within an organisation. It is indicated that the higher the level of ICT application, the more effective these ICT elements in the EKT is perceived. This brings an understanding to the application of ICT and its value in the management of knowledge assets in shipping organisations. It is expected that once the practices in the other two elements are strategically implemented, their value to the knowledge transfer process will be more evident.



### 7.3 Limitations of the study

While this study sheds light on knowledge management in the shipping industry, the interpretation of the findings from three research questions should only be done with an appreciation of the limitations of the study. One limitation is incurred by the scope of the survey. As the survey was conducted in China only, care must be taken in attempting to generalise the results to the shipping industry of other countries. Although high mobility is universal in the shipping industry worldwide, perceptions of effective knowledge transfer for example, might be different due to the different cultural backgrounds. However, the identified three-element framework may assist in developing comparative studies that may lead to generalised findings.

Another limitation of the study concerns the sampling frame. As discussed in chapter four, the compilation of the mailing list was based on the *World Shipping Directory* (2007-2008). It was found when compiling the mailing list that some entries were duplicated. Attention was paid to the accuracy of the list. However, it became apparent during the data collection process that, some contact information in the *Directory* was incorrect. The response rate would have been greater had the accuracy of the contact information been higher. Nevertheless, the *World Shipping Directory* was considered the best source (reliability and completeness) when a complete directory of shipping companies was sought. In addition, the sixty per cent response rate might have, to a great extent, mitigated any possible adverse effects of the incorrect contact information.

Limitations were also created through the designation of the respondents. Although each questionnaire was addressed to the contact person as indicated in the *Directory* (in some cases this information was found through organisations' websites), which in most cases would be a general manager or operation manager, the person who actually answered the questionnaire was someone else. This was identified by the work experience recorded in the questionnaire. While the effects of such a change are hard to determine, it would be ideal if the questionnaire had been answered by the one who was really familiar with the issues raised in the questionnaire. It would also

provide an opportunity to identify the differences of the perceptions by the respondents' designation should a relevant question be inserted in the questionnaire. To some extent, the limitation has been mitigated by the analyses of differences according to the respondents' total work experience.

There is also a limitation on the methodology of the study. Due to the constraints of time and financial resources, the author was unable to conduct qualitative research methods such as interviews through either phone or fact-to-face. The adoption of a triangulation of methods, that is, a combination of both qualitative and quantitative approaches in the same study, would have brought a deeper understanding of the issues being investigated and more insights into the interpretation of findings from the research. This can be addressed through future research which is discussed in the following section.

## **7.4 Contribution of the research**

Knowledge management has come a long way from the resource-based view of the firm (Barney 1991; Prahalad & Hamel 1990; Teece *et al.* 1997; Wernerfeld 1984), and organisational learning (Hedlund 1994; Wenger 1998), to a knowledge-based view of strategy (Grant 1996; Nonaka 1994; Spender 1996). Recent years have seen the wide application of knowledge management into various industries. The shipping industry has lagged behind in embarking on this new management practice. Skill shortages not only impact on the shipping industry itself, but also on the wider maritime community. While traditionally maritime nations such as the United Kingdom have been struggling in maintaining a pool of experts to sustain their maritime related industries, new maritime nations such as China have been working hard to develop their maritime skill base to meet the fast expanding maritime economy. Various efforts have been made to tackle the problem brought by high personnel mobility in the industry with limited success. The application of knowledge management into the shipping industry provides a different approach to address this long-standing problem.

The first contribution of this research is the establishment of the concept of the organisational knowledge base (OKB) through extensive literature review. Although there is a range of concepts in relation to knowledge or organisational knowledge, and models for the measurement of intellectual capital or intangible assets, there is a lack of study and understanding to cover the knowledge assets that an organisation possesses. It is believed that the concept of OKB better captures the knowledge resources that an organisation can possibly use as leverage to gain competitive advantage. The identification of components in the OKB provides a framework as to what to manage and how to evaluate knowledge assets. In this sense, the research bridges a gap in the literature.

The identification and confirmation of knowledge components of the OKB in the context of the shipping industry in China is another contribution of the research. While knowledge management has been applied, to varying degree, in different industries, there is a dearth of research in relation to the applicability of this management practice to the shipping industry. Due to the unique characteristics of this industry, it is vital to examine the industry specifically and to identify relevant approaches in order for the application to be effective. In fact, the identification of knowledge components in the context of the shipping industry lays the foundation for the employment of relevant management tools.

Another contribution comes from the identification of effective knowledge transfer practices. Knowledge transfer is the key to combat the adverse effects brought by high mobility in the shipping industry. There is a range of tools and resources available in an organisation. The proper organisation and use of these tools and resources is crucial to the effective management of knowledge assets, which management involves a diverse range of practices and requires corporate effort. The identification of effective knowledge transfer practices provides a pragmatic guideline for the shipping organisations in China to implement their knowledge management strategies.

High personnel mobility is the key issue in this industry which is closely related to the OKB. A balanced flow of knowledge throughout an organisation may not adversely affect the overall OKB. However, this is not the case in the shipping industry where personnel have moved in a one-way direction. The confirmed effects of such a movement on the OKB raise the need for proper actions if a rich skill base is to be maintained. The further exploration of effective knowledge transfer practices provides the means for proper actions. The whole conceptual framework therefore presents a complete package to assist shipping organisations to identify their specific needs and to adopt appropriate management practices.

The last proposed contribution of this research is the fact that as a result of this study, further research is likely to follow to enrich the study of knowledge management in the shipping industry. The current research represents only one of these steps to bring the shipping industry in line with the new knowledge economy. Further research is required to explore knowledge management practices in different economies and to examine other facets of knowledge management such as knowledge creation and integration in the context of the shipping industry.

## **7.5 Implications for future research**

As elaborated earlier, this research is one of these steps to apply knowledge management into the shipping industry in order to address the effects of high mobility of personnel from a different perspective. The research makes its contribution to the literature as well as to management practices. However, due to the limitations of the study as specified earlier and the scope of the study, a comparative study in another country using the same research instrument will identify potential differences and improve the generalisability of the findings.

The research identified and examined the knowledge components of an OKB. The need arose to investigate the indicators of the knowledge management performance. This should be done along with the effective knowledge transfer practices as explored in this research. The identification of relationships between the OKB and EKT will

provide a tool to evaluate the effectiveness of current practices for an individual organisation and make adjustment wherever appropriate. The process will also improve the accountability of the knowledge management department or the chief knowledge officer to the senior managers in relation to the resources committed to knowledge management activities.

Another research area is the investigation of the relationship between the application of knowledge management and the organisational performance. This is a step further from the research identified above and will produce measurable results for organisations to develop a long-term knowledge management solution and strategically allocate their resources for the implementation of relevant knowledge management practices. Practically when the application of knowledge management yields tangible and measurable benefits to the organisation, more commitment will be made by senior managers to support management practices promoted by the chief knowledge officer.

A further research area comes from the fact that more and more shipping companies are outsourcing out some of their management functions such as technical management, crew management, legal services, or commercial management. The outsourcing will reconfigure the core knowledge assets of shipping companies and the overall structure of the shipping industry. While the result of outsourcing may have the same effect as personnel mobility in terms of knowledge flows to the organisation that is buying in the services, the fact that one ship management company may have many clients at the same time means that the focus of knowledge management needs to be adjusted. It is worthwhile, therefore, to investigate the impacts of such disintegration of management functions on the knowledge management of shipping organisations.

It is found from the literature review that alliances and cooperation between organisations have considerable implications on knowledge acquisition and sharing. Alliances are very common in the shipping industry, particularly liner shipping, where shipping companies share resources and knowledge of operations. Research

can be done to explore the effectiveness of knowledge acquisition (or assimilation) and sharing through alliances or cooperation and to identify challenges of managing knowledge in these new structures.

The research examined the perceptions in relation to knowledge transfer from the organisations' perspectives. As the main participants of knowledge transfer are individuals, it is beneficial to examine how individuals perceive the process of knowledge transfer. As discussed in chapter three, the willingness, motivation, and absorptive capacity of individuals are critical for an effective knowledge transfer process to take place. An investigation of knowledge transfer barriers from the lens of individuals will add invaluable insights for the design and implementation of knowledge management strategies.

Finally a qualitative study of perceptions of shipping organisations in relation to the issues raised in this study could be a valuable supplement, especially for the interpretation of the findings from this research. A qualitative study may provide opportunities for shipping organisations to raise their concerns regarding the application of knowledge management practices and to discuss broader issues that a mail survey would not be able to achieve.

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## APPENDICES

### Appendix I Sample sizes for different sizes of population

Sample sizes for different sizes of population at a 95 per cent confidence level  
(assuming data are collected from all cases in the sample)

Population	Margin of error			
	5%	3%	2%	1%
50	44	48	49	50
100	79	91	96	99
150	108	132	141	148
200	132	168	185	196
250	151	203	226	244
300	168	234	267	291
400	196	291	434	384
500	217	340	414	475
750	254	440	571	696
1000	278	516	706	906
2000	322	696	1091	1655
5000	357	879	1622	3288
10000	370	964	1936	4899
100000	383	1056	2345	8762
1000000	384	1066	2395	9513
10000000	384	1067	2400	9595

Source: Saunders et al. (2000, p. 156)

## Appendix II Explanatory pre-test letter

Thank you for agreeing to pre-test the questionnaire that will be used in the *Major Study on the Knowledge Management Practices in the Shipping Industry*.

The purpose of the research is three-fold, firstly, to identify the knowledge components of an organisational knowledge base (OKB) in the shipping industry in China; secondly, to examine the effects of human mobility on the OKB; and finally, to explore effective knowledge transfer practices for shipping organisations in China. To achieve this, a mail survey will be conducted in China. Questionnaires will be distributed to 275 shipping organisations based on a careful sampling process.

Three research questions and their subsidiary research questions (SRQ) are provided as follows:

*Research question one: How is an organisational knowledge base described in the shipping industry?*

*Research question two: How are the effects of human mobility on the organisational knowledge base perceived in the shipping industry?*

*SRQ2.1: What are the effects of human mobility on the OKB?*

*SRQ2.2: How well can perceived effects of human mobility on the OKB be predicted by the current workforce stability?*

*Research question three: What are the effective knowledge transfer practices in the context of the shipping industry?*

*SRQ3.1: What are the effective knowledge transfer practices?*

*SRQ3.2: Can perceived effectiveness of knowledge transfer practices be predicted by the differing levels of existing management practices in a shipping organisation?*

Please contact me on (03) 6335 4877 or email at [J.Fei@amc.edu.au](mailto:J.Fei@amc.edu.au) if you have any questions when working through the questionnaire.

## **Questions for pre-testing the mail questionnaire**

Comments arising from your evaluation will be used to improve the questionnaire. Potential issues have been divided into three categories.

### **Layout**

- Does the layout of the questionnaire make it easy to read (for example font size and line spacing)?
- Are the questions in a logical order?
- Are all instructions clear?
- Are there any spelling and grammatical errors?

### **Completing the questionnaire**

- How long did the questionnaire take to read through?
- Are any of the questions unclear or ambiguous?
- Are there any questions you did not want to answer?
- Is the language appropriate for the proposed sample?

### **Purpose of the questionnaire**

- Did you consider that any major topics had been omitted?
- Are there any questions irrelevant to the research?

## Appendix III Covering letter (English)



### AUSTRALIAN MARITIME COLLEGE

Australian National Centre for Maritime Education, Training and Research

Australian Maritime College (AMC)  
Locked Bag 1397, Launceston  
Tasmania 7250, Australia  
Tel: +61 3 6335 4877  
Fax: +61 3 6335 4720

31 January 2008

#### **Re: Study of knowledge management practices in the shipping industry**

Dear Sir/Madam,

You have been identified as being someone who is able to significantly contribute to a major study on the knowledge management practices in the shipping industry. The study has been initiated to address the severe shortage of skilled and qualified personnel as a result of the shipping industry's low intakes and on-going outflow of its highly experienced personnel to other shore-based industries. Efforts have been made to address this issue with limited success. This study looks at the issue from a different perspective, which will provide the industry a new approach to tackling the problem of the shortage of qualified seafarers.

To complete this study, your input as a senior manager involved in the managing of human resources and knowledge assets of your organisation will make a valuable contribution to the quality of information obtained. It is anticipated that the findings of this study will enable shipping companies in China more successful, to manage their knowledge assets more effectively, and to assist in making shipping companies more competitive both domestically and internationally.

You are kindly asked to complete the attached questionnaire, which should take about 15 minutes to complete, and return it in the reply-paid envelope supplied. Please be advised that all information provided will be treated as completely confidential, you or your organisation will not be identified in the final report. Should you have any concerns of an ethical nature or complaints about the manner in which this study is conducted, please contact Marilyn Knott, Ethics Officer of the Human Research Ethics Committee (Tasmania) Network at Tel. +61 3 6226 2764; email: [Marilyn.Knott@utas.edu.au](mailto:Marilyn.Knott@utas.edu.au).

A summary report of the results of the study will be made available to participating organisations. The report will provide an opportunity to compare and benchmark your knowledge management efforts with those of other shipping companies. I am sure you will find the report useful for further developing your organisation's knowledge management practices.

Should you have any questions or require additional information, please feel free to contact Mr. Jiangang FEI (Tel: +61 3 6335 4877; email: [jfei@amc.edu.au](mailto:jfei@amc.edu.au)) or Professor Solomon Chen (Tel: +61 3 6335 4637; email: [Solomon.chen@amc.edu.au](mailto:Solomon.chen@amc.edu.au)).

Thank you for your participation!

Yours sincerely

Jiangang FEI    Lecturer, National Centre for Ports & Shipping  
Solomon CHEN Associate Director, National Centre for Ports & Shipping

## Appendix IV Covering letter (Chinese)



### AUSTRALIAN MARITIME COLLEGE 澳大利亚海事学院

Australian National Centre for Maritime Education, Training and Research  
澳大利亚国家海事教育、培训及研究中心

Australian Maritime College (AMC)  
Locked Bag 1397, Launceston  
Tasmania 7250, Australia  
Tel: +61 3 6335 4877  
Fax: +61 3 6335 4720

### 关于：航运业知识管理实践研究

尊敬的 先生/女士：

基于您在航运业内的丰富经验和对航运业的深刻了解，我们深信您能为航运业知识管理实践研究提供非常有价值的信息和建议。近年来全球进入航运界的新生力量(尤其是干部船员)逐年减少而人才流失现象越来越严重。从而造成了全球航运业人才严重短缺。尽管企业界和学术界为此做出了很多的努力，但收效甚微。航运业知识管理实践研究旨在从一个崭新的角度探讨人才短缺的问题。我们希望这一研究能为航运业知识管理的运用提供有价值的依据。

作为贵公司高级管理人员，您对人资源及企业知识财产的深入理解将确保此次研究所收集的信息具有很高的质量和可信度。我们期望这一研究结果能为中国的航运企业更有效地管理知识财产提供有益的帮助，使中国的航运企业在国内外市场更具竞争力。

本研究以不记名方式问卷进行调查，填写问卷约需15分钟。除研究主题外的有关您或贵公司的信息都将给予严格保密，不会泄露，敬请放心填答。如果您对此研究调查的内容及执行方式有任何疑问，请与澳大利亚人类研究伦理委员会(塔斯马尼亚)的 Marilyn Knott 女士联系(电话：+61 3 6226 2746；电子邮件：Marilyn.Knott@utas.edu.au)。

我们对您的参与深表感谢。本研究结果的摘要将对所有参与者开放。我们期望此摘要能为您比较和参照业内其它企业知识管理实践提供有益的参考，并为您继续发展完善贵公司的知识管理实践有所裨益。

完成的问卷将由我们委托的专人收回，您也可以将完成的问卷扫描后用电子邮件发给下面所提供的邮件地址。如果您对问卷有任何疑问或需要更多的信息，或者需要此研究结果的摘要，请与该研究项目的负责人费建钢先生(电话：+61 3 6335 4877；电子邮件：J.Fei@amc.edu.au)或者陈彦宏教授(电话：+61 3 6335 4637；电子邮件：solomon.chen@amc.edu.au)联系。

非常感谢您的参与和支持！

费建钢(项目负责人) Lecturer, National Centre for Ports & Shipping  
陈彦宏 Solomon CHEN Associate Director, National Centre for Ports & Shipping  
二〇〇八年一月三十日

## Appendix V Questionnaire (English)



**AUSTRALIAN MARITIME COLLEGE**  
National Centre for Ports and Shipping  
Locked Bag 1397  
Launceston, Tasmania 7250  
Australia



**UNIVERSITY OF TASMANIA**

### **Major Study on the Knowledge Management Practices in the Shipping Industry**

**Code Number.....**

### **Study of knowledge management practices in the shipping industry**

1. **‘Knowledge’** in the context of this study should be understood at both organisational and individual levels, that is, it includes both organisational knowledge and individual knowledge. In addition, knowledge can be either tacit (hard to articulate) or explicit (easy to express).
2. **‘Organisational knowledge base’** (OKB) refers to the total knowledge resource that an organisation can possibly use as leverage to gain competitive advantage. This includes both the organisational knowledge that is independent to any individual, as well as personal knowledge that can be possibly integrated into the organisational level.

#### **Part A: Components of an Organisational Knowledge Base**

##### **I. Please rate the importance of the following as knowledge assets of your organisation.**

		Very Important	Important	Unsure	Not Important	Not at all Important
A.1	Personal academic qualifications, such as university degrees	5	4	3	2	1
A.2	Organisational culture	5	4	3	2	1
A.3	Electronic Data Interchange (EDI)	5	4	3	2	1
A.4	Personal problem solving capability	5	4	3	2	1
A.5	Information storage and retrieval systems, such as databases	5	4	3	2	1
A.6	Personal work attitudes	5	4	3	2	1
A.7	Organisation's external relationships	5	4	3	2	1
A.8	Intellectual property, such as patents, copyrights, trademarks, registered design, and brands	5	4	3	2	1
A.9	Personal work experience	5	4	3	2	1
A.10	Information communication technologies, such as intranet including email, Bulletin Board System (BSB), and e-forum	5	4	3	2	1
A.11	Personal professional qualifications, such as certificates of competence	5	4	3	2	1
A.12	Organisational image	5	4	3	2	1
A.13	Organisational process manuals, for example, written instructions, and operational procedures	5	4	3	2	1
A.14	Personal innovation ability	5	4	3	2	1

##### **II. Are there any other components that you think are important and should be included in the organisational knowledge base? Please list and explain briefly your suggested components below.**

.....

.....

.....

**Part B: Personnel Turnover (Human Mobility)**

B.1 Does your organisation recruit graduates from Maritime Education Institutions? If yes, please tick the relevant box for the average number of graduates your organisation recruits every year.

No ..... ☐<sub>01</sub>

Yes

Onshore: 1-5 ..... ☐<sub>02</sub>

6-10..... ☐<sub>03</sub>

11-20 ..... ☐<sub>04</sub>

Over 20 ..... ☐<sub>05</sub>

Offshore: 1-10 .... ☐<sub>06</sub>

11-50 ..... ☐<sub>07</sub>

51-100 ..... ☐<sub>08</sub>

Over 100 ..... ☐<sub>09</sub>

B.2 If expressed in percentage, which of the following best describes the annual personnel turnover in your organisation?

Onshore

Less than 5% ..... ☐<sub>01</sub>

5-10% ..... ☐<sub>02</sub>

11-20% ..... ☐<sub>03</sub>

Over 20% ..... ☐<sub>04</sub>

Offshore

Less than 5% ..... ☐<sub>05</sub>

5-10% ..... ☐<sub>06</sub>

11-20% ..... ☐<sub>07</sub>

Over 20% ..... ☐<sub>08</sub>

B.3 Please indicate your views on the following statements about personnel turnover of your organisation.

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
B.3.1	Our entire workforce is very stable	5	4	3	2	1
B.3.2	Our shore-based positions are very stable	5	4	3	2	1
B.3.3	Seafarers move more frequently than shore-based personnel	5	4	3	2	1
B.3.4	Officers move more frequently than ratings	5	4	3	2	1
B.3.5	Higher rank officers (captains, chief engineers, chief officers, and 2 <sup>nd</sup> engineer) move more frequently than other seafarers	5	4	3	2	1
B.3.6	Seafarers in our organisation are contract-based	5	4	3	2	1
B.3.7	High personnel turnover affects our organisational performance	5	4	3	2	1
B.3.8	High turnover of our seafarers adversely affects our shipping operations	5	4	3	2	1
B.3.9	High turnover is quite normal in the shipping industry, we are used to it	5	4	3	2	1
B.3.10	Somehow we need to do something to reduce our personnel turnover	5	4	3	2	1
B.3.11	As long as there are enough people to recruit, turnover is not an issue	5	4	3	2	1
B.3.12	Anyhow, we prefer a stable workforce	5	4	3	2	1



**Part C: Perceived Effects of Human Mobility on the Organisational Knowledge Base**

**I. Because individuals are knowledge carriers, any movement of personnel will affect the organisational knowledge base (OKB). Please indicate your views on the following statements by rating them:**

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
C.1	Intake of graduates from Maritime Education Institutions (MEI) has a positive effect on the OKB	5	4	3	2	1
C.2	The intake of lecturers from MEI increases the OKB	5	4	3	2	1
C.3	The inflow of management staff increases the receiving organisation's OKB	5	4	3	2	1
C.4	The inflow of officers increases the receiving organisation's OKB	5	4	3	2	1
C.5	The inflow of ratings increases the receiving organisation's OKB	5	4	3	2	1
C.6	The OKB is negatively affected when management staff leave the organisation	5	4	3	2	1
C.7	The OKB is negatively affected when officers leave the organisation	5	4	3	2	1
C.8	The outflow of ratings has a negative effect on the OKB	5	4	3	2	1
C.9	The movement of management staff has a stronger effect on the OKB than that of seafarers	5	4	3	2	1
C.10	The movement of officers has a stronger effect on the OKB than that of ratings	5	4	3	2	1

**II. Individuals may move between organisations within the shipping industry or possibly move into non-shipping or even non-maritime industries. Please indicate your views on the following statements by rating them:**

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
C.11	Movement of personnel within the shipping industry does not affect the overall knowledge base of the industry	5	4	3	2	1
C.12	Further education or training of personnel has a positive effect on the knowledge base of the whole industry	5	4	3	2	1
C.13	The knowledge base of the shipping industry is negatively affected when personnel leave for positions outside the shipping industry	5	4	3	2	1
C.14	Shipping organisations benefit from the overall improvement of the knowledge base of the shipping industry	5	4	3	2	1
C.15	Compared with the personnel movement within the maritime industry, the impact is greater when personnel move to non-maritime industries, or into retirement	5	4	3	2	1

**III. Apart from above listed statements, if you have any other comments on the perceived effects of human mobility on the organisational knowledge base, please elaborate in the space given below.**

.....

.....

.....

**Part D: Current Knowledge Management Practices**

**I. General information about knowledge management practices in your organisation**

D.1 Does your organisation have a knowledge management (or information management) department?

Yes ..... ☐<sub>01</sub>

No ..... ☐<sub>02</sub>

D.2 Does your organisation have a designated person (for example, Chief Knowledge Officer – CKO) who is responsible for the management of organisational knowledge or information?

Yes ..... ☐<sub>01</sub>

No ..... ☐<sub>02</sub>

D.3 Does your organisation have an intranet?

Yes ..... ☐<sub>01</sub>

No ..... ☐<sub>02</sub>

D.4 Does your organisation have a database (similar to an Enterprise Resource Planning)?

Yes ..... ☐<sub>01</sub>

No ..... ☐<sub>02</sub>

D.5 Who do you think should have the access to this database?

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
D.5.1	All staff within the organisation	5	4	3	2	1
D.5.2	Only senior managers	5	4	3	2	1
D.5.3	Staff in different departments have access to their relevant part of the database	5	4	3	2	1
D.5.4	Only staff from information/knowledge department can access the database	5	4	3	2	1
D.5.5	Access to the database is approved by senior managers on a case basis	5	4	3	2	1

D.6 Is your fleet equipped with internet access?

All our ships have internet access ..... ☐ 01

Some of our ships have internet access ..... ☐ 02

None of our ships has internet access ..... ☐ 03

D.7 If your organisation has not installed or does not intend to install internet access facilities on ships, what are the main reasons?

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
D.7.1	The initial installation costs are too high	5	4	3	2	1
D.7.2	The usage is too expensive	5	4	3	2	1
D.7.3	Most crew onboard are not interested	5	4	3	2	1
D.7.4	Crewmembers are too busy to surf on the internet	5	4	3	2	1
D.7.5	There are no justifiable benefits of installing internet access facilities onboard	5	4	3	2	1

D.8 What communication means does your organisation have between your onshore management and onboard ship operations?

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
D.8.1	Telegraph	5	4	3	2	1
D.8.2	Radio/VHF	5	4	3	2	1
D.8.3	Satellite telephone	5	4	3	2	1
D.8.4	Internet (e.g. emails)	5	4	3	2	1

D.9 What is the most preferred means of communication between your onshore management and onboard ship operations?

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
D.9.1	Telegraph	5	4	3	2	1
D.9.2	Radio/VHF	5	4	3	2	1
D.9.3	Satellite telephone	5	4	3	2	1
D.9.4	Internet (e.g. emails)	5	4	3	2	1

**II. Please indicate the extent that you agree or disagree with each of the following statements about how your organisation endeavours to increase your organisational knowledge base.**

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
D.10	Employee retention is very important to our operations	5	4	3	2	1
D.11	We do not have any programs in place to attract new employees	5	4	3	2	1
D.12	We do not provide any incentives to retain current staff	5	4	3	2	1
D.13	We provide higher salary to retain our current staff	5	4	3	2	1
D.14	We provide higher salary to attract new employees	5	4	3	2	1
D.15	We provide better promotion opportunities to retain our current staff	5	4	3	2	1
D.16	We provide better promotion opportunities to attract new employees	5	4	3	2	1
D.17	We provide onboard-to-onshore career paths for our staff	5	4	3	2	1
D.18	We support personal development (including both academic and professional development)	5	4	3	2	1
D.19	We encourage such personal development by providing better promotion opportunities	5	4	3	2	1
D.20	We have our own training centre and programs	5	4	3	2	1
D.21	We regularly purchase training softwares and make them available to all staff	5	4	3	2	1
D.22	We source out our training tasks	5	4	3	2	1
D.23	We fully pay for employee training	5	4	3	2	1
D.24	We partially pay for employee training	5	4	3	2	1
D.25	Our employees take care of their own training needs	5	4	3	2	1
D.26	We use one-to-one mentoring to train our employees	5	4	3	2	1
D.27	We organise regular formal gatherings for our employees	5	4	3	2	1
D.28	We encourage informal networking among our employees	5	4	3	2	1
D.29	We collect information through regular debriefings of our seafarers	5	4	3	2	1
D.30	We make collected information available to all staff through written documents or in electronic forms	5	4	3	2	1
D.31	Only senior managers can access to these documents	5	4	3	2	1
D.32	Onboard crew have free access to internet	5	4	3	2	1

**Part E: Effective Knowledge Transfer Practices**

**I. Please indicate your view on the following statements by rating them:**

		Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
E.1	Learning and sharing environment enhances knowledge flows within the organisation	5	4	3	2	1
E.2	Accessibility of data storage and retrieval systems through information technology facilitates knowledge transfer	5	4	3	2	1
E.3	Knowledge transfer is encouraged when an organisation commits resources to related activities	5	4	3	2	1
E.4	Information technology is effective in facilitating the transfer of explicit knowledge, for instance written instructions or manuals	5	4	3	2	1
E.5	Knowledge transfer is facilitated when there is mutual trust between employees and their senior managers	5	4	3	2	1
E.6	Knowledge flow is enhanced when there is a high level of collaboration among individuals across departments.	5	4	3	2	1
E.7	Availability of communication-related technology such as email, video conferencing, bulletin boards, and discussion forum enables effective knowledge transfer among participants	5	4	3	2	1
E.8	Organisational culture that tolerates failures fosters confidence to share experiences	5	4	3	2	1
E.9	Information technology by itself is ineffective in transferring experiential knowledge, for example, the diagnosis of a problem	5	4	3	2	1
E.10	Knowledge transfer is facilitated in organisational culture where collective efforts are valued	5	4	3	2	1
E.11	Organisational culture that nourishes horizontal communication enhances a high level of collaboration among individuals across departments	5	4	3	2	1
E.12	Knowledge transfer can be facilitated by properly recognising active learning and sharing behaviours	5	4	3	2	1
E.13	Organisational culture that advocates equity among departments reduces the tendency of knowledge protection therefore increasing the likelihood of knowledge transfer within the organisation	5	4	3	2	1
E.14	Communication-related technology such as email, video conferencing, e-directories, bulletin boards, and discussion forums helps build up personal relationship through easy communication	5	4	3	2	1

## Part F: Classification Information

F.1 Please indicate the business sector of your organisation:

Ship Owner.....☐<sub>01</sub>      Manning company .....☐<sub>02</sub>      Ship Manager .....☐<sub>03</sub>

F.2 Please indicate the operation sector of your fleet:

Both ocean and inland water.....☐<sub>01</sub>

Ocean only .....☐<sub>02</sub>      Inland water only .....☐<sub>03</sub>

F.3 Please indicate the types of ships your organisation is operating?

General cargo .....☐<sub>01</sub>      container .....☐<sub>02</sub>      Dry bulk.....☐<sub>03</sub>

Wet bulk .....☐<sub>04</sub>      Gas .....☐<sub>05</sub>      Others .....☐<sub>06</sub>

F.4 In which of the following categories is your fleet size in number of ships?

Less than 5 .....☐<sub>01</sub>      5-10 .....☐<sub>02</sub>      11-20 .....☐<sub>03</sub>

21-30.....☐<sub>04</sub>      31-50 .....☐<sub>05</sub>      Over 50 .....☐<sub>06</sub>

F.5 In which of the following categories is your fleet size in dead weight tonnage (DWT)?

50,000 or less .....☐<sub>01</sub>      250,001 – 500,000.....☐<sub>04</sub>

50,001 – 100,000 .....☐<sub>02</sub>      500,001 – 1,000,000.....☐<sub>05</sub>

100,001 – 250,000.....☐<sub>03</sub>      Over 1,000,000.....☐<sub>06</sub>

F.6 How many employees are there in your organisation?

Onshore:      Less than 10.....☐<sub>01</sub>      10-20 .....☐<sub>02</sub>      21 – 50 .....☐<sub>03</sub>

51 – 100.....☐<sub>04</sub>      Over100.....☐<sub>05</sub>

Offshore:      Less than 50.....☐<sub>06</sub>      50-100 .....☐<sub>07</sub>      101 – 250.....☐<sub>08</sub>

251 – 500.....☐<sub>09</sub>      Over 500.....☐<sub>10</sub>

F.7 Your experience (in years) in the shipping industry:

Offshore: .....      Onshore: .....

If you would like to receive a copy of the summary of this report, please provide your post or email address (this will be kept confidential).

Email: .....

Post address: .....

**THANK YOU FOR YOUR PARTICIPATION**

## Appendix VI Questionnaire (Chinese)



**AUSTRALIAN MARITIME COLLEGE**

澳大利亚海事学院

National Centre for Ports and Shipping

Locked Bag 1397

Launceston, Tasmania 7250

Australia



**UNIVERSITY OF TASMANIA**

塔斯马尼亚大学

# 航运业知识管理实践研究

编号.....

## 航运业知识管理实践研究

“知识”在此研究中应从个人及企业两个层面理解，既包括个人知识也包括企业知识。另外，知识可以是显性的(易表达的)也可以是隐性的(不易表达的)。

“企业知识库”是指一个企业所拥有的，可以用于获得竞争优势的所有知识资源。企业知识库包括独立于个人之外的企业知识，比如说明书，操作流程，各种手册，数据库以及企业文化。企业知识库还包括个人知识，例如个人所获得的教育和培训，个人的经历，专业技术以及个人的工作和生活态度。这些个人知识有可能通过适当的管理手段融合到企业里。

### 第一部分：企业知识库的组成

I. 请标示下列各项作为贵公司企业知识库组成的重要性：

		很重要	重要	不确定	不重要	一点也不重要
A.1	个人的学历(比如大学的学位)	5	4	3	2	1
A.2	企业文化	5	4	3	2	1
A.3	电子数据交换系统	5	4	3	2	1
A.4	个人解决问题的能力	5	4	3	2	1
A.5	信息存取系统，比如数据库	5	4	3	2	1
A.6	个人工作态度	5	4	3	2	1
A.7	企业的外部关系	5	4	3	2	1
A.8	企业知识产权，比如专利，版权，商标，品牌等	5	4	3	2	1
A.9	个人工作经历	5	4	3	2	1
A.10	和通讯有关的信息技术，比如企业内部网包括电子邮件，在线论坛，电子公告牌系统等	5	4	3	2	1
A.11	个人职业资格，例如船员等级证书	5	4	3	2	1
A.12	企业外部形象	5	4	3	2	1
A.13	工程手册，比如说明书和操作流程	5	4	3	2	1
A.14	个人创新能力	5	4	3	2	1

II. 您认为还有没有其它的项目应该包括在企业知识库内？请将您建议的项目列在下面并作简要的说明。

.....

.....



## 第二部分：人才流动

B.1 请问贵公司是否招收海事院校的毕业生？如果是，请在下面相应的框里打√以显示贵公司每年招收的毕业生人数。

不招收 ..... ☐<sub>01</sub>

招收：

岸上工作人员：1-5人 .... ☐<sub>02</sub>      6-10人 ..... ☐<sub>03</sub>      11-20人 ..... ☐<sub>04</sub>      20人以上 ..... ☐<sub>05</sub>

海上工作人员：1-10人... ☐<sub>06</sub>      11-50人..... ☐<sub>07</sub>      51-100人... ☐<sub>08</sub>      100人以上..... ☐<sub>09</sub>

B.2 如果以百分比表示，下列的哪项最能体现贵公司每年的人员变动情况？

岸上

海上

5%以下 ..... ☐<sub>01</sub>

5%以下 ..... ☐<sub>05</sub>

5-10% ..... ☐<sub>02</sub>

5-10% ..... ☐<sub>06</sub>

11-20% ..... ☐<sub>03</sub>

11-20% ..... ☐<sub>07</sub>

20%以上 ..... ☐<sub>04</sub>

20%以上 ..... ☐<sub>08</sub>

B.3 请标示您对下列有关贵公司人员变动情况的陈述的同意程度

		完全 同意	同意	不确定	不同意	完全 不同意
B.3.1	我们公司的人员流动率很低	5	4	3	2	1
B.3.2	我们陆地上的职位很稳定	5	4	3	2	1
B.3.3	船员的流动比陆上人员更频繁些	5	4	3	2	1
B.3.4	干部船员(驾驶员和轮机员)的流动比低级船员(水手和机匠)更频繁些	5	4	3	2	1
B.3.5	职位高的干部船员(船长，轮机长，大副，大管轮)比其它船员流动更频繁些	5	4	3	2	1
B.3.6	我们公司的大部分船员是合同制的	5	4	3	2	1
B.3.7	人才流动率高影响企业业绩	5	4	3	2	1
B.3.8	船员流动率高负面影响船舶营运	5	4	3	2	1
B.3.9	航运业内人才流动率高是个正常现象，我们习惯了	5	4	3	2	1
B.3.10	我们应该采取点措施以降低人才流动	5	4	3	2	1
B.3.11	只要有足够的人员可以招收，人才流动不是个问题	5	4	3	2	1
B.3.12	无论如何，我们还是喜欢稳定的员工队伍	5	4	3	2	1

### 第三部分：人才流动对企业知识库的影响

I. 人是知识的载体，因此人才流动会影响企业知识库。不同类型的人才流动对企业知识库的影响也是不同的。请标示您对下列陈述的同意程度：

		完全 同意	同 意	不确 定	不同 意	完全 不同意
C.1	来自海事院校的毕业生对企业知识库有积极影响	5	4	3	2	1
C.2	来自海事院校的教职人员加入本企业会丰富企业知识库	5	4	3	2	1
C.3	管理人员加入到本企业对企业知识库具有积极的影响	5	4	3	2	1
C.4	干部船员(驾驶员和轮机员)加入本企业会增加本企业知识库	5	4	3	2	1
C.5	低级船员(水手和机匠)加入本企业会增加企业知识库	5	4	3	2	1
C.6	管理人员离开本企业对企业知识库有负面影响	5	4	3	2	1
C.7	干部船员(驾驶员和轮机员)离开本企业会对企业知识库造成负面影响	5	4	3	2	1
C.8	低级船员(水手和机匠)离开本企业会对企业知识库有负面影响。	5	4	3	2	1
C.9	管理人员的流动对企业知识库的影响比船员大	5	4	3	2	1
C.10	干部船员(驾驶员和轮机员)的流动对企业知识库的影响比低级船员(水手和机匠)的流动大	5	4	3	2	1

II. 人才的流动可能会局限于航运业，也可能在航运业与非航运业之间流动，有的甚至会从航运业流向非海事业。请您标示对下列各陈述的看法。

		完全 同意	同意	不确 定	不同 意	完全 不同意
C.11	航运业同业间的人才流动不会影响航运业的整体知识库	5	4	3	2	1
C.12	对人员的培训和再教育会对航运业的整体知识库产生积极影响	5	4	3	2	1
C.13	航运业内人士离开航运业会对航运业的整体知识库产生负面影响	5	4	3	2	1
C.14	航运企业会受益于航运业整体知识库的提升	5	4	3	2	1
C.15	和海事业内的人才流动相比，当人才流向非海事类行业(或退休)时，人才流动对航运业整体知识库的冲击更大些	5	4	3	2	1

III. 除了上述关于人才流动对企业知识库影响的陈述以外，请问您还有没有其它的看法，请在下面作简要的说明。

.....

.....

.....

## 第四部分：知识管理实践的现状

### I. 贵公司知识管理实践的信息

D.1 请问贵公司是否有独立的知识管理(或信息管理)部门？

是的 ..... ☐<sub>01</sub>                      没有 ..... ☐<sub>02</sub>

D.2 请问贵公司是否有专门人员（比如：知识/信息管理经理）负责管理公司知识财产(或信息)？

是的 ..... ☐<sub>01</sub>                      没有 ..... ☐<sub>02</sub>

D.3 请问贵公司有企业局域网吗？

是的 ..... ☐<sub>01</sub>                      没有 ..... ☐<sub>02</sub>

D.4 请问贵公司有类似于企业资源规划(Enterprise Resource Planning)方面的数据库吗？

是的 ..... ☐<sub>01</sub>                      没有 ..... ☐<sub>02</sub>

D.5 您认为谁有权进入这个数据库(请标示您对下列陈述的同意程度)？

		完全 同意	同意	不确定	不同意	完全 不同意
D.5.1	公司内的所有员工	5	4	3	2	1
D.5.2	企业内高层管理人员	5	4	3	2	1
D.5.3	公司不同部门的员工可以进入相应的	5	4	3	2	1
D.5.4	只有信息/知识管理部门的人员可以进入相应的 数据库	5	4	3	2	1
D.5.5	进入数据库必须征得高层管理人员的允许	5	4	3	2	1

D.6 贵公司的船队安装了英特网吗?

我们所有的船都安装了英特网 ..... ☐<sub>01</sub>

只有部分船舶才装有英特网 ..... ☐<sub>02</sub>

我们的船都没有安装英特网 ..... ☐<sub>03</sub>

D.7 您认为在船上不安装英特网的主要原因是什么?

		完全同 意	同意	不确定	不同意	完全 不同意
D.7.1	安装费用太高	5	4	3	2	1
D.7.2	使用费太贵	5	4	3	2	1
D.7.3	大部分的船员对英特网不感兴趣	5	4	3	2	1
D.7.4	船员工作太忙, 根本没有时间上网	5	4	3	2	1
D.7.5	在船上安装英特网没有太明显的益处	5	4	3	2	1

D.8 请问贵公司最常使用的岸与船的通信联络手段是什么?

		完全同意	同意	不确定	不同意	完全 不同意
D.8.1	电报	5	4	3	2	1
D.8.2	无线电话/甚高频	5	4	3	2	1
D.8.3	卫星电话	5	4	3	2	1
D.8.4	英特网(电子邮件)	5	4	3	2	1

D.9 您认为什么通讯手段最适合进行岸与船的通信联络?

		完全同 意	同意	不确定	不同意	完全 不同意
D.9.1	电报	5	4	3	2	1
D.9.2	无线电话/甚高频	5	4	3	2	1
D.9.3	卫星电话	5	4	3	2	1
D.9.4	英特网(电子邮件)	5	4	3	2	1

## II. 请您标示对下列有关贵公司致力于增加企业知识财产的陈述的看法

		完全 同意	同意	不确定	不同意	完全 不同意
D.10	留住现有的公司员工对我们企业的运行非常重要	5	4	3	2	1
D.11	我们目前还没有吸引人才的具体的措施	5	4	3	2	1
D.12	我们没有具体的激励机制留住公司现有人才	5	4	3	2	1
D.13	我公司用高薪留住现有人才	5	4	3	2	1
D.14	我公司用高薪吸引外来人才	5	4	3	2	1
D.15	我们通过为员工提供更好的升迁机会以留住现有公司人才	5	4	3	2	1
D.16	我们以提供更好的升迁机会吸引外来人才	5	4	3	2	1
D.17	我们为船员提供由海上到陆地的职业路径	5	4	3	2	1
D.18	我公司支持个人发展(包括学术和职业发展)	5	4	3	2	1
D.19	我们通过提供更好的升迁机会鼓励个人发展	5	4	3	2	1
D.20	我公司有自己的培训中心和培训项目	5	4	3	2	1
D.21	我公司经常购买培训软件供员工使用	5	4	3	2	1
D.22	我们把培训任务交给专业的培训机构	5	4	3	2	1
D.23	我们为员工支付培训费用	5	4	3	2	1
D.24	我们为员工培训提供补贴	5	4	3	2	1
D.25	员工的培训均由自己负责	5	4	3	2	1
D.26	我公司使用一对一指导的方式培训员工	5	4	3	2	1
D.27	我公司经常组织正式的员工聚会	5	4	3	2	1
D.28	我们鼓励员工参加社团或社交活动	5	4	3	2	1
D.29	我们通过听取船员的汇报收集信息	5	4	3	2	1
D.30	我们将收集到的信息用文件(或电子文件)的方式给员工参阅	5	4	3	2	1
D.31	只有高层管理人员才有机会参阅这些文件信息	5	4	3	2	1
D.32	我们的船员能在船上免费上网	5	4	3	2	1

## 第五部分：有效的知识传递实践

### I. 请您标示对下列陈述的看法。

		完全 同意	同意	不确定	不同意	完全不 同意
E.1	一个提倡学习和知识分享的企业氛围能促进企业内的知识流通	5	4	3	2	1
E.2	由信息技术提供的数据存取系统能促进知识的传递	5	4	3	2	1
E.3	如果企业为知识传递相关的活动提供相应的资源，那么这种知识传递活动就能得到鼓励和发展	5	4	3	2	1
E.4	信息技术能有效地促进显性知识的传递(比如书面的说明和手册)	5	4	3	2	1
E.5	普通雇员与高层管理之间的相互信任能促进企业内的知识传递	5	4	3	2	1
E.6	跨部门的高度协调合作能加强企业内部的知识流动	5	4	3	2	1
E.7	和信息交流有关的技术，比如电子邮件，视频会议，电子公告牌系统以及在线论坛等，使参与者能有效地传递知识	5	4	3	2	1
E.8	能容忍犯错的企业文化可以提高个人分享经历的自信和勇气	5	4	3	2	1
E.9	信息技术对传递经验性的知识(比如诊断问题)没有太大的帮助	5	4	3	2	1
E.10	崇尚集体精神的企业文化能促进企业内的知识传递	5	4	3	2	1
E.11	鼓励和培养内部横向交流的企业文化能促进高水平的跨部门人员协调合作	5	4	3	2	1
E.12	对学习和分享知识的行为给予适当的认可和表彰有利于企业内的知识传递	5	4	3	2	1
E.13	提倡部门平等的企业文化能减少部门间的知识保护，从而促进整个企业内部的知识流通	5	4	3	2	1
E.14	和信息交流有关的技术，比如电子邮件，视频会议，电子公告牌系统以及在线论坛等，能培养个人相互间的信任关系	5	4	3	2	1

### II. 除了上面关于有效的知识传递实践的陈述,请问您还有什么看法(请作简要说明)

.....

## 第六部分：分类信息

F.1 请标示贵公司商业活动的范畴(请在相应的框内打√)：

船东 ..... ☐<sub>01</sub>      船员服务公司 ..... ☐<sub>02</sub>      船舶管理公司 ..... ☐<sub>03</sub>

F.2 请标示贵公司船队的营运范围:

海洋及内河运输 ..... ☐<sub>01</sub>  
只有海洋运输 ..... ☐<sub>02</sub>      只有内河运输 ..... ☐<sub>03</sub>

F.3 请问贵公司营运的船舶包括下列哪些类型(请在相应的框内打√)：

杂货船 ..... ☐<sub>01</sub>      集装箱船 ..... ☐<sub>02</sub>      干散货船 ..... ☐<sub>03</sub>  
湿散货船 ..... ☐<sub>04</sub>      液化气船 ..... ☐<sub>05</sub>  
其它类型 ( 请说明 ) ..... ☐<sub>06</sub>

F.4 以船舶数量计算，请问贵公司的船队规模属于下列哪一组？

5艘以下 ..... ☐<sub>01</sub>      5-10艘 ..... ☐<sub>02</sub>      11-20艘 ..... ☐<sub>03</sub>  
21-30艘 ..... ☐<sub>04</sub>      31-50艘 ..... ☐<sub>05</sub>      50艘以上 ..... ☐<sub>06</sub>

F.5 如以载重量计算，请问贵公司的船队规模属于下列哪一组？

50,000吨以下 ..... ☐<sub>01</sub>      250,001 – 500,000吨 ..... ☐<sub>04</sub>  
50,000 – 100,000吨 ..... ☐<sub>02</sub>      500,001 – 1,000,000吨 ..... ☐<sub>05</sub>  
100,001 – 250,000吨 ..... ☐<sub>03</sub>      1,000,000吨以上 ..... ☐<sub>06</sub>

F.6 请问贵公司有多少员工(请在相应的框内打√)?

岸上    10人以下 ..... ☐<sub>01</sub>      10-20人 ..... ☐<sub>02</sub>      21-50人 ..... ☐<sub>03</sub>  
          51-100人 ..... ☐<sub>04</sub>      100人以上 ..... ☐<sub>05</sub>  
船上    50人以下 ..... ☐<sub>06</sub>      50-100人 ..... ☐<sub>07</sub>      101-250人 ..... ☐<sub>08</sub>  
          251-500人 ..... ☐<sub>09</sub>      500人以上 ..... ☐<sub>10</sub>

F.7 您在航运业的经历(工作年限)：

海上经历 ..... ( 年 )      陆上经历 ..... ( 年 )

如果您需要此研究报告的摘要，请提供您的通讯地址或电子邮件地址(所有这些信息将予以严格保密)。

电子邮件： .....

通讯地址： .....

谢谢您参与本次研究调

## Appendix VII Reminder letter (English)



### AUSTRALIAN MARITIME COLLEGE

Australian National Centre for Maritime Education, Training and Research

Australian Maritime College (AMC)  
Locked Bag 1397, Launceston  
Tasmania 7250, Australia  
Tel: +61 3 6335 4877  
Fax: +61 3 6335 4720

06 March 2008

**Re: Study of knowledge management practices in the shipping industry**

Dear Sir/Madam,

You have been identified as being someone who is able to significantly contribute to a major study on the knowledge management practices in the shipping industry. A letter and a questionnaire were sent to you in early February to ask for your input into this study. We would like to thank those who have already completed and returned the questionnaire. Your contribution to the study is invaluable. Meanwhile if you have not yet responded, we would highly appreciate if you could complete and return the questionnaire since your response is extremely important to our study.

A summary report of the results of the study will be made available to participating organisations. The report will provide an opportunity to compare and benchmark your knowledge management efforts with those of other shipping companies. I am sure you will find the report useful for further developing your organisation's knowledge management practices.

If you would like another copy of the questionnaire, please inform us by emailing Mr. Jiangang Fei at [J.Fei@amc.edu.au](mailto:J.Fei@amc.edu.au). Should you have any questions or require additional information, please feel free to contact Mr. Jiangang FEI (Tel: +61 3 6335 4877; email: [jfei@amc.edu.au](mailto:jfei@amc.edu.au)) or Professor Solomon Chen (Tel: +61 3 6335 4637; email: [Solomon.chen@amc.edu.au](mailto:Solomon.chen@amc.edu.au)).

Thank you for your contribution!

Yours sincerely

Jiangang FEI    Lecturer, National Centre for Ports & Shipping  
Solomon CHEN Associate Director, National Centre for Ports & Shipping



## Appendix VIII Reminder letter (Chinese)



### AUSTRALIAN MARITIME COLLEGE

澳大利亚海事学院

Australian National Centre for Maritime Education, Training and Research

澳大利亚国家海事教育、培训及研究中心

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Australian Maritime College (AMC)  
Locked Bag 1397, Launceston  
Tasmania 7250, Australia  
Tel: +61 3 6335 4877  
Fax: +61 3 6335 4720

### 关于：航运业知识管理实践研究

尊敬的 先生/女士：

基于您在航运业内的丰富经验和对航运业的深刻了解，我们深信您能为航运业知识管理实践研究提供非常有价值的信息和建议。二月初我们给您寄去了一封信和一份问卷以征求您对航运业知识管理实践的看法。对于那些已经完成并返回问卷的，我们深表感谢，您对次研究的贡献是无价的。如果您还没有回复，我们恳请您在百忙之中抽一点时间回复问卷。因为您的参与对我们的这一研究有着非常重要的意义。

本研究结果的摘要将对所有参与者开放。我们期望此摘要能为您比较和参照业内其它企业知识管理实践提供有益的参考，并为您继续发展完善贵公司的知识管理实践有所裨益。

如果您需要问卷，请用邮件通知我们，我们会立即给您寄去。如果您对问卷有任何疑问或需要更多的信息，或者需要此研究结果的摘要，请与该研究项目的负责人费建钢先生（电话：+61 3 6335 4877；电子邮件：[J.Fei@amc.edu.au](mailto:J.Fei@amc.edu.au)）或者陈彦宏教授（电话：+61 3 6335 4637；电子邮件：[solomon.chen@amc.edu.au](mailto:solomon.chen@amc.edu.au)）联系。

非常感谢您的参与和支持！

费建钢(项目负责人) Lecturer, National Centre for Ports & Shipping

陈彦宏 Solomon CHEN Associate Director, National Centre for Ports & Shipping

二〇〇八年三月六日

## Appendix IX Mailing list

1	Adani Shipping Co Ltd (Dalian)	SO
2	Anhui Ocean Shipping Co Ltd	SO
3	ATL Shipping Ltd	SO
4	Beihai International Marine Transportation Co	SO
5	Bright Marine Co Ltd	SO
6	Carbow International Pte Ltd	SO
7	Chang An Shipping Co Ltd	SO SM
8	Chang Jiang Enterprises Co	SO
9	Changjiang National Shipping Group	SO
10	Changjiang Transportation Technology Co Ltd	SO
11	Changshun Shipping Co Ltd	SO
12	CHEC Guangzhou Dredging Co	SO
13	Cheng Hao International Ship Management Co Ltd	SM
14	China National Machinery Import & Export Corp	SO
15	Donghai Rescue Bureau Ministry of Communications	SO
16	Fujian Province Shipping Co - Xiamen Branch	SO
17	Guangdong Shantou Water Transport General Co	SO
18	Institute of Oceanography	SO
19	Nanhai Rescue Bureau Ministry of Communications	SO
20	Nanjing Petroleum Transportation Co Ltd	SO
21	North Sea Branch of State Oceanic Administration	SO
22	Zhejiang Province Shipping Co - Wenzhou Branch	SO
23	China Communications Import & Export Corp	SO
24	China Da An Shipping Co Ltd	SO
25	China Marine Bunker Supply Co (Dalian Branch)	SO
26	China Marine Bunker Supply Co (Guangzhou Branch)	SO
27	China Marine Bunker Supply Co (Qinhuangdao Branch)	SO
28	China Merchants Yangtze LPG Transportation Co Ltd	SO
29	China Nanshan Development Co Ltd	SO
30	China National Offshore Oil Corp (CNOOC)	SO
31	China National Transport Machinery Import & Export Corp	SO
32	China Offshore Oil Bohai Corp (COOBC)	SO
33	China Oilfield Service Ltd (COSL)	SO
34	China Shipping (Group) Co	SO
35	China Shipping Container Lines Co Ltd	SO
36	China Shipping Development Co Ltd	SO
37	China Shipping Development Co Ltd Tramp Co	SO
38	China Shipping Guangzhou Ship Management Co Ltd	SO SM

39	China Shipping Haisheng Co Ltd	SO
40	China Shipping International Intermodal Co Ltd	SO
41	China Shipping International Ship Management Co Ltd	SM
42	China United Lines Ltd	SO
43	China Yangtze River Shipping Co Ltd	SO
44	Chinese-Polish Joint Stock Shipping Co	SO
45	Chongqing Marine Shipping Co Ltd	SO
46	Chun Wei Shipping Co Ltd	SO
47	CNOOC China Ltd	SO
48	COSCO Angang Shipping Co Ltd	SO
49	COSCO Bulk Carrier Co Ltd (COSCO BULK)	SO
50	Dalian Ocean Shipping Company (COSCO DALIAN)	SO
51	Guangzhou Ocean Shipping Company (COSCO GUANGZHOU)	SO
52	Qingdao Ocean Shipping Company (COSCO QINGDAO)	SO
53	Shenzhen Ocean Shipping Company (COSCO SHENZHEN)	SO
54	COSCO Wallem Ship Management	SM
55	Xiamen Ocean Shipping Company (COSCO XIAMEN)	SO
56	COSCO Shipping Co Ltd (COSCOL)	SO
57	COSCO Container Lines Co Ltd (COSCON)	SO
58	CSC Shenzhen Ship Management Co Ltd	SM
59	Da Tong Shipping SA	SO
60	Dalian Beihai Shipping Co	SO
61	Dalian Chun An Ship Management Co Ltd	SO SM
62	Dalian Container Shipping Co Ltd	SO
63	Dalian East Ocean Maritime Consulting Services Co Ltd	SO
64	Dalian Fareast International Shipping Co	SO
65	Dalian Five Resources Shipping Co Ltd	SO
66	Dalian Grand Marine Ltd	SO
67	Dalian Haida Shipping Co Ltd	SO
68	Dalian Hua Xin Shipping Co Ltd	SO
69	Dalian Jilin Shipping Co Ltd	SO
70	Dalian Jiyuan International Ship Management Co Ltd	SM
71	Dalian Lifeng Shipping Co Ltd	SO
72	Dalian Longjiang International Marine Shipping	SO
73	Dalian Shipping Group Dalian Marine Shipping Corp	SO
74	Dalian Master Well Ship Management Co Ltd	SM
75	Dalian Saint Dragon Ship Management Co Ltd	SM
76	Dalian Seacarrier Co Ltd	SO
77	Dalian Shenglida Shipping Co Ltd	SO
78	Dalian Sincere Nice International Ship Management Co Ltd	SO SM
79	Dalian Steam Shipping Co	SO

80	Dalian Surui Shipping Co Ltd	SO
81	Dalian Tiger Shipping Ltd	SO
82	Dalian Tongyuan Shipping Agency Co Ltd	SO
83	Dalian Xinxing Shipping Co Ltd	SO
84	Dalian Yanping Shipping Agency Co Ltd	SO
85	Dalian Yixin Shipping Agency Co Ltd	SO
86	Dandong Marine Shipping Co Ltd	SO
87	DL East Shipping Co Ltd	SO
88	Dong Chang Haichang Shipping Co Ltd	SO
89	Eastern Rain International Ship Management Co Ltd	SM
90	Ever Link Maritime Co Ltd	SO
91	Fenghai Ocean Shipping Co Ltd	SO
92	Yantai Development Zone Fengyuan Shipping Co Ltd	SO
93	Fortune Sea International Ship Management Co Ltd	SM
94	Fujian Anda Shipping Co Ltd	SO
95	Fujian Chang Da Shipping Co	SO
96	Fujian Foreign Trade Centre Shipping Co Ltd	SO
97	Fujian Guanhai Shipping Co Ltd	SO
98	Fujian Guantou Shipping General	SO
99	Fujian Luoyuan Shipping Co	SO
100	Fujian Mindong Fulin Shipping Co	SO
101	Fujian Minfeng Shipping Co	SO
102	Fujian Orient Shipping Co Ltd	SO
103	Fujian Pingtan Jimei Shipping Co Ltd	SO
104	Fujian Shipping Co	SO
105	Fujian Xiamen Shipping Corp	SO
106	Fujian Xinan Shipping Co Ltd	SO
107	Fujian Yuanyuan Shipping Co Ltd	SO
108	Fuzhou Haijin Shipping Co Ltd	SO
109	Fuzhou Jinrong Shipping Co Ltd	SO
110	Fuzhou Minlun Shipping Co Ltd	SO
111	Fuzhou Wan Tat Shipping Co Ltd	SO
112	Fuzhou Xinjiahong Shipping Co Ltd	SO
113	Glory Ships Co Ltd	SO
114	Grand Fortune Group Co Ltd	SO
115	Great Master Ships Management Co Ltd	SM
116	Guang Dong Shipping Co Ltd	SO
117	Guangdong Haidian Shipping Co Ltd	SO
118	Guangdong Petroleum Co	SO
119	Guangdong Shuangtai Transport Group Co Ltd	SO
120	Guangdong Sun Font Shipping Co	SO

121	Guangdong Yudean Shipping Co Ltd	SO
122	Guangxi Fanggang Marine Co Ltd	SO
123	Guangzhou Maritime Transport (Group) Co Ltd	SO
124	Guangzhou Pan Ocean Shipping Co Ltd	SO
125	Guangzhou Shipping & Enterprises Co Ltd	SO
126	Guangzhou Sunny Ocean International Ship Management	SO SM
127	Guangzhou Yuehang Freight Transport Co Ltd	SO
128	Guo Fa Ocean Shipping Ltd	SO
129	GUO Xing Ship Management Co Ltd	SM
130	Hainan Changhai Steam Shipping Co	SO
131	Hainan Fenghua Marine Shipping Co	SO
132	Hainan Hui Long Shipping Enterprise Co	SO
133	Hainan Huilian Shipping Co Ltd	SO
134	Hainan International Marine Co Ltd	SO
135	Hainan Qinglong Shipping & Industrial Corp	SO
136	Hainan Tonglian Shipping Co	SO
137	Hainan Yuhai Shipping Co	SO
138	Hebei Ocean Shipping Co Ltd (HOSCO)	SO
139	Heilongjiang Marine Shipping Co	SO
140	Hengfa Shipping Inc	SO
141	Hengrong Industry Co of Ningde, Fujian Province	SO
142	Hong Kong Cheng Lu International Ship Management Co Ltd	SM
143	Hong Kong Xiang Rui Shipping Co Ltd	SO
144	Hong Yun Shipping Co Ltd	SO
145	Hongda Shipping Inc	SO
146	Hongyuan Shipping Co Ltd	SO
147	HTM Shipping Co Ltd	SO
148	Hua Hai Petroleum Transport & Marketing Co Ltd	SO
149	Huangshi Huyang Shipping Co Ltd	SO
150	Nanjing Huaxia Maritime Corp	SO
151	Hubei Tianen Petroleum Gas Transportation Co Ltd (TGNC)	SO
152	Huihe Maritime Transportation	SO
153	Jiangsu Fareast Shipping Co Ltd	SO
154	Jiangsu Marine Shipping Co	SO
155	Jiangsu Ocean Shipping Co Ltd (JOSCO)	SO
156	Jiangsu Tongyua Shipping & Enterprises Co Ltd	SO
157	Jiangxi Ocean Shipping Co	SO
158	Jinbao Intl Shipping Ltd	SO
159	Jipeng (Fuzhou) Ship Management Co Ltd	SM
160	Kang Long Shipping Co Ltd	SO

161	Lianjiang Shipping Co	SO
162	Lianyungang Shipping Corp	SO
163	Liaoning Marine Shipping Co Ltd	SO
164	Liaoning Steam Shipping Co	SO
165	Linda Ocean Line Inc	SO
166	Lufeng Shipping Co Ltd	SO
167	Ming Wah (Shekou) Shipping Co Ltd	SO
168	Minsheng Shipping Co	SO
169	Nanjing Hengfeng Shipping Co Ltd	SO
170	Nanjing Hua Hai Shipping Co Ltd	SO
171	Nanjing Shicheng Ship Management Co Ltd	SM
172	Nanjing Tanker Corp	SO
173	Nanjing Yongzheng Marine Co Ltd	SO
174	New Unite Marine Co Ltd	SO
175	Ning Bo Merchant Shiping Co Ltd	SO
176	Ningbo Beilun Yong Heng Ship Management	SO SM
177	Ningbo Donghai Shipping Co Ltd	SO
178	Ningbo Economic and Technological Development Zone Longsheng Shipping Co Ltd	SO
179	Ningbo Marine (Group) Co Ltd (NMGC)	SO
180	Ningbo Marine Co Ltd (NMCL)	SO
181	NOIMC Shipping (Shanghai) Co Ltd	SO
182	NYKOS Car Carrier Co Ltd	SO
183	Oujiang Shipping Co Ltd	SO
184	Pacific King International Shipping Management Co Ltd	SO SM
185	Peace Ocean Shipping SA Panama	SO
186	Power Ship Management Co Ltd	SM
187	Pudong Shipping Co	SO
188	Qing Dao Zhongren International Ship Management Co Ltd	SO SM
189	Qingdao Dehai Marine & Shipping Co Ltd	SO
190	Qingdao Harmony Shipping Co Ltd	SO
191	Qingdao Ocean Shipping Mariners College	SO
192	Qingdao Shunho Shipping Co Ltd	SO
193	Qinhuangdao Shipping Co	SO
194	Qinzhou South Shipping Co Ltd	SO
195	Rongcheng City Dongdu Shipping Co Ltd	SO
196	Sanco Shipping Ltd	SO
197	SB Submarine Systems Co Ltd	SO
198	Sea Star Ships Management Co Ltd	SM
199	Shandong Bohai Ferry Co Ltd	SO
200	Shandong Far East Marine Shipping Co Ltd	SO

201	Shandong Muping Shipping Co Ltd	SO
202	Shandong Province Hongnan Navigation Co	SO
203	Shandong Province International Marine Shipping Co	SO
204	Shandong Province marine Shipping Co	SO
205	Shandong Weifang Shunyuanyuan Shipping Co Ltd	SO
206	Shandong Yantai International Marine Shipping Co	SO
207	Shanghai Adani Shipping Co Ltd (Adani Shanghai)	SO
208	Shanghai Bao Steel Ocean Shipping Co Ltd	SO
209	Shanghai Baojiang Shipping Co Ltd	SO
210	Shanghai Changjiang Shipping Corp	SO
211	Shanghai Deqin Beautiful Ocean Ship Management	SM
212	Shanghai Far East Ship Business	SO
213	Shanghai Hai Hua Shipping Co Ltd (HASC0)	SO
214	Shanghai Jinhai Shipping & Trading Co Ltd	SO
215	Shanghai Jinjiang Shipping Corp Ltd	SO
216	Shanghai North Sea Shipping Co Ltd	SO
217	Shanghai Puyuang Shipping Co Ltd	SO
218	Shanghai Shipping Shareholder Co	SO
219	Shanghai Taili Shipping Co Ltd	SO
220	Shanghai Time Shipping Co Ltd	SO
221	Shanghai Vasteast International Shipping Management Co Ltd	SO SM
222	Shanghai Yangtze Shipping Co	SO
223	Shanghai Zhenhua Shipping Co Ltd	SO
224	Shantou Diyuanyuan Maritime Transport Co Ltd	SO
225	Shen Yang Shipping Co	SO
226	Sheng Da Shipping SA	SO
227	Shenzhen Tri-Dynas Oil & Shipping Co Ltd	SO
228	Shenzhen Wanda Shipping Co Ltd	SO
229	S & S Ship Management Co Ltd	SM
230	Shun Winner Shipping Co Ltd	SO
231	Sino Far East Management Co Ltd	SM
232	SITC Container Lines Co Ltd	SO
233	South China Sea Oil Joint Service Corp Shipping Co	SO
234	Tai Yuan Shipping Co Ltd	SO
235	Tangshan Anping Marine Co Ltd	SO
236	Tangshan Huaxing Shipping Co Ltd	SO
237	Tangshan Jinshan Marine Co Ltd	SO
238	Tianjin Centrants Ship Management Co Ltd	SM
239	Tianjin International Marine Shipping Co	SO
240	Tianjin Tianhui Shipping Enterprises Co Ltd	SO

241	Tianjin Tongda Shipping Co	SO
242	Tianjin Yuanhua Shipping Co Ltd	SO
243	Tongli Shipping Co Ltd	SO
244	United Maritime Service	SO
245	Wan Shun Shipping SA	SO
246	Wei Fong Shipping Co Ltd	SO
247	Weihai Shipping Co Ltd	SO
248	Wenzhou Marine Shipping Co	SO
249	Wuhan Datong Industry Co Ltd	SO
250	Xiamen Business Marine Co Ltd	SO
251	Xiamen Cheng Yi Shipping Co	SO
252	Xiamen Lianghui Ship Management Co Ltd	SO SM
253	Yantai Guangtong International Ship Management	SM
254	Yantai Haidu Shipping Co Ltd	SO
255	Yantai Marine Shipping Co	SO
256	Yantai Quanzhou Shipping Co Ltd	SO
257	Yantai Shun Tong Shipping Co Ltd	SO
258	Yantai Xiachuan Shipping Co Ltd	SO
259	Yantai Yuan Tong Shipping Co Ltd	SO
260	YN Ship Management Co Shanghai Ltd	SO SM
261	Yuan Hua Shipping Co Ltd	SO
262	Yun Xing Shipping Co Ltd	SO
263	Zhangzhou Yihe Shipping Co Ltd	SO
264	Zhejiang Bao Hong Shipping Co Ltd	SO
265	Zhejiang Fuxing Shipping Co Ltd	SO
266	Zhejiang Taizhou Hongda Shipping Co Ltd	SO
267	Zhenghe Shipping SA	SO
268	Zhejiang Marine Shipping Co	SO
269	Zhong Yang Shipping Co Ltd Co	SO
270	Zhoushan Fengfan Ocean Shipping Co Ltd	SO
271	Zhoushan Haibao Transport Company	SO
272	COSCO Shanghai Manning Co Ltd	SM
273	Hebei Ocean Shipping Co	SM
274	Tianjin Sealad Maritime Service Co Ltd	SM
275	Yantai Seaview Shipping	SM

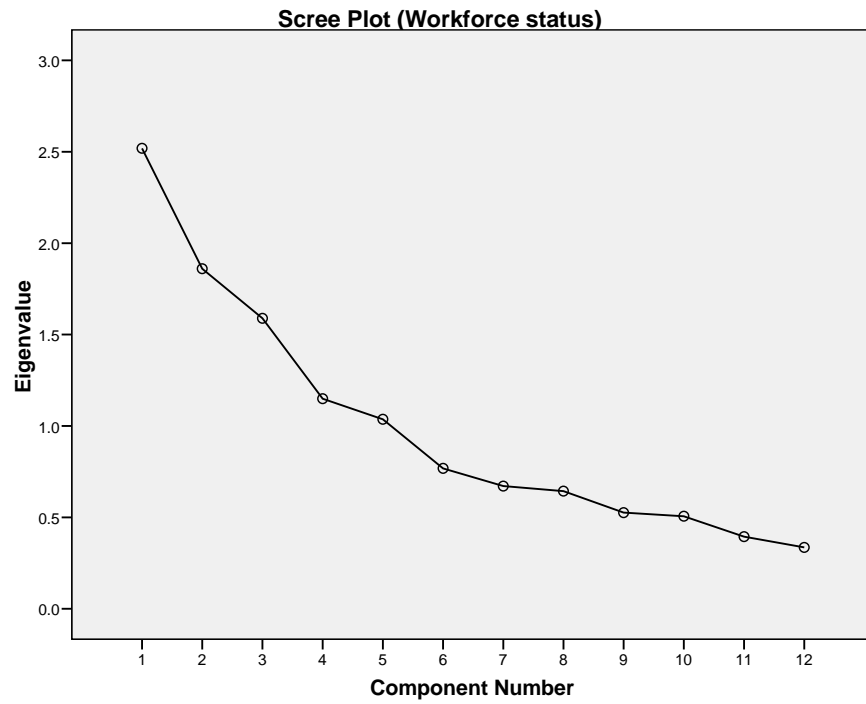


## Appendix X Crosstabulation of demographic data

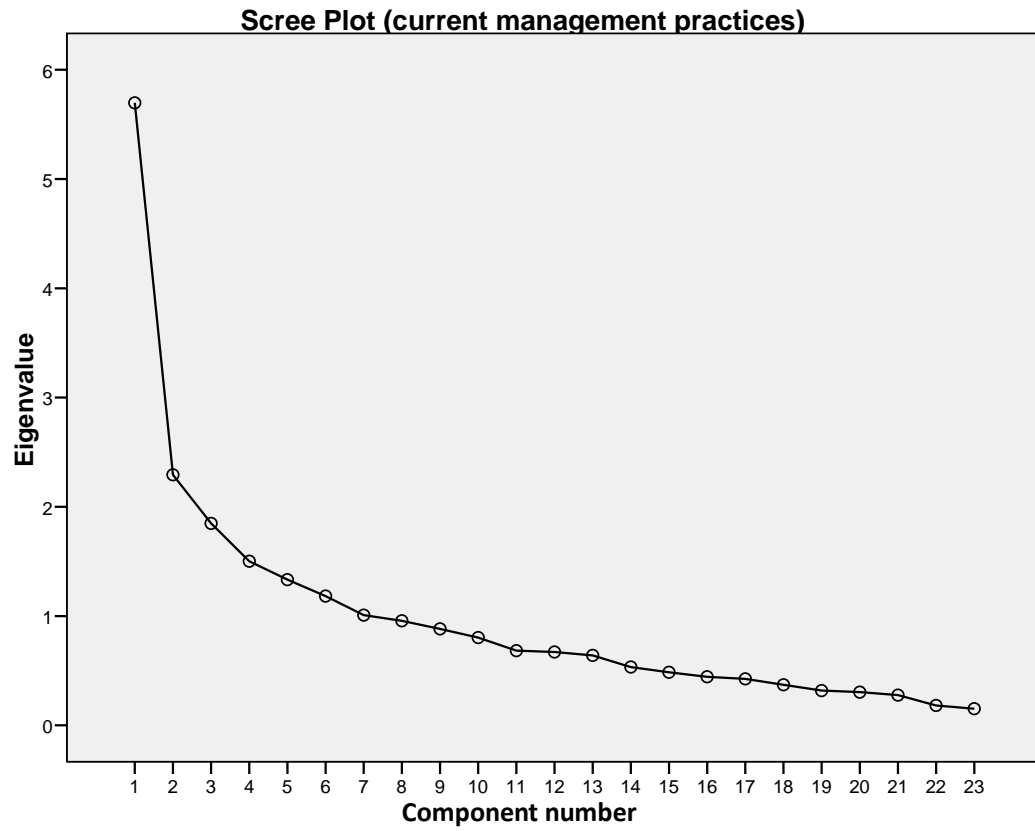
**Crosstabulation of demographic data (business sector, fleet size, experience offshore)**

Business sector	Fleet size	Frequency & Percentage	Offshore experience (years)			
			<= 5	6 - 10	11+	Total
Ship owner	Small	Count	9	13	10	32
		% within Offshore experience	31.0%	59.1%	35.7%	40.5%
		% of Total	11.4%	16.5%	12.7%	40.5%
	Medium	Count	7	4	5	16
		% within Offshore experience	24.1%	18.2%	17.9%	20.3%
		% of Total	8.9%	5.1%	6.3%	20.3%
	Large	Count	13	5	13	31
		% within Offshore experience	44.8%	22.7%	46.4%	39.2%
		% of Total	16.5%	6.3%	16.5%	39.2%
	Total	Count	29	22	28	79
		% within Offshore experience	100.0%	100.0%	100.0%	100.0%
		% of Total	36.7%	27.8%	35.4%	100.0%
Ship manager	Small	Count	5	5	4	14
		% within Offshore experience	15.2%	21.7%	50.0%	21.9%
		% of Total	7.8%	7.8%	6.3%	21.9%
	Medium	Count	8	9	1	18
		% within Offshore experience	24.2%	39.1%	12.5%	28.1%
		% of Total	12.5%	14.1%	1.6%	28.1%
	Large	Count	20	9	3	32
		% within Offshore experience	60.6%	39.1%	37.5%	50.0%
		% of Total	31.3%	14.1%	4.7%	50.0%
	Total	Count	33	23	8	64
		% within Offshore experience	100.0%	100.0%	100.0%	100.0%
		% of Total	51.6%	35.9%	12.5%	100.0%

## Appendix XI Screeplot (workforce status)

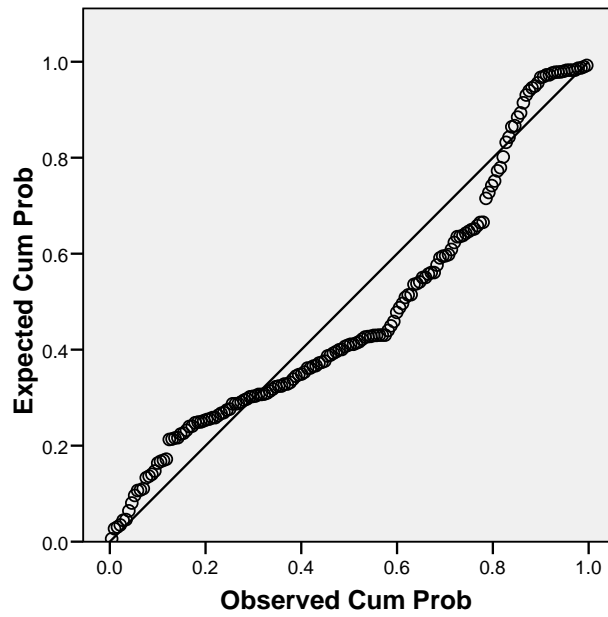


## Appendix XII Screeplot (current management practices)

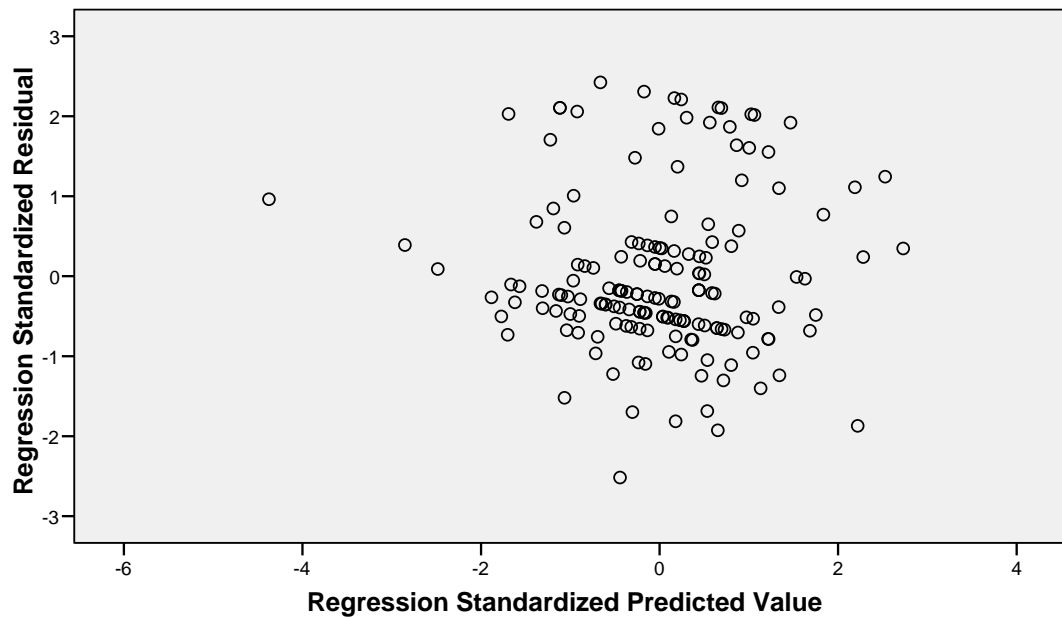


## Appendix XIII Normal P-P plot, Scatterplot

Normal P-P Plot of regression standardised residual (ekt e.9 deleted)



Scatterplot (ekt e.9 deleted)



## Appendix XIV Internet access

### Percentage of intranet, database, and onboard internet access

	YES	NO
Does your organisation have a intranet	89.2	10.8
Does your organisation have a database	62.0	38.0
<b>Is your fleet equipped with internet access?</b>		
All our ships have internet access	50.6	
Some of our ships have internet access	31.3	
None of our ships has internet access	18.1	

