Organisational Knowledge Transfer through Creation, Mobilisation and Diffusion: a case analysis of *InTouch* within Schlumberger

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Ashley Braganza
Cranfield University, UK
a.branganza@cranfield.ac.uk

Ray Hackney
Brunel University, UK
Business School
ray.hackney@gmail.com

Satrijo Tanudjojo
Cranfield University, UK
satrijo.tanudjojo.dba.02@cranfield.ac.uk

Abstract

There is a paucity of theory for the effective management of knowledge transfer within large organisations. Practitioners continue to rely upon 'experimental' approaches to address the problem. This research attempts to reduce the gap between theory and application, thereby improving conceptual clarity for the transfer of knowledge.

The paper, through an in-depth case analysis conducted within Schlumberger, studies the adoption of an intranet-based knowledge management (KM) system (called *InTouch*) to support, strategically align and transfer knowledge resources.

The investigation was undertaken through the adoption of a robust methodological approach (abductive strategy) incorporating the role of technology as an enabler of

knowledge management application. Consequently, the study addressed the important question of translating theoretical benefits of KM into practical reality.

The research formulates a set of theoretical propositions which are seen as key to the development of an effective knowledge based infrastructure. The findings identify 30 generic attributes that are essential to the creation, mobilisation and diffusion of organisational knowledge.

The research makes a significant contribution to identifying a theoretical and empirically based agenda for successful intranet-based KM which will be of benefit to both the academic and practitioner communities. The paper also highlights and proposes important areas for further research.

Key words: *Information and Communication Technology, Knowledge Management, Knowledge Management Transfer Attributes*

Introduction

There is a significant gap between theory and practice in the field of knowledge management (Grover and Davenport, 2001; De Long and Fahey, 2000; McInerney, 2002; Rao, 2005). Prior research suggests that organisations need to understand and effectively manage their knowledge as a basis for sustainable advantage (Evermann, 2005; Grant, 1996; Davenport et al, 2003; Friedman, 2002; Buckley and Carter, 2000; Hackney et al, 2004; Salazar et al, 2004). The use of information systems and technology to support effective knowledge management is widely accepted (Krogh,

1998; Newell et al, 2000; Alavi & Leidner 2001; Ibrahim and Nissen, 2005). However, in practice, it is hard to find extensive evidence of actual implementation and the realisation of benefits from knowledge management. Gilmour's research (2003), for example, shows that US organisations alone spent nearly $4.5 billion on software and other technologies, designed to share knowledge across organisations, without much success. One reason for these poor results is that the KM and IS literature provides only high level frameworks for IT-supported knowledge management (El Sawy et al, 2001: Hauschild et al, 2001). We believe that these are inadequate for bridging the gap between theory and practice. Consequently, practitioners continue to rely on imitating 'best practice' or using trial and error to cope and are unable to achieve benefits from the management of knowledge (Desouza, 2003(a)(b); Hansen and Oetinger, 2001; Grover and Davenport, 2001). We argue that there is need for a theory that builds on extant research but extends our conceptual understanding of knowledge management to a more granular level. Our overarching concern is that unless academic endeavours pursue lines of theory development that close the gap between concepts and practice, knowledge management will become yet another fad, driven, on this occasion, not by management consultants but by academics (Doolin, 2004; Blair, 2002; Southon et al., 2002).

In this paper a theory is developed of the attributes that can lead to greater levels of knowledge creation, mobilisation and diffusion in distributed contexts. The need for such a theory is essential because knowledge is distributed unevenly in organisations. Following Eisenhardt (1989), we use qualitative methods to undertake the investigation. We created a profile of an effective knowledge management archetype

based on theoretical sampling logic, which we explain in detail. We selected *InTouch*, Schlumberger's globally distributed knowledge management initiative, because it met the archetype profile. We conducted an in-depth study of *InTouch* using the means-end chain framework, a proven data gathering and analysis technique. We condense our findings into four theoretical propositions that are novel, empirically derived and testable through further research. In addition to these propositions, this study's contribution is a set of attributes that close the theory-practice gap. The theory developed in this paper addresses vital challenges of generating, sharing and diffusing knowledge in distributed organisational environments. These challenges resonate closely with the aims and purpose of the Special Issue on Managing Knowledge Transfer in Distributed Contexts.

The paper proceeds as follows. We introduce key concepts and the means-end chain, which is the conceptual framework used to move through different levels of abstraction for managing knowledge. Attention then turns to the case study itself – we present an analysis of Schlumberger's *InTouch* system. This leads to a discussion of the research methodology, data collection and analysis techniques used to move from descriptive data to the theoretical propositions that form the results of this research. Based on the strategy and techniques discussed, we develop attributes, consequences and results from the data and their conceptual relationships. These relationships form the basis for the beneficial results derived from managing knowledge. In the next section, we discuss the findings from the case study and condense these as theoretical propositions for the management of knowledge. Finally, we summarise the study's contributions and limitations and draw together our conclusions from the study.

Linking Concepts in the Means-End Chain Framework

Knowledge is contextual in that it distinguishes one person or organisation as more knowledgeable than other(s) (Blair, 2002). Davenport and Prusak (1998) define knowledge as ‘a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms’ (1998:5). Sanchez (2001) defines knowledge as ‘a set of beliefs about causal relationships in the world and an organisation’ (2001:5).

We used the means-end chain framework with the laddering technique as a conceptual framework to understand different layers of abstraction to manage knowledge. A means-end chain is a knowledge structure containing inter-connected meanings through which the attributes of action are seen as the ‘means to an end’ (Baker, 2002). Following Gutman (1997), the means-end framework enabled us to conceptualise the hierarchy of organisational goals in managing knowledge within Schlumberger - Figure 1 illustrates the framework. The theoretical underpinnings of the mean-end chain framework allow for a better understanding of case study analysis (Cachon and Fisher, 2000; Li, 2002).

< FIGURE 1 Here)

The circles are conceptual representations and are not meant to define structural entities. The bottom circle represents attributes, which are actions that organisations intentionally enact to achieve an outcome, which in the parlance of the means-end framework are consequences or strategy elements. These consequences lead to and produce beneficial results, which are benefits that the organisation that the organisation can gain from managing knowledge across different lifecycle stages.

Birkinshaw and Sheehan (2002) suggest a knowledge life-cycle theory where knowledge goes through the stages of creation, mobilisation, diffusion and commoditisation. New knowledge is 'born' as something fairly nebulous, takes shape as it is tested, matures through application in a few settings, is diffused to a growing audience and eventually becomes widely understood and recognized as common practice Nonaka and Takeuchi (1995). Many ideas die in the creation stage because they fail to generate interest or support, but some become more clearly formed and make it to the mobilisation stage. The defining characteristic of the transition point from creation to mobilisation is that the originators share their knowledge with people who make up part of a trusted community (Iverson and McPhee, 2002; Brown and Duguid, 1991, 2001; Wenger and Snyder, 2000). Once mobilised, the knowledge is then diffused through further exchanges within the relevant market place. The commodity stage is where the knowledge becomes common and enters the public domain. Thus the theory developed in this study pertains to three stages of the knowledge lifecycle - creation, mobilisation and diffusion of knowledge.

We recognise that there are competing conceptual frameworks and we examined the potential of two others for our research: repertory grid and cognitive mapping.

Finding the attributes that enable the creation, mobilisation and diffusion of knowledge in a technical service delivery process is an activity that has no pre-defined constructs. It relates to the hierarchy of goals and causal relations. Therefore, the repertory grid technique was not considered suitable for this research. Cognitive mapping can be applied to find attributes. However, this was excluded for practical reasons: respondents were geographically and temporally dispersed and data collection had to be by way of individual interviews. Given this situation and on balance the strengths of the means-end chain framework with its laddering technique would lead to more robust findings. In order to develop our theory, we focused upon the following research questions:

1) How does a global knowledge intensive organisation create, mobilize and diffuse knowledge among socially and geographically distributed employees?
2) What are attributes lead to effective knowledge creation, mobilisation and diffusion?
3) What are the results of effectively managing knowledge across its lifecycle?

These research questions formed the basis of the empirical investigation and the development of concepts that are reported in the following sections.

Schlumberger Case Analysis

The case study was conducted in Schlumberger – a leader in the oilfield services industry. It operates in more than 100 countries around the world with several engineering and research centres, multiple divisions, functions and products. It

provides technical services to major oil companies wherever they operate geographically. Schlumberger recognised the need to enhance customer service and improve efficiencies in its technical service delivery process. A central part of these improvements was the development of *InTouch.*

Within two years of its launch, *InTouch* was evaluated by an independent third party and they found that it saved Schlumberger in excess of US$ 200 million. *InTouch* received public recognition in the form of the 'Innovative and Effective Knowledge Management System' award from Wharton Business School. In many other organisations, Knowledge Management Systems are only 'repository-based' (Desouza, 2003b). *InTouch* goes beyond this because it facilitates both people-to-repository and people-to-people knowledge activities. In effect, *InTouch* is argued to be clearly suitable for the study of a knowledge management system that facilitates the creation, mobilisation and diffusion of knowledge.

Schlumberger considers knowledge intensive activities and technical service delivery to be important. Prior to *InTouch*, when in need of specific knowledge, for example, when a drill head broke down in a certain type of subsoil, a field engineer or manager sent their request through the country and geographical area management units. In turn, the geographical area management sent the request to the product line headquarters that, in turn, sent it to the product development manager in the appropriate technology centre. Within this centre, the request flowed to the subject matter expert. Once this subject matter expert answered the question raised by the field engineer, a reverse flow took place to transfer knowledge from subject matter experts to delivery site managers in the field where turn around time was slow. It

could take between two and sixteen weeks to answer a technical assistance request, sixteen weeks to resolve engineering modifications and more than two years to update documentation. The creation and mobilisation of knowledge, prior to *InTouch,* were isolated activities within each technology centre with almost no inputs from the field. *InTouch* created direct links from the field service delivery organisation to the technology centres. It was designed and built to form the backbone for knowledge creation, mobilisation and diffusion in the community of people within the technical service delivery process.

Field users access *InTouch* via the company intranet and conduct real-time searches for the knowledge they need for a specific activity. When the required knowledge is not found in the system, delivery site engineers and managers pose questions to the system. In response, *InTouch* Engineers, located in the various technology centres contact relevant subject-matter experts who provide the support in pre-agreed timescales. Answers deposited in the system are made available to all users when the system is queried. When appropriate, answers are validated by other field users and experts who are identified as Applied Community Experts. This community of applied experts can be the targeted experts of *InTouch* engineers when questions are more application oriented.

The main purpose of *InTouch* is to support the communities of people that constitute the technical service delivery process. It enables knowledge capture and intensive transfer between different communities. It provides a contribution to the integration of knowledge creation as part the new product and service development that occurs in the research and engineering domain. To enable field users and experts to use the

InTouch system each individual is equipped with a laptop computer loaded with a standard software. This intranet-based technology allows users to pose queries and receive answers 24 hours of the day, 7 days of the week, 365 days a year, regardless of global location.

Research Methodology

According to Blaikie (2000), an abductive research strategy provides the greatest scope for studying a phenomenon from the first hand accounts of actors who have experienced the phenomenon to be investigated. There are two stages in this strategy: one, describing the everyday activities and meanings; two, deriving categories and concepts that can form the basis of an understanding or an explanation of the issues at hand. An abductive strategy has the added advantage of providing researchers with a framework for collecting data (semi-structured interview, participation observation) and for analysing data (first to second order constructs) from which results can then be obtained. An abductive strategy is flexible enough to be used with other data analysis techniques (Blaikie 2000). The abductive strategy entails different ontological assumptions from those of inductive and deductive strategies, a detailed differentiation of which is beyond the scope of this paper. However, the abductive strategy is not only based on a constructivist view of social reality but also the source of its explanatory accounts, in our context Schlumberger. This was adopted through the use of the means-end chain framework with its laddering technique to examine data collected for this research.

The empirical endeavour for the research in this paper provided a unique opportunity to evaluate systems and processes through close engagement within a large complex

knowledge-intensive organisation. The choice of the research subject and environment followed a qualitative sampling method (Eisenhardt, 1989). The criteria used to select the research context required the site to demonstrate the knowledge lifecycle, that knowledge is managed within communities and that the organisation should have obtained positive recognition from the industry for the provision of its services. Schlumberger's technical service delivery process fulfilled these criteria.

The adoption of a constructivist phenomenological approach involving socially constructed realities may call for a methodology to embrace qualitative enquiry. We consider that, instead of examining a phenomenon from a distance – as the inductivist school suggests – it is important to determine how the actors themselves interpret what they do within their social interactions, to grasp the social reality as they understand it, and to discover the everyday knowledge they use in this respect. Based on the ontological view that reality is socially constructed, and that epistemologically knowledge can be derived from individuals' everyday concepts and meaning, the abductive research strategy (Blaikie, 2000), which flows from these ontological and epistemological assumptions, is therefore the choice for our research approach. The abductive research strategy lays down the principles that guided data collection and analysis.

Data Collection

The research methodology and subsequent data collection in this paper adopted a robust approach referred to as the 'laddering technique', which is based upon the seminal work of Reynolds and Gutman (1988). Here laddering refers to, '…an in-

depth, one to one interviewing technique used to develop understanding of how actors translate the attributes of products into meaningful associations with respect to self, following Means-Ends theory' (p12). In this same way actors within Schlumberger were able to make sense of a product (*In-Touch*) in order to identify possible links between its attributes and their personal values. The technique is a valid, highly appropriate and justifiable mechanism for data collection and analysis for the purpose of the study.

In addition, Reynolds and Gutman (1988) prescribe detailed steps in applying their method. As a consequence, interviews were conducted using these guidelines where the environment, conduct and issues relating to respondent concerns were all fervently addressed. Consequently, the authors undertook the empirical work in accordance with and closely aligned to the laddering technique approach.

The case analysis involved data collected through in-depth semi structured interviews which were undertaken face to face in 2003/4. This was intended to generate the maximum opportunity for rich qualitative analysis. In addition, different sources of information were used in order to triangulate the data. These included technical descriptions and internal staff surveys relating to *InTouch*, performance measures from internal on-line systems, presentations to clients and internal emails and memos. In total 19 interviews were conducted with Schlumberger employees in their different roles related to *InTouch*: 7 from the core team, 7 from users, and 5 from senior management.

The study covered the international use of *InTouch* and global coverage was ensured through interviewee selection. Schlumberger is divided into three different geographical areas and one Headquarters. Four of the interviewees worked in the North and South America area (NSA), five in the Europe, CIS (new Euromean countries that were part of the old Soviet Union) and Africa (ECA) area, four people work in the Middle East and Asia (MEA) area, and six worked in the headquarters (HQ), as listed in Table 1.

<TABLE 1 Here>

The interview questions focused mainly on perceived benefits realised through the use of *InTouch.* Internal notes, e-mails and company presentations were used to probe and construct a deeper understanding. All interviews were taped and transcribed. The transcripts and additional sources of data were used as the basis for data analysis.

Data Analysis

Data analysis followed an abductive strategy (Blakie 2000), based on grounded theory Partington (2000). Throughout this analysis, emergent conceptual constructs were identified from which categories were built. These conceptual constructs – referred to, within the abductive strategy, as second-order constructs – were derived from the interviewees perceptions as recorded in the transcripts – referred to, within the abductive strategy, as first-order constructs – which constitute participants' social (essentially cognitive) reality.

From each interview transcript, relations among the elements are built with the means-end chain framework. Using this content relation analysis from the individual

interview data as a basis, conceptual relationships among specific attributes, consequences, and values are aggregated across respondents in an asymmetric implication matrix (Table 2). Such a matrix bridges the gap between the qualitative and quantitative aspects of the laddering technique by displaying the number of times each element (attribute, or consequence, or value) leads to another element (Deeter-Schmelz et al., 2002; Reynolds and Gutman, 1988). The implication matrix reveals both direct and indirect relationships, which facilitates the identification of linkages in the ladder across respondents. A direct relationship is where one element gives an impact directly to another element. An indirect relationship is where one element gives an impact to another element indirectly through a relationship with a different element. Examples of laddering are presented in Figure 2.

For example, the interviewees said that ‘recognition scheme’ has a direct impact upon ‘culture that fosters continuous learning’ and ‘knowledge sharing’ whereas they said that it has an indirect impact upon ‘improved speed’ and ‘quality of technology solutions to clients’. In another example, interviewees state that ‘training programme’ has a direct impact upon ‘culture that fosters continuous learning’ and ‘knowledge sharing’ and ‘reliable knowledge sources that maintain member confidence’ and indirect impact upon ‘improved speed’ and ‘quality of technology solutions to clients’ and ‘meritocracy of ideas’.

<FIGURE 2 Here)

The implication matrix is constructed through laddering analysis of the interview data by counting the number of relationships. Table 2 (appendix) presents row-column

frequency matrix indicating the number of times directly or indirectly all row elements lead to all column elements. The numbers are expressed in decimal form with direct relations to the left of the decimal and indirect relations to the right of the decimal. Thus “Recognition Scheme” (element no. 27) leads to “Culture that fosters continuous learning and knowledge sharing” (element no. 39) six times directly and four times indirectly. More precisely, this means that six respondents said element 27 directly leads to element 39, whereas five respondents sequentially related the two elements with another element in between. The implication matrix is constructed by going through all the ladders from the interview data.

The hierarchical value map (HVM) is constructed from the implication matrix as determined by Reynold and Gutman (1988). The most efficient way is to start in the first row (element 1) for which there is a value at or above the a cut-off level (3 for this research), the first significant value is “element 41” with a value of 4.00 indicating four direct relations and zero indirect relations between these two elements. Next, we move to the “element 41” row and find the first value at or exceeding the cut-off value. The matrix shows that “element 39” is the first that bears the significant value of 3.02 indicating 3 direct relations and 2 indirect relations between elements no. 41 and no. 39. Thus, the chain has now grown to element no. 1 – element no. 41 – element no.39. Continuing in the same manner, we build the chain. Having reached the end of the chain, we then go back to the beginning and verify if there is any duplication of links. After that, the next step is to move to the second row and start the process over again.

The goal of mapping these HVM is to interconnect all the meaningful chains in a map in which all relations are plotted with no crossing lines (as far as possible). This results in a map which includes all relevant relations, as illustrated in Figure 3.

<FIGURE 3 Here)

Criterion for evaluating the ability of the map to represent the data is to assess the percentage of all relevant and meaningful relations among elements accounted for by the mapped elements; a value of more than 70% is recommended (Deeter-Schmelz, Kennedy et al, 2002). The HVM presented, in this paper, accounts for 82.3% of all the direct and indirect relations. This represents 112 out of 136 meaningful ladders from the implication matrix which are discernable.

Developing Conceptual Relationships

Findings of the case study show 30 attributes, 15 high-level consequences and 14 beneficial results. These conceptual relationships are outlined in the HVM (Figure 3). The white circles numbered 1 to 30 represent the attributes of *InTouch*, the full list of attributes are in Tables 3, 4 & 5. The dotted circles represent the consequences (Table 4) and the striped circles represent the beneficial results from *InTouch* (Table 5). The bold circles represent the dominant perceptual or cognitive orientation (Reynolds and Gutman, 1988). The solid bold circles represent the dominant direct relations for the elements and the bold dotted circles represent the dominant indirect relations. For example, ‘Knowledge Broker’ (‘18’ in the HVM map) is an attribute that gives dominant direct relations to consequences, whereas attribute 22 (communities) is an

attribute that gives dominant indirect relations to consequences. Elements 31, 39, 41, 42 are dominant consequences and reflect direct relations, whereas elements 46, 53, 55 are dominant results that reflect indirect relations.

The HVM shows the intricacies of implementing a system that enables the creation, mobilisation and diffusion of knowledge. The attributes are neither linear nor discrete and did not neatly fit into different stages of the knowledge lifecycle. There are interdependencies across and between the consequences and beneficial results. Much of the literature focuses on each independent knowledge lifecycle stage, for example Nonaka and Takeuchi's (1995) work on knowledge creation and Storck and Hill's (2000) work on knowledge diffusion. The findings highlight the need to integrate dynamically the stages of the knowledge lifecycle.

The attributes found in this study are the practical items that Schlumberger actually created or where it took action in operationalising *InTouch*. As shown in the HVM, each of the attributes identified were coupled with one or more consequences that, in turn, impacted desired results. The findings suggest that KM initiatives start with a recognised issue within the business where the effective management of knowledge creation, mobilisation and diffusion is a key factor. Addressing problematic concerns, identifying their knowledge component, and using organisation's values to resolve them as justification for knowledge efforts are all good ways of managing knowledge. For example, *InTouch* started with a recognised business problem that related to knowledge. It took too long to answer a technical assistance request, to update documentations and to resolve engineering issues. Rapid and accurate decision-making is crucial in today's business environment, in particular within the oilfield

industry due to the nature of the business which involves high value assets that incur significant cost. *InTouch* was adopted to address this need.

The HVM was discussed with Schlumberger's *InTouch* Program Director and the other four interviewees. The Program Director noted that the 'identification of patterns of problems and common lessons learned' did not have any perceived relations to the 'improved speed and quality of technology solutions to client'. This relation was designed within *InTouch* as a logical flow. The lesson for the *InTouch* team was that this relation may have to be better publicised in order to get the correct perception from the users and management.

The attribute 'communities' did not really correspond well with the definition of 'communities of practice' found in the literature. A Community of Practice (CoP) is a self-organized group of employees who share common work experiences, interests, or aims (Wenger and Snyder, 2000). Community members are bound together by their collectively developed understanding of what their community is about. Communities evolve through mutual engagement and as members build their community they produce a shared repertoire such as language, values, and routines.

In contrast, members of the *InTouch* community were appointed and while some collaborate freely over extended periods of time, others worked together with a short term purpose of solving problems or to generate better solutions for clients. Lesser and Storck (2001) have found that although many communities of practice create organisational value, there has been relatively little systematic study of the linkage between communities of practice outcomes and the underlying social mechanisms that

are at work. They argue that the social capital resident in communities of practice led to behavioural changes, which in turn positively influenced business performance.

The HMV shows the network of relationships between the attributes. This network of relationships led to Schlumberger achieving a number of beneficial results. These are discussed in the following section.

Beneficial Results from *InTouch*

Schlumberger achieved a number of enhancements resulting from effective KM that in turn have brought significant financial improvements and industry recognition of *InTouch* as a knowledge management system - the benefits are discussed below:

- gain tangible benefits

Schlumberger's business advantage was strengthened through the implementation of *InTouch* with the continued development and growth of its technological capabilities. Organisations who understand and develop the management of knowledge dominate, because products are physical manifestations of knowledge, and their worth largely, if not entirely, depends on the value of the knowledge they embody (Bessant, 2003; Leonard-Barton, 1998). An external survey showed that the system had generated cost savings and revenue totalling more than $200 million. Moreover, this study showed a 95 % reduction in the time required to solve operational-problems and a 75% decrease in the time necessary to update engineering modifications.

- create new form of coordination

In the past, e-mails and phone calls were the primary means for discussing technical issues in decision-making. *InTouch*, however, directs knowledge through a single communication channel, which enabled Schlumberger to apply knowledge more

efficiently and to provide seamless operations with innovative solutions. In fact, the previous knowledge flow could not be effectively sustained within the new matrix organisation. The delivery sites assigned to Geomarkets and the technology centres became the responsibility of the Business Segments. *InTouch* provided the 'space' (Nonaka and Konno, 1998) for the CoPs. Therefore, the establishment of a direct connection between the delivery sites and technology centres solved the hierarchical issue and *InTouch* facilitated the technical service delivery process which provided a common global standard.

- improved speed and quality of decision taking

Decision makers need to integrate local knowledge with information from other parts of the organisation. In the oil industry, this is particularly vital in the exploration of new and existing oil fields. For example, action taken by field managers in the Middle East will depend on decisions made by executives located in various American, Far Eastern or European cities. In turn, to effectively manage the global organisation, executives need to be familiar with the actions taken in the field while exploration and exploitation work is underway. The nature of the oil business also involves high value assets that incur significant costs. Rapid and accurate decision-making is crucial which makes managing knowledge critical. Organisations serving the oil industry must also be able to respond to this intensive requirement for sharing and transferring knowledge.

With users actively creating, mobilising, and exchanging knowledge across functional and regional boundaries, *InTouch* enabled the technology centres to understand end-user needs in a much shorter time. Consequently, technology centres were able to

define issues more accurately and propose more relevant and reliable solutions to clients.

- meritocracy of ideas

The creation of new knowledge is often within knowledge transfer activities (Hargadon and Sutton, 2000). Newly acquired knowledge interacts with existing knowledge to generate ideas (Hansen and Oetinger, 2001). According to Wenger (2000) and Nonaka and Takeuchi (1995), the major source of new knowledge is bringing together people with different ideas to work on the same problem. Davenport and Prusak (1998) further emphasise that active knowledge interaction brings a meritocracy of ideas – it continually validates and refines knowledge, it tests official beliefs and exposes the flaws of the faulty ones and espouses the ones with merit. Operationalising *InTouch* triggered open feedback and debate among field users, subject matter experts, and applied community experts, which led to the development of more effective solutions for clients.

- increase job enrichment for employees

Several roles and responsibilities were affected by the implementation of *InTouch.* Positions related to knowledge flow, prior to *InTouch,* became redundant and were suppressed while new positions were created. Drucker (1995) anticipated that the roles of knowledge workers would transform into knowledge intensive roles. One respondent, an *InTouch* manager, expressed, ‘The thrust was away from positions focused on pushing the knowledge flow and towards finding solutions’. Managing knowledge for effective decision-making and the development of improved, real-time solutions, enriched the jobs of many employees. The extensive, continued exchange within *InTouch,* and the horizontal integration of knowledge workers (Ghoshal and Gratton, 2002), appear to motivate users to further share and transfer knowledge.

- real time access to knowledge

Braganza and Morgan (2000) point out that speed of access to knowledge affects organisational performance. Schlumberger gained the advantage of having a real time access to knowledge. In the past, users had to wait days or even weeks to receive much-needed information from subject-matter experts. With the *InTouch* intranet-technology based system, users obtain the required knowledge immediately, at any time and from anywhere. Moreover, new solutions can be proposed to meet growing business demands.

- efficient link between delivery sites and technology centres

InTouch links the delivery sites and the technology centres. It connects the subject-matter experts directly to the people in the field who need the expert's knowledge to deliver quality services to customers. For instance, through the use of *InTouch*, a delivery site manager in offshore Indonesia or Congo enjoys the same level of knowledge support as a delivery site manager in West Texas or the North Sea. Moreover, since *InTouch* promotes people-to-people collaboration, these managers are both able to benefit from each other's experiences.

- faster introduction of new products

Typically new products were introduced in a vacuum from introductions in other parts of the company resulting in slow deployment and repeated mistakes. Through *InTouch*, users of new products shared and reused knowledge in real-time. This created the fast-moving knowledge that is shared worldwide in the introduction of new products. This also facilitated the engineering centres to react quickly for any required modification that resulted in a substantial reliability improvement. The result was that new products were introduced faster and they delivered revenues earlier.

- use metrics to adjust to external changes

Schlumberger introduced metrics to manage InTouch performance and its impact upon the business. For example, to ensure the knowledge sharing activity, a metric measuring of the number of contributions (shared knowledge) per employee is taken. Another example of a metric is one that will identify the current business-critical issues. The objective of this kind of metric is to ensure a quick-response adjustment to those issues.

Discussion

This paper identifies a number of attributes for a successful knowledge management system. These attributes provide not only a useful starting point for any organisation considering their implementation but also in the development of future knowledge-based systems (Braganza and Lambert, 2000). The attributes are used to develop a set of theoretical propositions and responses to them, as follows;

- attributes for knowledge creation

Nonaka and Takeuchi (1995) highlight the enablers for knowledge creation as: i) *organisation intention* which is its aspiration to its goals; ii) *autonomy* which enables individual to act autonomously; iii) *fluctuation and creative chaos* which stimulates the organisational interaction with its external environment; iv) *redundancy* which indicates the existence of information that goes beyond the immediate operational requirement; and v) *requisite variety* which will allow equal access to information through out the organisation. For example see Wenger (2000); Heaton (2002); Davenport and Prusak (1998) and Hansen et al. (1999).

The case study provides further detail to the enablers extant in the literature. It highlights the need to manage a number of attributes for knowledge creation (Figure

1). These are: accessibility to knowledge (attribute 2); a training program (attribute 11); provide answers to user needs (attribute 16); offer problem solving activities (attribute 17); have knowledge brokers (attribute 18); identify existing expertise – yellow pages (attribute 19); have a knowledge champion (attribute 20); identify subject matter experts (attribute 21); communities of practice (attribute 22); relevant knowledge (attribute 25); an awareness program (attribute 26); a recognition system (attribute 27) and a system for knowledge feedback (attribute 28).

Evidence from the data suggests that a number of these attributes are dominant over others. The direct and indirect relationships between attributes shows that attribute 2 has 21 direct relations and 12 indirect relations (therefore a total of 33 relations), attribute 16 has 20 direct and 18 indirect relations; attribute 18 has 45 direct and 46 indirect relations and attribute 22 has 22 direct and 30 indirect relations. The following quotes provide a few examples of the importance of some of these attributes.

'Our people need to have the ability to interact with the knowledge system real time. This will facilitate them to ask question and get the necessary knowledge at real time. Question is one of the basis for knowledge creation.' Quote from senior management and field supervisors (Attribute. 2)

'Try to provide a system that does not correspond to users needs and very fast you will find it useless' Quote from one of the InTouch Managers (Attribute 16).

Theoretical Proposition One: Identifying user needs, using knowledge brokers and communities of practice leads to an increase in knowledge creation and accessibility

- attributes for knowledge mobilisation

Obstfeld (2002) highlights the importance of training for effective knowledge mobilisation. Sawhney and Prandelli (2000) point out that communities facilitate

easier knowledge mobilisation. Grover and Davenport (2001) state that, ‘one of the reasons that knowledge is such a difficult concept is because this process is recursive, expanding, and often discontinuous’ (2001:8). Cycles of creation, mobilisation, and exchange of knowledge occur concurrently in businesses and consequently knowledge within a designated system becomes disorganised and unreliable.

In general, researchers agree that execution through the determination of metrics may ensure the implementation of a more effective strategy (Kaplan and Norton, 2001). However, designing metrics in KM is not often mentioned in the literature, although more recently Siemieniuch and Sinclair (2004) have begun to move the discussion in this direction.

The case study highlights the need to manage attributes for successful knowledge mobilisation. These include all the attributes highlighted in the previous section on knowledge creation and additional ones such as attributes 3, 6, 7, 10, 14, 15, 23, 24. Of these 8 attributes, two (23, 24) appear to be dominant as indicated by the implication matrix of the means-end chain framework while attribute 23 has 25 direct relations and 41 indirect relations and attribute 24 has 32 direct and 38 indirect relations.

Schlumberger uses a number of methods to validate the knowledge (attribute 23). The process is rigorously monitored by knowledge brokers. According to one *InTouch* engineer:

‘We used to have a bulletin board and we still do now. In this bulletin board people can communicate. But InTouch is different. In the bulletin board people share knowledge but unfortunately this knowledge is unqualified and some of them (sic) are simply wrong. This leads to operational problems. With InTouch, only validated knowledge is there – with this InTouch gains credibility among engineers’

Schlumberger introduced metrics (attribute 24) to manage *InTouch* performance and its impact upon the business. For example, to ensure the knowledge sharing activity, a metric assessing the number of contributions (transferred knowledge) per employee is taken. Another example of a metric is the one that will identify the current business-critical issues. The objective of this was to ensure quick-response adjustment to those issues. Schlumberger manages to react and provide the necessary actions to *InTouch* users and Schlumberger clients by taking advantage of having the metrics built into it. A product president noted;

'*We have this culture in the company that if you measure it then you will get it done and achieve it. We use the same method to ensure InTouch is working.'*

Theoretical Proposition Two: Identifying user needs; using knowledge brokers and communities of practice; having in place validation and measurement processes leads to an increase in knowledge mobilisation

- attributes for knowledge diffusion

Lesser and Storck (2001) note that Social Network theories support the notion that unique knowledge source can be more valuable than knowledge sources shared by everyone (Cummings, 2004; Granovetter, 1973). The case analysis found this as a dominant factor for knowledge diffusion. For effective knowledge transfer there was a need to manage, in addition to 21 attributes identified in knowledge mobilisation, nine further attributes (see Figure 1 and Tables 1, 2 and 3). Of these, attribute 13 appears to be dominant from the implication matrix and has 20 direct and 13 indirect relations. The following from an *InTouch* Manager highlights this.

'I believe it is a bold decision from the management to 'kill' other knowledge sources and ask everybody to just use this single source called InTouch. However, looking back – it was an excellent decision. Diffusing knowledge needs consistency and more than one source creates the 'unnecessary competition' between sources that finally probably none will be usable because with the constraint of resources, maintaining

multiple sources seems inefficient. One source, put all the energy there, and make it work. That's how we did it.' (Attribute 13)

Theoretical Proposition Three: Identifying user needs; using knowledge brokers and communities of practice: having in place validation and measurement processes including a single source of knowledge leads to an increase in effective knowledge transfer.

- attributes for diversity in knowledge management

Cummings (2004) and Taylor (2004) claim that KM activities are more encouraged and successful when the workgroup is diversified structurally. According to Cummings, while demographic diversity (sex, age, tenure) barely increases knowledge sharing activities structural diversity does lead to an increase in knowledge diffusion. This diversity refers to the variation in features of the group structure such as different geographical locations, different functions, different reporting hierarchy, and different business units (Maznevski and Chudoba, 2000).

Conceptual diversity exists in *InTouch*. The community consists of engineers working in different geographical areas and in different business units. Subject matter experts work in the R&D centres with reporting lines within R&D management. They are located in different areas in the world. Each area works for a different product line. *InTouch* brought together experts who had the responsibility to create real time innovative solutions for customers. For example, problems in the Vietnam operation in the exploration field were solved due to the involvement from user expert communities in Scotland, UK and Subject Matter Experts in R&D in Houston.

Theoretical Proposition Four: Knowledge-based ICT systems that increase structural and conceptual diversity and their cohesiveness produce beneficial results.

Without *InTouch* it would take weeks compared to the day it took to identify a solution. This saved millions of dollars in relation to faster new product introduction. New products which normally took 6 to 8months to introduce were being bought into operation within 2 months.

Contributions and Limitations of the Study

While this study has used rigorous qualitative data collection and analysis procedures it nevertheless has limitations as it refers to only one company in the oilfield services industry. In this respect the attributes established from this study have limited generalizability to all business settings. The findings are however, of relevance to other units of analysis that meet the theoretical criteria set out earlier. Further research within different case study contexts is required to advance our theoretical understanding and, most critically, to actually test the theoretical propositions derived. This type of research is particularly important in light of the current trends in knowledge intensive industries reflected in joint ventures, take-overs and consolidation activities. It should be directed towards developing a readiness model based on the attributes identified in this study. This would bring particular benefits to practitioners by ensuring the organisation was ready for investment in a knowledge based ICT system. This is one way of addressing the important question of translating theoretical benefits of KM into practical reality.

The paper contributes to academic knowledge by identifying empirically based attributes for successful intranet-based KM, by setting out theoretical responses to problematic areas in the domain and by highlighting benefits from the use of a knowledge based ICT tool. However, managing knowledge is more than implementing technology and this paper elaborates a number of theoretical attributes that need to be considered for the effective creation, mobilisation and diffusion of knowledge. Eight attributes were identified as particularly important for providing a useful starting point for an organisation considering an ICT based KM initiative. It is clearly critical to ensure that these attributes are addressed prior to any investment decision relative and prior to implementation.

Moreover, this study has shown translating knowledge into business advantage is not simply a matter of implementing an intranet-based KM system. Underpinning this system is the ability to create conceptual diversity with individuals from different parts of the organisation, working in different functions and performing different jobs. It is their integrated actions that bring beneficial results. Hence, we conclude that diverse workgroups are more likely to encourage knowledge activities that lead to successful KM (Cummings 2004). The variation in features of the group structure, such as different geographical locations, functions, reporting hierarchy and business units defines this organisational diversity (Maznevski and Chudoba, 2000). It is in this context where *InTouch* achieved significant benefits for Schlumberger.

Organisations rely on many kinds of workgroups to manage operations. This study confirms that for these groups to be effective, structures and processes must be in place to foster member coordination and cooperation (Allen, 1977: Cummings, 2004).

In this respect *InTouch* enables communities to conduct their knowledge transfer and sharing activities which has brought numerous advantages to both Schlumberger and its clients.

This study demonstrates that metrics increase participation of targeted stakeholders. The current literature on KM rarely mentions that the domain or area of knowledge to be managed is vital for effective organisational performance. Often, managers embarking on knowledge initiatives have only a vague idea of what 'knowledge' must be managed. Acknowledging that not all organisational knowledge can be managed may enable managers to recognise the importance of defining more precisely the knowledge domain. The attributes identified in the case study support this view and show that knowledge needs to be in the unit of analysis of the business process - for Schlumberger this is the service delivery process.

This paper also demonstrated the intricacy of implementing an ICT system that enables the creation, mobilisation and diffusion of knowledge. Much of the existing literature on KM focuses on each independent knowledge life cycle characteristics such as knowledge creation or knowledge diffusion. The case study however illustrates that attributes do to not fit neatly into different stages of the knowledge lifecycle. Managers embarking on a ICT knowledge management project need to consider integrating across all knowledge lifecycle stages. While *InTouch* physically appears as a conceptual repository it also functions as a facilitator for person-to-person knowledge transfer activities. Therefore, the *InTouch* 'system' serves both as knowledge service (person-to-repository) and knowledge support (person-to-person)

for users. Technology has immensely improved access to knowledge, but it cannot replace the value of such direct person-to-person social interaction.

Conclusion

The paper reported an analysis of the theoretical foundations for the creation, mobilisation and diffusion of knowledge. This was augmented through an in-depth case study conducted within Schlumberger which explored the adoption of an intranet-based ICT knowledge management system to support, strategically align and transfer these knowledge resources – called *InTouch*.

The findings identified 30 generic attributes that are essential to the creation, mobilisation and diffusion of organisational knowledge. The formulation of a set of theoretical propositions is seen as key to the development of an effective ICT knowledge based management infrastructure. The process of managing these systems was operationalised through the adoption of a unique methodological approach incorporating the role of technology as an enabler of knowledge management practice. The case analysis provided evidence that such systems can deliver significant benefits to the organisation. The system therefore supported critical strategic organisational activity, capability and competitiveness.

The paper discussed areas for future research where the challenge for future investigations will be to replicate these techniques, test the theoretical proposition and most critically demonstrate further valuable bridges between academia and practice.

References

Alavi, M. & Leidner, D. E. 2001, "Knowledge Management and Knowledge Management Systems: conceptual foundations and research issues", MIS Quarterly, vol. 25, no. 1, pp. 107-136

Allen, T.J. (1977), Managing the Flow of Technology, MIT Press, Cambridge, Massachusetts

Baker, S. (2002), Laddering: Making Sense of Meaning, in Partington, D. (ed), Essential Skills for Management Research, Sage Publication, London, pp. 226-253.

Bessant J (2003), High Involvement Innovation, John Wiley, Chichester.

Birkinshaw, J. and Sheehan, T. (2002), Managing the Knowledge Life Cycle, MIT Sloan Management Review, Fall, pp. 75-83.

Blaikie, N. (2000), Designing Social Research, Blackwell Publishers, Oxford.

Blair, D.C. (2002), Knowledge Management: Hype, Hope, or Help?, Journal of the American Society for Information Science and Technology, Vol. 53(12), October, pp. 1019-1028.

Boisot, M. and Griffiths, D. (2001), To Own or to Possess? Competence and the Challenge of Appropriability, in Sanchez, R. (ed), Knowledge Management and Organizational Competence, Oxford Press, Oxford, pp. 210-226.

Braganza A. and Lambert, R. (2000), Strategic Integration: Developing a Process-Governance Framework, Knowledge and Process Management, Vol. 7, no. 3, pp. 177-186.

Braganza, A. and Morgan, C. (2000), Mature Organizations and the Internet: Lessons for Net-Competition, Int. J. Services Technology and Management, Vol. 1, No. 4, pp. 447-458.

Brown, J.S. and Duguid, P. (1991), Organization Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation, Organization Science , Vol. 2, no.1, February, pp. 40-57.

Brown, J.S. and Duguid, P. (2001), Knowledge and Organization: A Social-Practice Perspective, Organization Science, Vol. 12, No. 2, pp. 198-213.

Buckley, P.J. and Carter, M.J. (2000), Knowledge Management in Global Technology Markets, Long Range Planning, Vol. 33, No. 1, pp. 55-71.

Cachon G P and Fisher M (2000), Supply Chain Inventory Management and the Value of Shared Information, Management Science, Vol 46, No 8, pp 1032-1048

Cummings, J.N. (2004), Work Groups, Structural Diversity, and Knowledge Sharing in a Global Organization, Management Science , Vol. 50, No. 3, March, pp. 352-364.

Davenport, T.H. and Prusak, L. (1998), Working Knowledge: How Organizations Manage What They Know, Harvard Business School Press, Boston.

Davenport, T.H., Prusak, L. and Wilson, H.J. (2003), What's the Big Idea?, Harvard Business School Press, Boston, USA.

De Long, D.W. and Fahey, L. (2000), Diagnosing Cultural Barriers to Knowledge Management, Academy of Management Executive, Vol. 14, No. 4, pp. 113-127.

Deeter-Schmelz, D.R., Kennedy, K.N. and Goebel, D.J. (2002), Understanding Sales Manager Effectiveness: Linking Attributes to Sales Force Values, Industrial Marketing Management, Vol. 31, No. 7, Oct, pp. 617-626.

Desouza, K.C., (2003)(a) Facilitating Tacit Knowledge Exchange Communications of the ACM June 2003/Vol. 46, No. 6

Desouza, K.C., (2003)(b). Barriers to effective use of knowledge management systems in software engineering. Communications of the ACM 46 (1), 99–101.Drucker, P.F. (1995), Managing in a Time of Great Change, Truman Talley Books/ Dutton, New York.

Doolin, B. (2004) Power and Resistance in the Implementation of a Medical Management Information System. Information Systems Journal 14 (4), 343-362Eisenhardt, K.M. (1989), Building Theories From Case Study Research, Academy of Management Review, Vol. 14, No. 4, pp. 532-550.

El Sawy, O., Eriksson, I., Raven, A. and Carlson, S. (2001), Understanding Shared Knowledge Creation Spaces Around Business Processes: Precursors to Process Innovation Implementation, Int. J. Technology Management, Vol. 22, no. 1/2/3, pp. 149-173.

Evermann, J. (2005) Towards a Cognitive Foundation for Knowledge Representation Information Systems Journal 15(2), pp. 147-178Friedman, V.J. (2002), The Individual as Agent of Organizational Learning, California Management Review, Vol. 44, No. 2, Winter, pp. 70-89.

Ghoshal, S. and Gratton, L. (2002), Integrating The Enterprise, MIT Sloan Management Review, Vol. 44, No. 1, Fall, pp. 31-38.

Gilmour, D. (2003), How to Fix Knowledge Management, Harvard Business Review, October,

Granovetter, M. (1973), The Strength of Weak Ties, Amer. J. Sociology, Vol. 78, pp. 1360-1380.

Grant, R.M. (1996), Toward a Knowledge-Based Theory of the Firm, Strategic Management Journal, Vol. 17, Winter special issue , pp. 109-122.

Grover, V. and Davenport, T. (2001), General Perspectives on Knowledge Management: fostering a research agenda, Journal of Management Information Systems, Vol. 18, No.1, Summer, pp. 3-21

Gutman, J. (1997), Means-End Chains as Goal Hierarchies, Psychology & Marketing, Vol. 14, No. 6, September, pp. 545-560.

Hackney R, Burn J and Salazar A (2004) Strategies for Value Creation in eMarkets: towards a framework for managing evolutionary change, Journal Strategic Information Systems, Vol 13, No 3, pp 91-103Hansen, M.T., Nohria, N. and Tierney, T. (1999), What's Your Strategy for Managing Knowledge?, Harvard Business Review, March-April, pp. 106-116.

Hansen, M.T. and Oetinger, B.v. (2001), Introducing T-Shaped Managers: Knowledge Management's Next Generation, Harvard Business Review, March , pp. 106-116.

Hauschild, S., Licht, T. and Stein, W. (2001), Creating a Knowledge Culture, The McKinsey Quarterly, Vol. 1, pp. 74-81.

Heaton, L. and Taylor, J.R. (2002), Knowledge Management and Professional Work, Management Communication Quarterly, Vol. 16, No. 2, Nov, pp. 210-236.

Ibrahim, R and Nissen, M E (2005) Developing a Knowledge-Based Organizational Performance Model for Discontinuous Participatory Enterprises. HICSS 2005

Iverson, J.O. and McPhee, R.D. (2002), Knowledge Management in Communities of Practice, Management Communication Quarterly, Vol. 16, No. 2, November, pp. 259-266.

Kaplan, R.S. and Norton, D.P. (2001), The Strategy-Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment,

Harvard Business School Publishing, USA.
Krogh, G. (1998), Care in Knowledge Creation, California Management Review, Vol. 40 no.3, Spring, pp. 133-153.
Leonard-Barton, D. (1998), Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation (paperback edition), Harvard Business School Press, Boston, USA.
Lesser, E.L. and Storck, J. (2001), Communities of Practice and Organizational Performance, IBM Systems Journal, Vol. 40, No. 4, pp. 831-841.
Li, L (2002), 'Information Sharing in a Supply Chain with Horizontal Competition', Management Science, Vol 48, No 9, pp 1196-1212
Maznevski, M. and Chudoba, C. (2000), Bridging Space Over Time: Global Virtual Team Dynamics and Effectiveness, Organizational Science, Vol. 11, No. 5, pp. 473-492.
McInerney, C. (2002), Knowledge Management and the Dynamic Nature of Knowledge, Journal of the American Society for Information Science and Technology, Vol. 53 (12), October, pp. 1009-1018.
Newell S., Swan J. A., Galliers R. D. (2000) A Knowledge-focused Perspective on the Diffusion and Adoption of Complex Information Technologies: the BPR example Information Systems Journal Vol 10, 3, pp. 239-259Nonaka, I. and
Takeuchi, H. (1995), The Knowledge Creating Company, Oxford University Press, Oxford.
Nonaka, I. and Konno, N. (1998), The Concept of "Ba": Building a Foundation for Knowledge Creation, California Management Review, Vol. 40 no.3, spring, pp. 40-54.
Obstfeld, D. (2002), Knowledge Creation, Social Networks and Innovation: an Integrative Study, in Academy of Management Proceedings pp. H1-H6
Partington, D. (2000), Building Grounded Theories of Management, British Journal of Management, Vol. 11, pp. 91-102.
Rao, M. (2005), Overview: The Social Life of Knowledge Management Tool, in Rao, M. (ed), Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate Knowledge Management Solutions, Elsevier Butterworth-Heinemann, Oxford, UK, Reynolds, T.J. and Gutman, J. (1988), Laddering Theory, Method, Analysis, and Interpretation, Journal of Advertising Research, Vol. 18, No. 1, Feb/Mar, pp. 11-31.
Salazar A, Hackney, R and Green T (Eds) (2004) The Strategic Impact and Diffusion of eCommerce Services and Technologies, International Journal Information Technology & Management, Vol 4, No 2 & 3, pp 123-126
Sanchez, R. (2001), Managing Knowledge into Competence: the five learning cycles of the Competent Organization', in Sanchez, R. (ed), Knowledge Management and Organizational Competence, Oxford Unversity Press, Oxford, pp. 3- 37.
Sawhney, M. and Prandelli, E. (2000), Communities of Creation: Managing Distributed Innovation in Turbulent Markets, California Management Review, Vol. 42, No. 4, Summer, pp. 24-54.
Siemieniuch, C. and Sinclair, M. (2004), A Framework for Organisational Readiness for Knowledge Management, International Journal of Operations & Production Management, Vol. 24, No. 1, pp. 79-98.
Southon, F.C.G., Todd, R.J. and Seneque, M. (2002), Knowledge Management in Three Organizations: An Exploratory Study, Journal of the American Society for Information Science and Technology, Vol. 12 no.53, October, pp. 1047-

1059.
Storck, J. and Hill, P.A. (2000), Knowledge Diffusion Through "Strategic Communities"', MIT Sloan Management Review, Winter, pp. 63-74.
Taylor, W.A. (2004), Computer-mediated Knowledge Sharing and Individual User Differences: an exploratory study, European Journal of Information Systems, Vol. 13, pp. 52-64.
Wenger, E. (2000), Communities of Practice and Social Learning Systems, Organization, Vol. 7, No. 2, pp. 225-246.
Wenger, E.C. and Snyder, W.M. (2000), Communities of Practice: Organizational Frontier, Harvard Business Review, January-February, pp. 139-145.

Table 1: Interview Subjects, Location and Schedule

Name	Years seniority	Position now	Position at early *InTouch*	Geographical Area	Time of interview
AK (core)	16	Program Director Learning Management System	*InTouch* Manager at the engineering centre	Paris, France HQ	Oct 2003 60 minutes
CM (core)	31	Program Manager *InTouch* North America	Technical Manager D&M Headquarters	Houston, Texas, USA NSA	Oct & Nov 2003 70 minutes
RH (user)	06	British Training Centre Manager	Field Engineer	Edinburgh, U.K.	Oct 2003 45 minutes
YTL (user)	07	Service Delivery Manager	Field Engineer	Kuala Lumpur, MEA	Dec 2003 30 minutes
AJ (top)	20	Vice President - MBT Geomarket	Product Champion	Kuala Lumpur, MEA	Dec 2003 21 minutes
JD (top)	30	Vice President – Business Systems	Quality Director	Paris, France HQ	Dec 2003 45 minutes
GA (top)	18	Vice President - Knowledge Mgmt	IT Director	Austin, USA HQ	Dec 2003 45 minutes
LPG (core)	15	KM systems manager	IT services	Paris, France ECA	Dec 2003 90 minutes
SB (top)	21	President – Business Unit	President – Business Unit	London, UK HQ	Dec 2003 30 minutes
PD (core)	19	Program Director – *InTouch*	*InTouch* Product champion	Paris, France HQ	Jan 2004 90 minutes
SC (top)	15	CIO	Personnel Manager	Paris, France HQ	Jan 2004 30 minutes
HA (user)	24	Discipline Director	Technical Manager	Houston, USA, NSA	Jan 2004 45 minutes
TS (core)	26	Program Manager	*InTouch* Champion NSA	Houston, USA NSA	Jan 2004 60 minutes
JLP (core)	30	Manufacturing Director	Technical Manager	Houston USA NSA	Jan 2004 30 minutes
MRK (user)	7	Product Champion	Field Engineer	Clamart, France ECA	Jan 2004 45 minutes
LP (user)	23	Technology Center Manager	*InTouch* support	Clamart, France ECA	Jan 2004 45 minutes
KR (core)	31	Technology Centre Manager	Technical Manager	Fuchinobe, Japan	Jan 2004 45 minutes

				MEA	
AM (user)	7	*InTouch* Engineer then Operations Manager	Field Engineer	Perth, Australia MEA	Feb 2004 45 minutes
BA (user)	19	Contract Manager	Document Manager	Paris, France ECA	Feb 2004 30 minutes

Table 2: Implications Matrix

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	KC	KM	KD	
1									0,01		4,00										0,01		0,01							1,00			5,03
2	1,00		1,00		1,00	3,03			5,04				9,00	0,03									0,01		1,00					0,01			21,12
3									3,03	1,00																	2,00					1,01	7,04
4				0,01					0,01		5,00		0,01										0,01				0,01					0,01	5,06
5									0,01		5,00																						5,01
6		2,04			0,04				1,00		3,00												0,03										6,11
7				0,01					1,00			1,00	6,00	0,04		0,01							0,04		1,00		0,03					1,02	10,15
8											5,00												0,01										5,01
9	4,00	0,02							4,01																0,01		1,00					0,02	9,06
10									4,00				2,03																				6,03
11	7,00							1,01	1,07	1,00	3,00	1,00											0,01		0,01								14,10
12									3,01	5,00	1,00	2,03				1,00							1,01			1,00	1,01				0,01		15,07
13	1,00	1,00				3,03			7,04		5,01	1,01		1,00		0,01					1,02											0,01	20,13
14	1,00	0,01			0,02				1,03				4,00	0,01					0,01				0,01									0,02	6,11
15									1,01														5,01		0,02						0,01	2,01	8,06
16	5,01		4,00	0,01					9,06		1,00					0,01						0,01	0,04							0,01	0,01	1,02	20,18
17	1,00		4,01						1,01														0,03							0,01		2,02	8,08
18			1,00	1,01		6,00	0,04	0,04	11,02	2,00	3,00	10,01	2,00	2,01	2,00	0,02		0,01	1,01	0,01	0,01		1,07	0,02	0,02	2,04	0,01	0,01		0,03	0,02	1,05	45,46
19				1,00					6,00			4,01			1,00	0,02							0,02		0,01						0,03	0,04	12,13
20									4,00		1,00			0,01									0,01	0,01	1,00								6,03
21				1,00					3,00			5,01			1,00	0,01							0,02		0,01					0,06		0,01	10,12
22				1,00					4,01			7,03		1,00	3,00	0,02	0,04		0,01				3,05		0,04		0,01			1,01	1,05	1,03	22,30
23	1,00	1,00		0,01					1,02			16,01			2,00	0,06	0,01	0,01	1,00			0,01	0,06	0,01	1,04		0,01			0,02	1,01	1,13	25,41
24	1,00			4,00	1,01	0,01	0,01	0,01	8,04	3,02	9,00	0,02	1,00			0,04			0,01		0,03		1,02	1,01	0,02	0,01	0,04	3,01	0,02		0,01	0,04	32,38
25	4,00	0,02							5,02																						0,01	0,01	9,06
26	4,00		0,02						3,01														0,01										7,04
27	4,00								6,05		2,00															1,00							13,05
28	5,00	0,02							2,02			1,00														1,00			0,01		0,01		9,06
29									1,02		10,00						0,01						0,01		0,01								11,05
30									2,04		5,00																						7,04
31		2,00							3,02													0,01										1,00	6,03
32					4,02							1,01				2,03														0,01	0,02	1,04	8,13
33									3,00							0,02														0,01			3,03
34									1,00			4,01							0,01	1,00			1,00	1,00			1,03			0,01			9,06
35											1,01					3,02																0,02	4,05
36							8,00	9,00				1,01	1,01			0,02		0,05	1,02	1,01	1,01	0,06	2,01	0,02				1,00	3,02	0,02		0,03	28,29
37	1,00																		4,01												0,01	0,02	5,04
38																		4,00		3,02				0,05						0,05	0,01	0,01	7,14
39																1,00	1,00	2,00	3,00	1,00		1,00	1,00		1,00	1,00	1,00			1,03	1,01	1,01	16,05
40									0,02																0,01	5,00						0,03	5,06
41									3,02			1,00									6,00	1,00			1,00	1,03	0,01			0,01	0,01		13,08
42				1,04					1,00					1,00		4,00	0,05	1,00	1,00	1,00		1,00	2,01		2,02		1,00			1,04	1,04	1,02	19,22
43									1,00			1,00		3,00		0,01			1,00	1,00	1,00	0,01	1,01			1,00					2,00	2,00	14,03
44																1,00	1,00						4,00		1,00								7,00
45		1,00										6,03																		3,00	0,03		10,06
46								0,01															3,02		1,00	2,00	0,01					0,03	6,07
47																																	0,00
48																			2,00	0,01										3,01			5,02
49																																	0,00
50																																	0,00
51																																	0,00
52																																	0,00
53																																	0,00
54																		1,00												0,01			1,01
55																																	0,00
56																																	0,00
57																																	0,00
58																																	0,00
59																															1,00		1,00
KC																																	0,00
KM																																	0,00
KD																																	0,00
	40,01	7,11	10,03	9,09	6,09	12,07	8,05	10,07	109,65	12,02	63,02	62,19	25,05	8,10	9,00	12,30	2,11	8,07	14,08	8,05	9,08	3,10	25,54	2,12	10,22	15,08	7,17	4,02	3,05	10,35	7,30	16,66	
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	KC	KM	KD	

Table 3: Attributes of *InTouch* in the technical service delivery process

Number	Description
01.	Targeted domain. A specific activity knowledge domain, e.g. InTouch addresses the operational and technical knowledge within a technical service delivery process
02.	Accessibility. The way users can reach to the knowledge source, e.g. through Intranet.
03.	Standard Language. The lingua franca or media that the knowledge activity is conducted
04.	PM Reporting. Project Management reporting structure of the knowledge management initiative.
05	Financial Support. Allocated financial commitment.
06.	System Feedback Systematic opportunity of giving feedback for the change or development of the system.
07.	Content management The way the content of knowledge is structured within a system.
08.	Governance body. The committee that sets the rules of the game and provide the go/no-go of initiatives
09.	Can be tailored. The interaction with the system that can be tailored or personalized by users.
10.	User-friendliness Simple and easy to use for users
11.	Training program. A structured training program addressing different types of users or roles
12.	People mobility Employees from one function to another and/or from one geographical area to another
13.	Single source. That there is no other option that can replace the system as such.
14.	Embedded process The use of the system for the knowledge activities is within users work process.
15.	Alert feature. Automatic alert feature within the system
16.	Answer to users need. The system answers to users' needs such that the users can benefit from the system.
17.	Problem solving The system offers problem solving activities.
18.	Knowledge broker. A person assigned to link the people who need the knowledge and the people who has the knowledge, e.g. in InTouch it is the InTouch Engineer.
19.	Expert Users Users identified as experts in some products or services who are willing to collaborate within communities.
20.	Knowledge champion. A person in the delivery site that acts as cheer-leader and is knowledgeable in his/her duties as well as the knowledge project.
21.	Subject Matter Experts. Identified subject matter experts for certain

knowledge that is managed within the system.

22. Communities. People getting together to collaborate and to come up with a solution to a problem.
23. Validation process. A process to validate a proposed solution prior to its diffusion throughout the organisation.
24 Measurement. Metrics that are created within the system and are communicated to the organisation.
25. Relevant knowledge. The knowledge in the system must be relevant to users' duties in their work.
26 Awareness program. A program that reveals the benefits to the users and the management.
27.. Recognition scheme Recognition, by name, of contributors to the creation, mobilisation and diffusion of knowledge.
28. Knowledge Feedback. A mechanism for users to give feedback to the knowledge being shared.
29. Communication. Direct championing of communicating the knowledge project by the leadership
30. Campaign. Campaigns run by a few people to ensure coverage of users, at least at the beginning of the system being put into operations.

Table 4: Consequences – high level strategy elements of implementing *InTouch*

Number	Description
31.	Self-interest (WIIFM - What Is in It For Me) is well addressed.
32..	Users feel to have ownership of the knowledge system
33.	Users are encouraged to ask questions.
34.	Knowledge that is captured and reused.
35.	The life of the knowledge system is ensured.
36.	Direct link that is established between the people who need the knowledge and the people who have the knowledge.
37.	Knowledge users that understand knowledge suppliers and their environment
38.	Knowledge suppliers that understand knowledge users and their environment.
39.	Culture that fosters continuous learning and knowledge sharing.
40.	Human resources policies that facilitate knowledge activities.
41.	Leadership that facilitates and encourages knowledge activities.
42.	Reliable knowledge sources that maintain member confidence.
43.	Technologies that enable mobilisation and diffusion of knowledge and friendly accessibility to users.
44.	Real time access to knowledge
45.	Meritocracy of ideas.

Table 5: Beneficial Results from *InTouch*

Number	Description
46.	Increased user confidence and knowledge, e.g. Schlumberger engineers feel more confident.
47.	Increased customer confidence.
48.	Improved understanding of Research & Engineering drivers.
49.	Faster new product introduction.
50.	Appropriate time to market.
51.	Streamline and more efficient organisation.
52.	30% of less engineer training duration.
53.	Improved speed and quality of technology solutions to clients.
54.	Identification of patterns of problems and common lessons learned.
55.	Improved/maintained service quality level despite less experienced population.
56.	Job enrichment to employees.
57	Knowledge is made transferable to the next generation.
58.	Quick response adjustments through use of metrics.
59.	Stronger communication link among users in the knowledge activities.

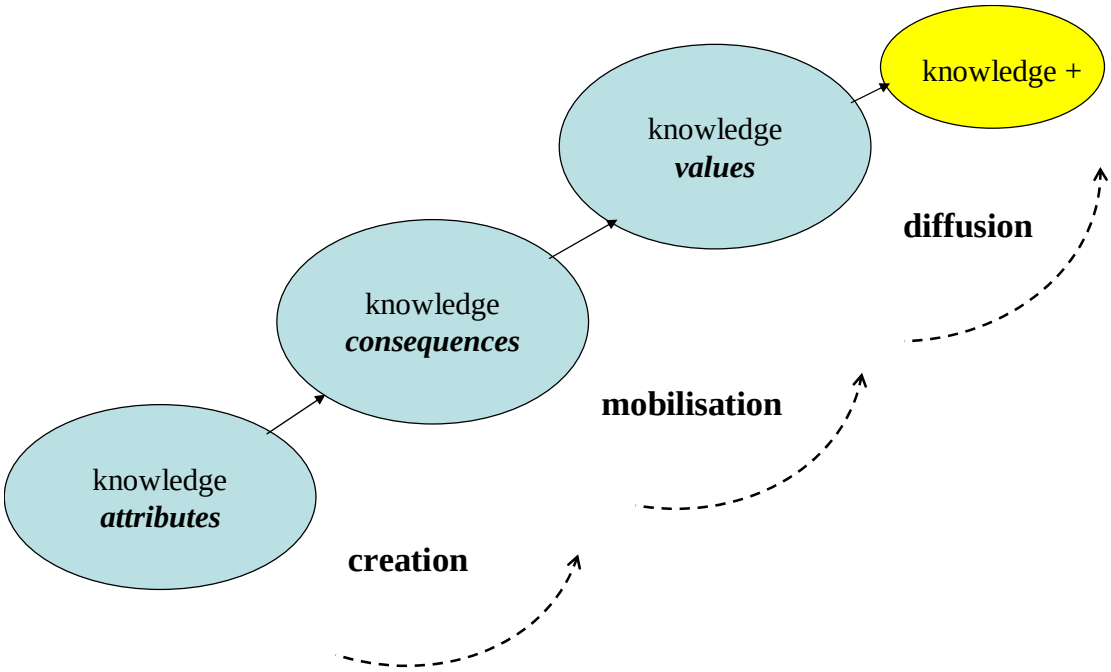

Figure 1: KM Means-Ends Framework

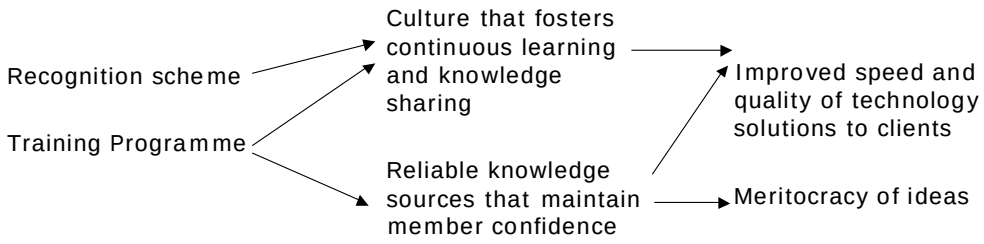

Figure 2: Examples of laddering from the *InTouch* case study

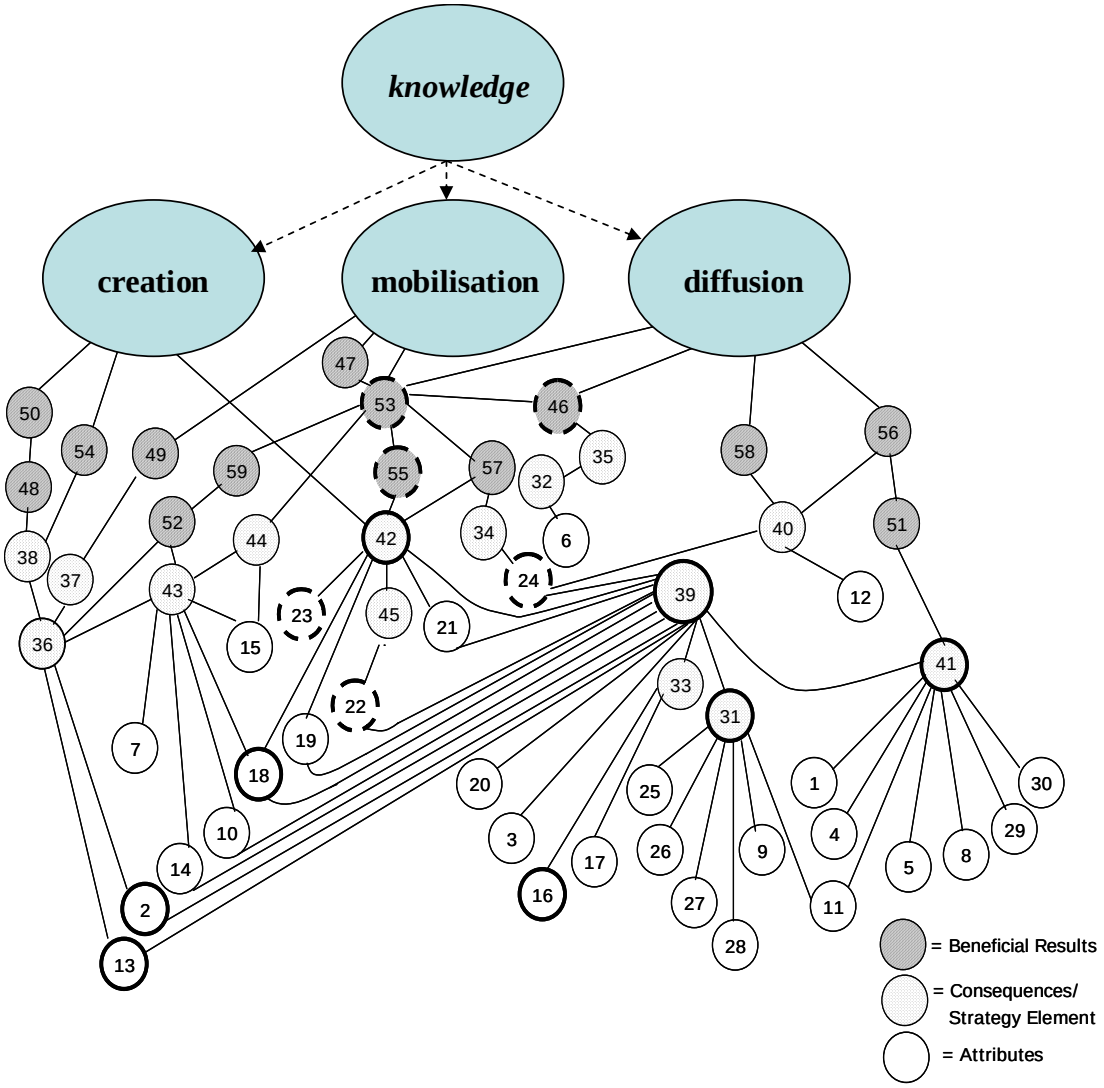

Figure 3: Hierarchical Value Map - attributes, consequences and benefits