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Knowledge governance in Aker Subsea, a part of Aker Solutions

by

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Preface

This master thesis is a part of a five-year Master degree in Strategy and Management at the Norwegian School of Economics and Business Administration (NHH). The master thesis is also part of the research project: "A local cluster going international: Balancing local and non-local networking?" financed by the Research Council of Norway, NCE Subsea and NCE Maritime and led by Inger Beate Pettersen. The master thesis concentrates on Aker Subsea and the service department Subsea Lifecycle Support, which is a part of Aker Solutions.

Knowledge governance is fundamentally important for companies striving for competitiveness. During the master thesis period, the world witnessed an environmental disaster in the Gulf of Mexico. An oilrig owned by British Petroleum (BP) exploded, killing 11 people and spilled huge amounts of oil into the sea. Oil companies have recently experienced the vulnerability of their advanced technology. Knowledge governance through procedures, such as sharing and creation of best practice and quality, is a subject particularly applicable in such a situation. Global certification procedures will probably be in focus throughout the cleanup process related to this manmade disaster. This disaster will hopefully give Aker Subsea an extra motivation to invest in effective knowledge flow and sharing of experiences, both to avoid similar disasters and to become the preferred subsea partner through competitive advantage.

It has been very interesting to study the knowledge-related initiatives Aker Subsea does on the surface to master the deep. I would like to thank the employees at Aker Subsea who have participated in interviews; especially Vice President in Lifecycle Technology, Odd-Egil Haug, he has been very helpful giving me entry into his organization. In addition, I would like to thank Inger Beate Pettersen, who established contact with Aker Solutions. Finally, I would also like to thank my supervisor, Associate Professor Svein Ulset at NHH, for valuable discussions and feedback along the way.

Bergen, 20 June 2010

Pål-Vemund Vermedal

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Summary

The purpose of this study is to examine knowledge flows and coordination problems experienced by Aker Subsea. We apply theories on international strategy and organizational structure to analyze Aker Subsea´s knowledge governance.

The subsea value chain consists of five elements: development, production, construction, installation and subsequent aftermarket services. Product groups and local service bases for specific fields and oil companies carry out these activities. The research problem deals partly with inefficient knowledge flow and coordination along the value chain, and partly of inefficient sharing of best operating practice between service bases located in different foreign oil provinces. The vertical knowledge flow along the value chain is the major issue in the study.

Aker Subsea, as a part of Aker Solutions, has recently changed their international strategy from one of being a global transnational organization to one of becoming a regionalized international actor. Yet, the focus is to maintain global benefits through standardizing and by using common procedures and processes. This new strategy has a clear impact on how to approach knowledge governance that contributes to an efficient knowledge flow between product groups and different service bases worldwide.

This study focuses mainly on the service department in Aker Subsea, Aker Subsea Lifecycle Services (Aker SLS), and takes the perspective of Aker SLS personnel working in the Norway-Africa region (Oslo, Ågotnes and Angola). This region includes service bases in Angola and Ågotnes (Norway) as well as SLS Headquarters (HQ) in Oslo. Recently, SLS established a Cross-Functional Integration team (CFI team) called Lifecycle Technology (LT) as an intermediary between product groups and service bases.

The product groups develop technology and systems through projects delivered to service bases for further operations. Knowledge flow, effective coordination and communication between the product groups and the service bases are essential in order to offer the best technology to the customer. To gain empirical knowledge of the phenomenon of knowledge governance I conducted 11 interviews with 13 employees from the two service bases, SLS/LT and one specific product group.

Aker Subsea's organizational structure is a reflection of its international strategy in terms of role clarifications, distribution of authority and mandate, and the interaction between the units

(service bases, product groups and SLS/LT). These are ongoing processes in the company; the organizational structure has been diagrammed and different aspects have already been implemented.

In the new project model, product groups and service bases are better integrated. The project-based organizational structure is vital for the involvement of both product groups and services. This involvement is important to achieve effective interaction and knowledge creation through projects. For routine operations, it is a matter of how much power should be exercised by the different service bases and how much exercised by a central authority (SLS/LT). The company has to clarify the needs of power distribution to a greater degree.

The establishment of Lifecycle Technology (LT) as an intermediary between service and product development contributes to increase coordination. LT ensures that organizational entities jointly carry out activities and develop a common understanding of each other's challenges and needs. The organizational structure is divided into three layers: project-based, operations-based and knowledge-based. This division is based on a theoretical framework and LT is defined as the knowledge base in Aker SLS throughout the study. LT collects knowledge from different bases and fields, and disseminates it to the product groups, and vice versa.

Since both the strategic change and the organizational structure are relatively new (implemented in 2009), it is too early to conclude whether these work effectively for the company as a whole. The study bases conclusions on the progress up until June 2010 as well as on the company´s intentions and ambitions for knowledge governance.

1. Introduction

1.1 Purpose and research problem

The purpose of this study is to examine knowledge flow and coordination problems experienced by Aker Subsea, and to examine, through theory on international strategy and organizational structure as theoretical framework, its approach to knowledge governance.

The research problem concerns inefficient coordination along the value chain consisting of product development, production, construction, installation and subsequent aftermarket services carried out by product groups and local service bases, respectively, for specific fields and oil companies. In addition, it concerns inefficient sharing of best operating practice between service bases located in different foreign oil provinces.

This research problem will be answered by first analyzing Aker Subsea´s organizational structure and its different knowledge processes. Subsequently, the study goes into detail regarding how the newly established central service support can contribute to coordination of knowledge flow between product groups and service bases.

1.2 Introduction of Aker Subsea´s problem and their solution

Aker Subsea is a part of Aker Solutions. Aker Subsea is described in this study as having eight product groups and eight service bases. This is a simplified picture of the organization, but sufficient for the purpose of this study. The main focus is on the service department in Aker Subsea called Subsea Lifecycle Support (SLS), which includes all service bases and the Lifecycle Technology (LT) department.

1.2.1 Aker Subsea' s problem

Prior to the late 1990s, Aker Solutions was region oriented, but through a multidomestic strategy. In the late 1990' s it drew up a global strategy and was a global, standardized business until 2009, when it regionalized its operations on a global basis.

The table below illustrates the company's strategic development:

Strategy	Multidomestic	Global/ Transnational	Internalization/ Transnational
Organizational Structure	Autonomous Bases	Standardization and a matrix structure	Hypertext structure with CFI teams
Decision-making Authority	Decentralized	Centralized	Mix

Figure 1: Aker Solutions' strategic choices

Aker Subsea's global strategy evolved into a transnational form with a matrix structuring. The matrix structure resulted in a highly complex reporting system. This organizational structure did not sufficiently allow for handling the products' lifecycle through clear roles, ownership and coordinating knowledge flow between the different units. Product groups and service bases were fragmented and autonomous, and were only coordinated through various projects.

Aker Subsea is a project-oriented company that delivers products and systems to the customer's field through projects. Products are developed and tested before they are delivered to the customer (oil company). When products are delivered to the customer, the related project is handed over from project management to the service base located in the region. In several projects, handovers have been badly executed, followed by repudiation of liability with regard to support and follow-up. The lines of communication and support have been unclear towards what formerly was called "After Market Services" (now Subsea Lifecycle Services). Best practice from projects has not been preserved and therefore has not been explicitly used in later projects. The vertical problem between projects/product groups and service bases consists of both organizational and coordinating issues.

Service bases worldwide have not seen the usefulness of regular contact with each other because of differences in customer (oil companies) needs. Knowledge and routines of standard operational procedures have largely been developed at individual bases. Autonomous service bases spread across the world have often rapidly led to differences in handling operations and the same mistakes have been made at several locations. Sharing of best practice is difficult to facilitate if bases are not sufficiently coordinated. How to distribute

authority (how much centrally and how much locally at each service base) is therefore a key question.

1.2.2 Aker Subsea's solution

The regionalized international strategy primarily sought to customize Aker Subsea's operations in a better way than previously and to give each region clearer fields of responsibility. Aker Subsea has to deal with how they can regionalize their global strategy and still ensure that the organizational structure is compact and integrated. The organizational structure is meant to reflect their strategy.

In addition to the strategic change, Aker Subsea's central service support function was renamed *Lifecycle Technology (LT)* and staffed with employees covering competencies of all products in Aker Subsea. This change came about mainly because not all service bases have engineers, and they therefore need to have access to engineering support from LT. Such a central support function enables Aker Subsea to realize gains through coordinating solutions and expertise across the value chain: (1) Vertically in terms of being a supporting and coordinating function in projects as well as having regular dialogue with product groups regarding the needs and issues of service bases; (2) Horizontally in terms of gathering, preserving and spreading best practice and relevant information to the service bases. The figure below shows LT´s position as an intermediary between product groups and service bases.

Product groups		Service bases
System		UK
Controls		Australia
XMT		Malaysia
WOS & Tooling	SLS/LT	Ågotnes
Tie-in & Structure		Brazil
Umbilical		Angola
Risers		USA
Wellhead		India
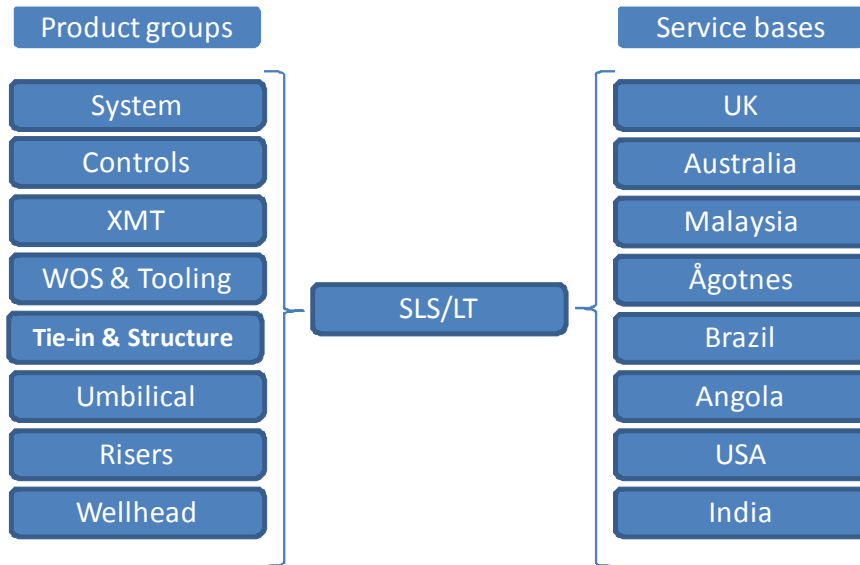
Figure 2: The connection between product groups, SLS/LT and service bases

Aker Subsea has started to improve their organizational structure by focusing on knowledge governance in order to handover projects to service bases more smoothly and to develop closer interaction between units. Service personnel are getting more involved in projects to improve on the required competencies for the products in a project handover. The goal is to improve the governance and management of knowledge so that products and services are more coordinated.

1.3 Structure and composition of the case study

The concept *knowledge governance* is the central topic in this study and is defined as *structures and processes developed or put in place to implement, coordinate and handle both tacit and explicit knowledge in the organization.* In this study, the concept also deals with distribution of decision-making authority and responsibilities towards the subsea products' value chain. The concept is hereafter abbreviated as KG.

Aker Subsea's switch to its international strategy influences the organizational structure in terms of authority and coordination of different units. Theory on international strategy and KG will guide the following analysis of Aker Subsea, with focus on its service activities.

The theoretical framework on organizational structure derives from Nonaka and Takeuchi (1995). The authors describe a structure that allows for organizational knowledge creation. This structure includes three layers: project team, business system (routines) and knowledge base. These layers fit well into this study because Aker Subsea is project oriented in their operations, but also includes in the project layer routine work at the service bases. The knowledge base layer in Aker Subsea SLS is defined to be its newly established Cross-Functional Integration team (CFI team), LT. LT as a CFI team will be analyzed in order to see how such a team can contribute to creating a simpler, clearer and more systematic support and knowledge flow in Aker Subsea. The theoretical framework on CFI team is derived from industrial marketing and product development. This part will describe important organizational factors related to Aker Subsea's aim to increase focus on the products' lifecycle through the value chain.

The research model is illustrated below:
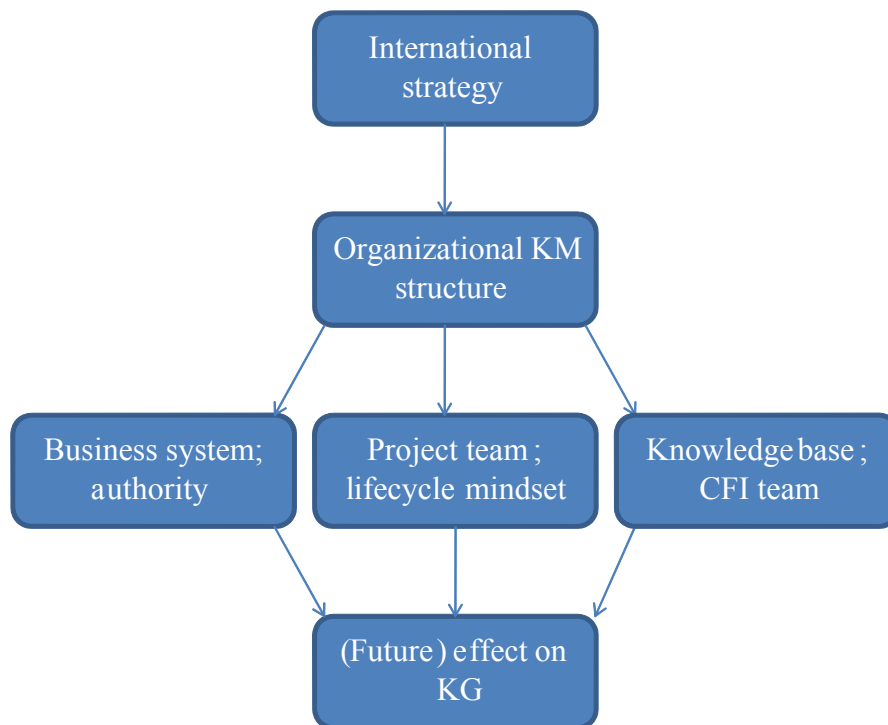
Figure 3: Research model

The main point of this model is to elucidate the relationship between choice of international strategy and organizational structure, and to elucidate the effect on KG in terms of sharing and coordinating knowledge and information. It is important that these KG structures are

balanced against each other to achieve an effective and efficient knowledge development and knowledge flow within the company.

1.3.1 The differentiation between knowledge flow and assistance

LT acts as both a competence hub and a capacity buffer for the service bases. Not every SLS unit needs to have specialists within all product areas (competence) and LT can support both engineering and project execution during periods with high workload at service bases (capacity). It is therefore important to point out a difference between knowledge *flow* and *assistance through problem solving*. A practical example of the difference in these two terms would be a case in which employees from LT assist a service base on a technical job that the service base struggles with due to a lack of competence or due to capacity constraints. In this case, LT assists the customer directly, and therefore the service base does not benefit from gaining new knowledge through learning. This study will focus on the sharing of knowledge from a governance perspective. This perspective includes a focus on types of knowledge flow where LT´s role is more as a coordinator than as an executor. One type of knowledge flow I discuss is how operational knowledge (e.g., procedures and routines) is shared by service bases with a service support center with the intention of spreading this knowledge to other bases in terms of best practice and adjustments in working routines. Another example concerns vertical knowledge flow where product groups create, through projects, knowledge in terms of new technology and systems. This knowledge is shared with base personnel who are supposed to install, operate and maintain the technology. Such knowledge is shared both explicitly, through manuals and instructions, and tacitly, through integrated testing and training on the system.

1.4 Practical limitations

This case study focuses on Aker Subsea´s Norway-Africa region, service bases in Angola and Ågotnes, and on SLS/LT centrally. Aker Subsea´s regions are described more in detail in the Case Description (part 5). LT is defined in this context as an engineering support center/unit in Oslo. A unit called Rental Tool Pool (RTP) is also part of LT, but is not considered in this study.

Concerning the scope of the study and schedule, as well as access within Aker Subsea, the Norway-Africa region has been a natural focus area. After the service base in India, the

Norway-Africa region ranks second in activity for LT and thus probably also ranks second in level of feedback. In addition to inputs by respondents from LT and service bases in the Norway-Africa region, inputs by respondents from one product group will help in understanding their respective roles towards SLS. Nevertheless, we may have lost important arguments because we focus on only one of eight product groups.

2. Theoretical perspective

KG is a relatively new field of research; few studies have looked at this part of knowledge management (KM). KG integrates theoretical aspects of both knowledge management and organizational governance. Companies interested in managing their knowledge effectively, to enhance organizational performance and competitiveness, need to create structures and processes to manage the wide range of knowledge activities.

The concept *KG* in this study is defined as *structures and processes developed or put in place to implement, coordinate and handle both tacit and explicit knowledge in the organization.* Polyani (1962) first proposed the distinction between tacit and explicit knowledge, which are concepts widely used in research. *Tacit knowledge* is defined as personal knowledge, experimental and context specific. *Explicit knowledge* is knowledge that has been codified, articulated and published in some way.

Nonaka and Takeuchi (1995) have designed a model for knowledge conversion processes that connects both tacit and explicit knowledge (figure 4 below). Sharing knowledge is fundamental to the establishment of best practice, the creation of new knowledge and the achievement of common learning. Primarily, this sharing is achieved through tacit to tacit communication, but it is clear that knowledge sharing can also be achieved through a tacit to explicit to tacit conversion loop, as shown in the figure below.
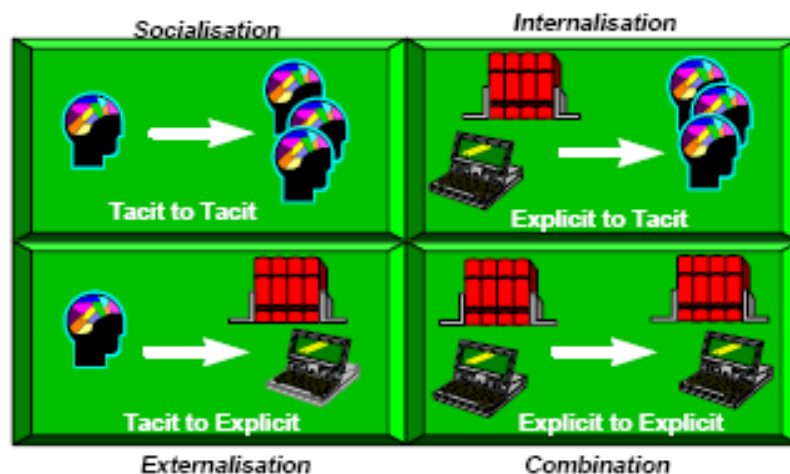
Figure 4: Knowledge conversion processes (Nonaka and Takeuchi, 1995)

Scholars and others agree that we know far more than we can make explicit (Polanyi, 1966).

To engage in knowledge sharing requires interaction and communication between the sharing and the receiving units. Compatible practices thus affect whether and how knowledge developed by one unit can be shared with and used by other units (Kogut and Zander, 1992, Adenfelt and Lagerström, 2006). This study attempts to describe the governance structure and processes required to succeed in sharing knowledge.

The literature examined for this study often stresses the importance of KG. Other literature does not specifically refer to the concept of governance, but rather emphasizes certain aspects of the topic, such as the importance of strong leadership to the success of Knowledge Management initiatives (Chourides et al., 2003, Pan and Scarborough, 1999, Storey and Barnett, 2000), and the role of top executives as role models (Davenport et al., 1998, Mason and Pauleen, 2003), as knowledge architects and as catalysts (Inkpen, 1996).

2.1 The company's choice of international strategy

Aker Subsea has recently changed their global strategy and new strategy influences its approach to KG in terms of coordination and governance of the various service bases and product groups.

Bartlett and Ghoshal (1989) describe four strategies that companies may use when competing across borders: (1) *multidomestic*, (2) *international*, (3) *global* and (4) *transnational*. A multidomestic strategy is a strategy in which the foreign entities are highly independent, acting as autonomous subsidiaries. This autonomy enables them to react quickly to changes in local markets. However, this is a strategy where there is likely to be little contact and exchange of knowledge and experiences between the various subsidiaries. The international strategy is different from the multidomestic strategy in that it involves more centralized strategic management and R&D. Centrally developed products and technologies are adapted to local conditions, and more coordination is required from the HQ than is required in the multidomestic strategy. Some decision making is decentralized, but there is still more control from HQ than in the multidomestic strategy.

The global strategy is a strategy where actions and procedures in the subsidiaries are highly regulated and controlled by HQ. This approach ensures the achievement of global efficiencies through economy of scale. Global strategies are particularly effective in markets where

products are not very differentiated and transaction costs are low. The transnational strategy aims to "think globally, act locally," as the slogan goes, through a dynamic interdependence between the parent/HQ and the subsidiaries. Organizations that use a transnational strategy to coordinate their work ensure local flexibility while exploiting the benefits of global integration and efficiency. In addition, the worldwide spread of innovation is ensured. Responsibility is spread throughout the activities and locations, and matrixes are developed on these dimensions. This is a much more complex form of organization than the other three above.

2.1.2 Centers of Excellence

Aker Subsea has defined their product groups (located in Norway) as Centers of Excellence regarding the product technology and has defined SLS in Norway (including the service base at Ågotnes and SLS/LT at HQ in Oslo) as the Center of Excellence regarding subsea operations and service. According to Holm and Pedersen (2000), a Center of Excellence (CoE) is defined as follows:

A subsidiary is "excellent" if it has some kind of distinct competence that gives it a competitive advantage in relation to competition in the market. This competence can be related to its capability within production, product development, marketing and/or other functional areas. Subsidiaries are "centers" in the Multinational Company (MNC) if the subsidiary competence is of use for other MNC units. Thus, the excellence must relate to the activities or development of other MNC units. Such CoEs are subsidiaries/units, which have special expertise in a specific field, and this expertise will benefit the entire company. Such a definition of competence fields has become widely used by companies.

CoEs often influence the long-term trends in the company through sharing of knowledge and strategic decisions (Holm & Pedersen, 2000).

2.2 Organizational Structure for effective KG

Aker Subsea is defined as a Multinational Company (MNC) and its choice of international strategy determines its organizational structure. An increasingly important share of MNCs' sharing of knowledge is not necessarily just one-way (from HQ to subsidiaries), but two-way, or even in multiple directions (Cantwell, 1994).

Since the mid-1980s, it has been argued that since subsidiaries are becoming more knowledgeable, MNCs have been moving away from hierarchical and bureaucratic models where knowledge flows top-down from the HQ. The movement has been towards a model often referred to as *heterarchy*, which is an "integrated network" and characterized by strong lateral connections and interactions across units (Hedlund, 1986). The role of HQ is to design process architecture rather than to exert control in the classical hierarchical sense. This lack of formal authority forces knowledge networks to depend on convincing arguments and experience rather than on authoritative selection and implementation (Ulset & Gooderham, 2007).

Based on the knowledge conversion model described above, Nonaka and Takeuchi (1995) developed the concept of a *Hypertext* organizational structure. Hypertext organizational structure is based on the efficiency of the bureaucracy model's hierarchy (standardization and formalization), combined with creativity, flexibility and dynamic characteristics of the project model (Heterarchy). Aker Subsea is a project-oriented company but also includes operational routines and regular business at the service bases. Therefore, the hypertext organizational structure, which focuses on organizational knowledge creation and coordination, is well suited for this study.

Nonaka and Takeuchi (1995) describe Hypertext organizational structure as having three layers:

1. *Business system* layer: This is where routine operations are performed (e.g., service base operation). The business system layer operates along the bureaucratic model, and products and services are delivered here. This is where we find the great diversity of tacit knowledge in the organization. Business system is the part of the organization that deals directly with the customer and with the organization's operating environment – that is where "rubber meets the road" and where the reality of the business is truly known.

2. *Project team* layer: This is where knowledge-based tasks, such as developing new products, are carried out. This layer operates according to a taskforce model where people are drawn from their normal duties to join a project with a specific purpose and perspective for implementation. This layer is where knowledge conversion takes place, converting tacit knowledge from individuals from the business system layer and

engaging that knowledge to develop new concepts, ideas and products (processes or services). When the project is completed, the individuals return to their normal roles and responsibilities within the business system layer.

3. *Knowledge base* layer (SLS/LT): Here, knowledge generated in the two layers above is codified and stored to ensure availability for everyone in the organization. The most effective organizational knowledge base is structured around the organization's intent/vision and long-term goals. Within this layer, new knowledge is re-categorized and re-contextualized to make it more accessible and more valuable to as many individuals and business units as possible. Thus, new "soft" knowledge – such as culture, interaction and relations – is as valuable as new "hard" knowledge – such as technology and manufacturing processes.

The success of a Hypertext organization is in the ability it affords individuals to move seamlessly into and out of each of these three layers. The hierarchical model makes it difficult to pull out the tacit knowledge, while the project structure (taskforce) further complicates the work of pulling out the explicit knowledge. According to the knowledge conversion model by Nonaka and Takeuchi (1995), a Hypertext structure is bureaucratic/hierarchical through internalization and combination of knowledge, and task force/heterarchical by generating new knowledge through socialization and externalizing. New thinking concerning Hypertext is that a knowledge base categorizes and conceptualizes new knowledge in line with the organization's vision, culture and technology. For Aker Subsea, this knowledge base is defined in this study as LT.

One of LT's tasks as a knowledge base for the service bases is precisely to categorize and to conceptualize knowledge and information.

Criticism of the Hypertext organizational structure theory concerns its failure to give a clear picture of how authority should be distributed to achieve the company´s strategy. Responsibilities and the extent of the knowledge bases' mandate must be clearly defined. Furthermore, a decision must be made regarding whether and to what extent units or subsidiaries should be governed. And or whether they should have decision-making authority and if so, how much, even for follow-up and implementation of initiatives and best practice.

2.3 Knowledge base layer: Cross-Functional Integration team (CFI team)

Literature on Cross-Functional Integration (CFI) teams deals with the establishment of a knowledge base. Integration of various disciplines has been popular in many organizations (Adler, 1995, Brown and Eisenhardt, 1995). *CFI* is defined as *the extent of interaction and communication, level of information sharing, the degree of coordination, and extent of joint involvement across functions* (Song and Montoya-Weiss, 2001).

A CFI team is a team in which employees with several forms of functional competence are gathered. This organic structure allows team members to realize their tacit knowledge in the development of new products/services through utilizing the team's knowledge. Therefore, the structure represents a comprehensive recognition and understanding of how to achieve the development of new goals. This structure enhances expertise across disciplines and is adapted to the needs of a project-based team (Cannon-Bowers et al., 1990). However, such a team can be more or less permanent, as the case shows in the study. CFI facilitates communication, collaboration, sharing of information, coordination and cooperation between functions in the development of products and services (Song and Montoya-Weiss, 2001). Porter (1998) argues that the unlocking of competitive advantage from dispersed activities must be coordinated globally. Such coordination will ensure consistency and reinforcement between the countries.

Knowledge is not just an individual occurrence, but also a team's incidence (Dixon, 2000). A person's tacit knowledge can be transformed into the person's group's tacit knowledge or *collective knowledge* – a group's "know-how" which can be used to solve problems in different business contexts (Spender, 1996). Tacit knowledge embedded in individual employees is not fully functional unless the team uses the specific processes that facilitate transformation of collective tacit knowledge. This transformation is in line with the model above by Nonaka and Takeuchi (1995) concerning the knowledge conversion for purposes of socialization. Since CFI is an organic structure that engages various features/areas, knowledge can be preserved in the CFI team to improve and enhance "retrieval cues", and thus help to spread knowledge and improve the team's decision-making processes (Rulke and Galaskiewicz, 2000). This structural approach can accelerate the exchange of knowledge through cognitive and social processes (Griffith et al., 2003, Madhavan and Grover, 1998).

2.3.1 Theoretical framework for coordination through CFI teams

The theoretical framework on CFI teams largely derives from an article by Hirunyawipada et al. (2009), titled *Cross-functional integration as a knowledge transformation mechanism: Implications for new product development*. Much of their framework fits well in this study because it deals with the creation of such a cross-functional service team. The aim is to increase coordination between and to establish closer relationships amongst product groups and service bases. The theoretical framework described in this article is recent (2009) and serves as a motivation to put new theoretical research into practice. The drawback is that little research exists for comparison purposes.

A basic prerequisite for tacit to collective knowledge transformation is socialization. Although the CFI team possesses some advantages, formation of such teams alone does not improve socialization. Hirunyawipada et al. (2009) identified different team-specific individual factors that come into play and affect each other in a CFI team. The individual factors are common knowledge, functional expertise and network centrality. These three important factors influence the transformation of tacit to collective knowledge through the socialization process in a CFI team (Burt et al., 1998, Cohen and Levinthal, 1990, Sobek et al., 1998). Firms should consider these three factors when forming teams. Otherwise, suboptimal team socialization process can become a barrier to the effectiveness of knowledge transformation. *These factors will be included in the study to analyze LT as a coordinating team.*

The framework by Hirunyawipada et al. (2009) also includes several team-level factors: goal congruence, team cohesion (task cohesion and interpersonal cohesion) and transformational leadership. We treat transformational leadership with respect to LT, while goal congruence will be analyzed over the whole of Aker Subsea (SLS/LT, two of the eight service bases and one of the eight product groups). We analyze the team cohesion factor with respect to SLS (service bases and LT). In the figure 5 below, we illustrate the application of the framework:

**LT vs.
Aker Subsea**

Goal Congruence

**LT vs.
Service bases**

Team Cohesion

Knowledge
Transformation

**LT as a
CFI team**

Functional Expertise
and
Common Knowledge

Network Centrality

Transformational
Leadership
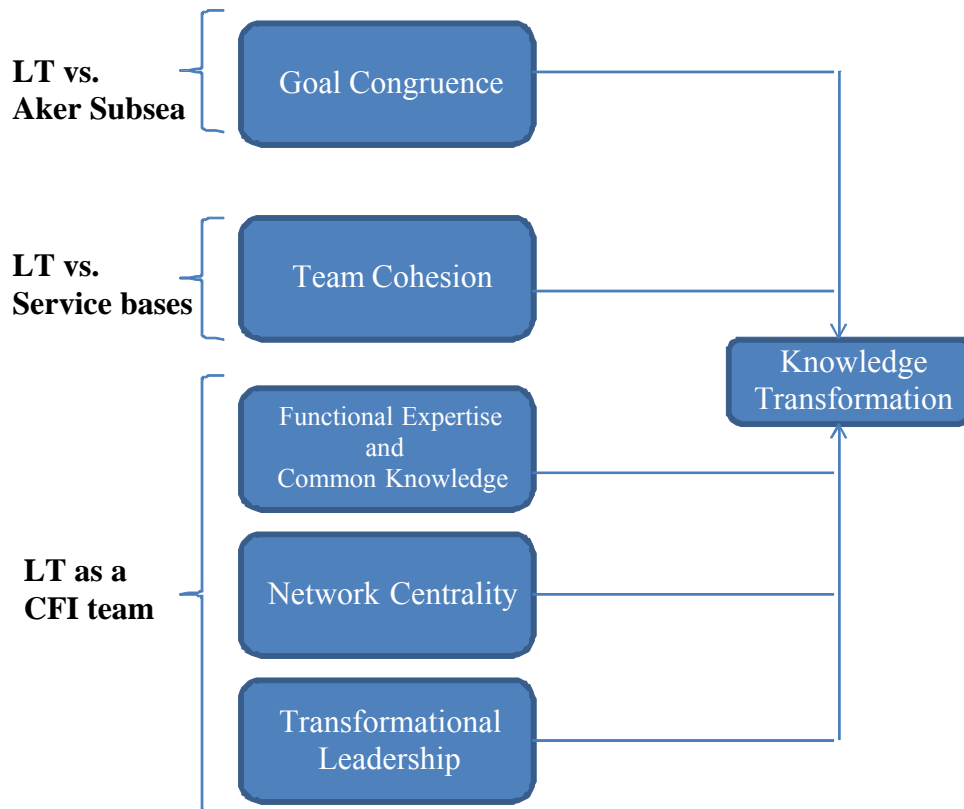
Figure 5: CFI factors influencing knowledge transformation

The above adjustment in the theoretical framework enables us to answer how LT as a coordinating CFI team can handle knowledge flow more efficiently. And we explain this by both internal factors and factors that focus on LT's interaction with the other units.

We analyze all factors to answer how LT as a coordinating CFI team can make knowledge flow more efficient. In the following, we describe the relevant factors theoretically.

2.3.2 Goal congruence

Related to goal congruence, we perceive Aker Subsea as a team. We try to explain how LT, as part of that team, can act as a driving force to ensure a greater community of interest across both service bases and product groups.

Team effectiveness requires that team members must be able to handle several tasks including the duties of their main task and the duties of the tasks of other team members. This requirement can often lead to friction concerning how to allocate time, effort and attention to new tasks or new features. Several studies suggest that having a common goal (goal

congruence) strongly correlates with team effectiveness (Kristof-Brown and Stevens, 2001, Witt et al., 2001). Goal congruence is achieved when members agree on the importance and the priority of their goals (Vancouver et al., 1994). A goal can affect both individual and collective performance (Locke and Latham, 1990, O'Leary-Kelly et al., 1994).

2.3.3 Team cohesion

Team in this context comprises LT and service bases. Team cohesion consists of *task cohesion* and *interpersonal cohesion* (Carless and Paola, 2000, Zaccaro and Lowe, 1988). Task cohesion exists when team members are mutually committed to their team's tasks (Hackman, 1992, Mullen and Copper, 1994). Task cohesion stimulates conformity and preserves the team members' orientation to the task (Man & Lam, 2003). Task-cohesive teams operate more efficiently if coordination increases between the members (Mullen and Copper, 1994). In addition, task cohesion is necessary for the team to pursue its mission effectively, especially for CFI teams where members represent different expertise, functions and roles. These members are assigned to the team with specific purposes. Increased cooperation in the CFI team (LT) improves interaction amongst team members. The possibility to exchange opinions and experiences about the task increases as cooperation and interaction increase (Hirunyawipada et al., 2009).

Interpersonal cohesion is based on personal relationships and friendships with other members of the group (Moorhead et al., 1998). Having a too high social context on a team – if interpersonal cohesion on a team is too high – can easily become counterproductive (Langfred, 2000). When members become too socially linked to each other, exchange of opinions within the team will be limited because members will tend to focus more on maintaining relationships by seeking greater consensus (Bateman et al., 1987). The challenge is to find a balance between task cohesion and interpersonal cohesion.

2.3.4 Functional expertise and common knowledge

CFI team members possess knowledge and are actors who play key roles in tacit sharing and transformation of knowledge. Team members' special skills (e.g. characteristics, predisposition, learning and experiences) that they bring into the team affect the transformation of tacit knowledge into collective knowledge (Odom and Pourjalali, 1996, Stonebraker and Hazeltine, 2004).

Tacit to collective knowledge transformation in a CFI team depends on the sharing of experience and on the application of tacit knowledge in a new context (Nonaka and Takeuchi, 1995). CFI team members need to have the appropriate skills to perform new product development or service-based tasks. Functional expertise reflects the employee's working knowledge, experience and skills in a particular subject. Put simply, it deals with the possession of exhaustive knowledge. Team members with functional expertise probably know how to treat functional tasks, solve problems and get relevant information, and therefore have more time to build their knowledge base and expertise in their fields.

While a CFI team is developed to integrate expertise from different disciplines, it must form a common ground to initiate social and cognitive processes in the team. What the team members mutually know (common knowledge) can serve as a prerequisite for initiating good dialogues. Common knowledge is knowledge that team members possess (Grant, 1996). Such knowledge can be commonly accepted methods, skills, sharing of assets and so on (Dixon, 2000). Common knowledge is essential for cross-functional learning (Grunwald and Kieser, 2007; Nonaka and Takeuchi, 1995). Common knowledge allows individuals to share and integrate aspects of knowledge not shared between them (Grant, 1996).

Different specialists use common knowledge (e.g. procedures for developing new products, technical component details, and general market perceptions) to begin the discussion and exchange of ideas. Through common knowledge, team members can share and access each other's domain-specific knowledge (Carlile, 2004). Common knowledge increases cooperation and coordination. Thus, team socialization is enhanced, which in turn promotes the tacit-to-collective knowledge transformation within a CFI team.

2.3.5 Network centrality

Network centrality refers to the degree to which an individual is connected to others in a network (Sparrow et al., 2001). It is the structural part of the individual's relationships with other members, in their own team, in the organization and between organizations. Network centrality can be measured in *degree* – the number of members who have direct relationships with the focal member, in *proximity* – the distance between the contact member and other network members, and in *betweeness* – the extent to which the focal member holds the position with the shortest distance between groups of other network members (Freeman, 1979, Houston et al., 2004). When a CFI management recruits team members with high

network centrality this personal resource will enrich the team's socialization in three ways. First, (1) a person with a strong position in a network has the ability to access and control the flow of information (Houston et al., 2004). Critical information (such as previous projects, policies, crises, resources, situations and experiences) is stored within the employee's faith and commitment and is valuable tacit knowledge (know how) that flows from workers (e.g. personnel at service bases) to a collection point or a CFI team member who has a central position in the network. The focal member´s network centrality gives him/her the opportunity to gather non-redundant information faster than others do. Second, (2) team members with strong network centrality develop a diversified knowledge base. Because they hold a superior position in the network, they tend to have contact with several other workers within their functions/disciplines, internally in the organization and externally in other organizations. Third, (3) members with a central network position also have a tendency to sustain their interaction and socialization with external parties even after they leave the CFI team. In case of job transfers from the CFI team to other units within the company, former members of the CFI team could serve as knowledge brokers by bringing to their new unit knowledge to share.

2.3.6 Transformational leadership

 A team leader who has overview of the development of products and/or service procedures may bring about an effective integration of various functions (Sobek et al., 1998). The head of a CFI team is committed to maintain project continuity by integrating various functions, fostering collaboration projects' decision-making, monitoring and controlling information flow, negotiating with other managers, and so on (Grenny et al., 2007, Moenaert et al., 2000). Experienced managers can reduce communication costs and improve "credibility and knowledge codification" (Moenaert et al., 2000).

It is not the amount of authority or power possessed by team managers or project managers, but rather their behavior and leadership styles that significantly affect the performance in CFI teams (Norrgren and Schaller, 1999). Their position of power in a CFI team also depends on how productive they are and on what value-adding effect they have. Elements of effective transformational leadership can affect team members' socialization and the effectiveness of tacit knowledge transformation. The idea is to facilitate personal values with the team's vision (inspirational motivation), to stimulate intellectual abilities within the team (intellectual stimulation), and to treat and respect team members as individuals (individualized treatment). These elements significantly affect team performance (Hirunyawipada et al., 2009).

The transformational leader helps to adjust personal needs based on the team's collective interests and encourages members to act with a single mind in their assigned tasks (Jung and Avolio, 2000). A leader who initiates clear goals and expectations for CFI team members could increase team learning which in turn positively affects innovativeness (Sarin and McDermott, 2003). Several innovative leaders are using this "buy-in" approach effectively to foster team members' commitment to tasks and goals. Such an approach will in turn improve the members' interaction and increase the likelihood of sharing experiences with others. The innovative team leader purposefully delegates authority to team members, pushing them to experiment and to solve problems themselves (Barczak and Wilemon, 1989). Such behavior encourages team members to seek new ways of solving problems. This approach can enrich the sharing of experiences in the socialization mode and thus the transformation from tacit to collective knowledge is likely to improve.

2.3.7 Summary of the conceptual framework of CFI teams

Socialization is the underlying mechanism of knowledge conversion in a CFI team. In addition, it is important to focus on explicit knowledge sharing and on the use of technological tools for more efficient sharing of experiences and best practice. The efficiency of knowledge transformation in a CFI team depends on how much team socialization can be improved, both internally and with other business units. With this background, the focus is on various individual factors for LT as a CFI team (common knowledge, functional expertise, their network positions and transformational leadership), on the goal congruence between units in Aker Subsea and on team cohesiveness in the SLS department.

This theoretical framework concerning CFI teams will both explain intra-team properties and knowledge flow between units. The analysis through this framework will create a picture of how LT as a central cross-functional service support contributes in creating a simpler, clearer and more systematic support and knowledge flow in Aker Subsea.

2.4 Barriers against knowledge sharing

Coordination between different units/subsidiaries on a global level raises some organizational challenges. Porter mentions in the article *Competing across Locations* (1998) barriers such as language, culture, and geography in terms of communication and common ways of thinking. Foreign subsidiaries have a natural tendency to develop autonomy and extensively tailor their activities to local circumstances. In the same article, Porter mentions five approaches concerning how successful global players can handle these barriers through coordination. First (1) the company must have a well-defined global strategy that everyone can identify with. Second (2) subsidiary managers recognize the overall global position as a difficult-to-match source of advantage in their particular country. Thus, they are careful to tailor their local activities in a way that will not undermine the global strategy. Third, (3) information systems are made consistent worldwide, facilitating operational coordination, the exchange of information comparisons across locations, and the making of appropriate tradeoffs. Fourth, (4) encourage personal relationships and learning among subsidiary managers, both to foster mutual understanding and to give coordination a human face. Fifth, (5) any company that seeks a global strategy must put in place an incentive system that weights overall contribution to the company in addition to subsidiary performance. We will discuss all these approaches in the analysis, but under different topics.

In their book, *Global Strategy and the Organization* (2004), Gupta and Govindarajan discuss barriers and pitfalls associated with knowledge sharing in companies. The authors discuss barriers surrounding the *social ecology*, a term that implies a social system influencing people. The term is broad and covers culture, structure, information systems, reward and incentive systems, processes, people and managers. It is not a random collection of these items; they are put into a system where they interact with each other.

Regarding knowledge preservation, a major barrier is the development of system and knowledge databases that are only a collection of one-upmanship. This barrier is called garbage in-garbage out, in line with Porter's third approach regarding consistent information. Mismatch between knowledge structure and sharing structure often results in random and ad hoc transmission channels. Use of e-mail rather than face-to-face contact or telephone communication is, for instance, a poor method for tacit knowledge sharing. In addition, it is also important to set up efficient and commonly understood organizational paths to follow.

Gupta and Govindarajan (2004) discuss knowledge sharing and argue that the transmission mechanisms have to be appropriate for the type of knowledge being shared. *Efficient* transmission mechanisms (cost and speed of the transmission channels) are useless if they are not *effective* (if the recipient does not receive what the sender has sent). Efficiency is particularly important where tacit knowledge (communication, face-to-face contact, phone, transfer of personnel etc.) is most appropriate. With respect to the formation of a Hypertext structure, success is enhanced not only by forming a knowledge base, but also by increasing the amount of knowledge that actually is integrated and transformed into effective knowledge (DeLuca and Atuahene–Gima, 2007, Madhavan and Grover, 1998). A CFI team can enhance the integration of knowledge (e.g. product development, maintenance, technology, marketing), and this integration tends to incorporate important product attributes (Marsh and Stock, 2006). Such a team can thus serve as a mechanism to achieve both effective (response time) and efficient knowledge sharing.

2.5 Critiques of the theoretical approach

This study describes how Aker Subsea approaches a KG structure. The study's intention is to provide the best possible balance between global integration and local response (between cost-economizing global standardization and value-creating local customization). It is important for this study's credibility to point out that this approach is one of several ways of approaching the topic *KG*. Different trade-offs, processes and tools exist, or can be developed. For example, Zyngier et al. (2005) have developed a framework for conceptualizing Knowledge Management (KM), strategy development and implementation processes as key aspects of KG. Their focus is particularly on aspects of risk management and evaluation processes. Other scholars focus more on change management and diagnostic tools to facilitate the company's focus to a KM strategy.

3. Research method

This study uses an exploratory design through a case study methodology. We collect data from only one company, but respondents represent different units in Aker Subsea. Such a qualitative research strategy is used to study a phenomenon in a systematic way (Saunders et al., 2007). The research strategy involves an empirical investigation of a phenomenon in a natural setting, using multiple data sources (Saunders et al., 2007). Robson (2002) defines this as "*a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence"*. Using case study design allows for seeing if the theories chosen are in line with the findings at the focal company. General conclusions would have limited applicability because of the focus on a single company. The next sections will give a more detailed picture of how data has been collected and analyzed.

3.1 Data collection

The most common form of data collection in case studies is interviews. Interviews are relevant for collecting non-numeric data, or data that are not quantified, namely qualitative data (Saunders et al., 2007). I have chosen to collect data through interviews with persons involved in various functions/units where I have studied the flow of knowledge: product group, service bases and the central support function (LT). I have also analyzed public documents and presentations by Aker Subsea.

The interviews are semi-structured. Such interviews have predefined topics, issues and questions. Yet, they allow adaptation to individual respondents (Saunders et al., 2007). The study is based on 11 interviews with 13 employees from two service bases (Angola and Ågotnes), SLS/LT and one specific product group. Each interview lasted between 45 to 90 minutes.

3.1.1 Design of questions for the interviews

The theoretical framework has guided the development of an interview guide (in Appendix 3). Four interview guides have been used: one for LT employees, one for employees at service bases, one for the management in LT and one for the respondents from the product group. Most of the questions are similar but some issues have been approached differently for each

group of respondents. This method ensured that the questions covered the theoretical basis as well as being formulated in an open and appropriate manner. During the interviews, respondents were asked to cite practical examples.

A flexible interview guide stimulated open, natural discussions, and in general the interviews functioned well. Respondents gave feedback on less successful aspects of their work. Such feedback helped me in describing and analyzing factors that work better than others at Aker Subsea and in their process to create an organizational structure where knowledge is governed efficiently.

3.1.2 Execution of interviews

It is challenging to ask questions, write notes, listen and plan follow-up questions all at once. I used a tape recorder during the interviews to enhance flexibility, i.e. to be able to concentrate and to follow up respondents' answers. I transcribed interviews as soon as possible after the interviews when details were fresh in my mind. Using a tape recorder can have a negative aspect, however. Its use can cause respondents to become withdrawn and unwilling to provide all information (especially critiques) if they fear consequences for doing so. Respondents agreed to use a tape recorder during the interview. Most of the interviews were in Norwegian and I subsequently translated the quotes. The interviews were generally face-to-face, but two interviews were by telephone and one was via video conferencing. One challenge of doing telephone interviews is we cannot see the respondent´s body language, such as facial expressions and hand gestures. Therefore, it is more difficult to get an impression of whether they mean to communicate more than they do in words. Moreover, it is difficult to establish a trustful relationship by telephone. Generally, trust is easier to create in face-to-face interviews. Therefore, some respondents may have revealed in telephone interviews less than they would have revealed in a face-to-face interview.

3.2 Analysis of collected data

I have chosen to use a deductive and hybrid approach to analyze my data (Saunders et al., 2007). Consequently, I have gone from theory to data using an established theoretical framework to better interpret data. It is important to be able to categorize the qualitative data. I have focused on a few overarching categories/topics which reflect my research problem and have placed the information received into these topics. This process is called *coding* (Saunders et al., 2007). Such coding gives a better overview and systematizes the information.

Coding has been a time consuming process and it has been difficult to plan a detailed coding procedure. During the coding process, I had to expand and merge some topics to get a better overview of the data. It has been important during coding to constantly look for correlations in the data to put information into a systematic layout. However, qualitative data makes it difficult to standardize respondents' views and come up with general descriptions (external validity). I separated the collected information based on the different approaches in my research model (operation/authority, project structure/Lifecycle, mindset and best practices and knowledge base/coordination) and the factors underlying them. In this way I have managed to systematize the task and demonstrate an appropriate relationship between theory/research model and analysis.

Expectations of findings are limited because Aker Subsea´s organizational change was carried out less than one year ago. Employees have not had time enough to become familiar with the new organizational form and all its advantages. Therefore, parts of the analysis will describe how different topics intend to be implemented.

4. Description of case study/organization

4.1 Aker Subsea and the Norway-Africa region

Aker Subsea, a part of Aker Solutions, aims to have a leading position in the delivery of key subsea technologies. The company has about 6000 employees worldwide. In 2009 it was a NOK 13 Billion revenue business. They have had a solid growth in their top line recent years (from approximately NOK 7.5 Billion in 2005). One explanatory factor is a strong growth in Subsea Lifecycle Service (SLS) (Aker Subsea Presentation, 2010). In addition, they have managed to win a high percentage of projects in a difficult market. We study the following areas of Aker Subsea: their product groups and Subsea Lifecycle Services (SLS), which includes a central service support (LT) and service bases worldwide. Figure 3 illustrates the connection between the service bases and product groups. Aker Subsea is divided into five regions, as illustrated in figure 6 below:
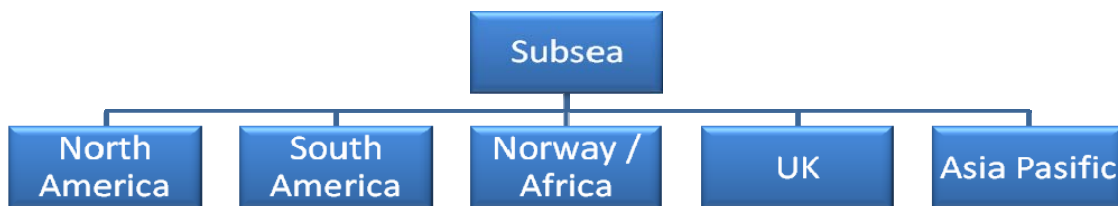
Figure 6: Aker Subsea´s regions

The focus is on Aker Subsea's Norway-Africa Region, which includes the service bases in Angola and Ågotnes (Norway). Norway and Africa are combined into one region for practical reasons. Traditionally, much of the work for African projects are conducted in Norway due to a shortage of local personnel and expertise in Africa. However, a high proportion of local content is increasingly required. Therefore, Aker Subsea is trying to build capacity and expertise locally in all regions. Business volume in Africa is still not sufficient to require establishment of a separate regional business unit. The base in Angola has about 200 employees, whereas the base in Ågotnes is the largest service base in all of Aker Subsea, employing over 400 people (SLS Presentation, 2009).

4.2 The development of a central support function

Data indicates that the Dalia project (Angola) and the Reliance Project (India) largely were the projects that triggered the management decision to focus on developing local support and competence at regional service bases. Previously, Aker had no central function to facilitate service support. Therefore, service bases applied directly to product groups for service support. Dalia was the first Aker project in Angola, where Aker had no previous presence. Aker won the contract in 2001 and established the service base in 2004.

The knowledge flow has often been based on individual's knowledge; individuals´ wander in the system. Sometimes individuals spread new knowledge as a result of job transfers, sometimes by bringing knowledge back to HQ from a project (respondent, LT).

No system required units to share knowledge. Therefore, personnel shared knowledge only when units made specific requests of other units. Consequently, knowledge and competence were embedded in individuals rather than spread organization-wide, and the organization's development thereby suffered.

Experience from service handling after project delivery of the Dalia project was limited communication back to the people from the original project team. Service personnel especially struggled when there were problems offshore that needed quick response from product groups and/or the project management. These inquiries were in conflict with what was focused on at HQ. Product groups' attitude was that they were only supposed to deliver their products and had little ownership of what happened after the delivery/handover. Former head of base in Angola during parts of the Dalia project went home to Norway in 2006. In his notebook he had a desire to start up a group supporting service bases. The support function "Aftermarket Technology" was established in 2006. The establishment of a central support function should support both product groups and service bases. It was important that service bases had an organization able to resolve technical queries submitted.

4.3 The improvement in June 2009: Lifecycle Technology (LT)

The support function was created to support both service bases and product groups but they became very oriented towards the product groups and product development. This function did not satisfy the service bases' needs. The 1st of June 2009 the product groups and service activity were clearly separated. Product development became purer while service support went into Subsea Lifecycle Services (SLS) (formerly called Aftermarket Services). This separation should strengthen both sides.

All service bases were required to have access to engineering support. And engineering knowledge network developed with the intention of contact that is more regular. Former *Aftermarket Technology* became a more defined group of members from the various product-related disciplines. The group was named *Lifecycle Technology* (LT), counting 19 members. LT´s staffing configuration is based on covering all engineering functions in Aker Subsea. Their goal is to have two members in each product discipline. Product groups acknowledge the need for a relieving intermediary group that can systematize and filter service related inquiries. This structuring of the approach to product groups ensures that problems are addressed to the person with knowledge to respond properly and saves both the service bases and the product groups for a lot of work. LT can answer requests more quickly. Regular weekly meetings are held to ensure that information and experiences from the bases are routed back. Technical inquiries are channeled back to LT and product groups in a systematic manner.

According to theory, LT is organized as a permanent Cross-Functional Integration team (CFI-team). The establishment of such a team is an attempt to break the different coordination barriers and interaction barriers. Their strategy/overall ambition is:

The overall ambition for the LT group is to support the different SLS entities in order for them to meet the customer expectation with respect to local operations on all products and projects. The LT group shall also make sure that operational feedback is routed back to products and projects in a systematic way (LT Presentation, 2010).

LT will be an accumulating unit and synergy manager in the dynamic process of knowledge between the operational service bases and technological and innovative product groups. Their role is ambitious because the service bases are dispersed around the world.

The group will support the various SLS bases in addition to route operational feedback back to product groups and projects in a systematic manner. Product knowledge, project knowledge, training and networks and practices are needed for this. Service bases should be made more independent of the product groups' support in their day-to-day business. LT aims to be a contributor in developing and implementing best practices, as well as making information flow between product groups and service bases more efficient.

LT has designed some success factors, and it has been natural to focus on these factors in the analysis. The success factors are: (1) *Commitment and follow up from SLS units – have to ensure proper service order agreement, hand over and start up – are still overall responsible vs. customer through service contract, (2) LT commitment – Services are performed, handled and solved in a professional way – capacity & competence and (3) Communication: Easy & clear process for ordering of work/getting support and clearly defined roles and responsibilities.*

The first success factor will be discussed when analyzing the project structure. The two other success factors are relevant when analyzing LT as a knowledge base in relation to CFI-team factors.

4.4 What is supported by LT

LT focuses on multi-discipline projects, or EPC projects (Engineering, Procurement and Construction). In such projects there is a great need of of support, because of the difficulty for service bases to maneuver around in the organization during large projects. Simpler "Stand-alone projects" consists of fewer and clearer lines of communication between the project and the base. It is more one to one work relationship and easier to get attention. LT has weekly meetings with engineering points of contact from the base at Ågotnes, Angola, India and Houston. Although LT is a support function available for all service bases, it has been natural that there is most contact with Ågotnes, Angola and India because of the activity and need for support at these bases. The service base at Ågotnes is without doubt the largest base in SLS, and which is more independent than the bases in Angola and India. Anyway, the general impression is that LT should be an equally available third line support for all service bases in terms of use (as shown in the figure below).
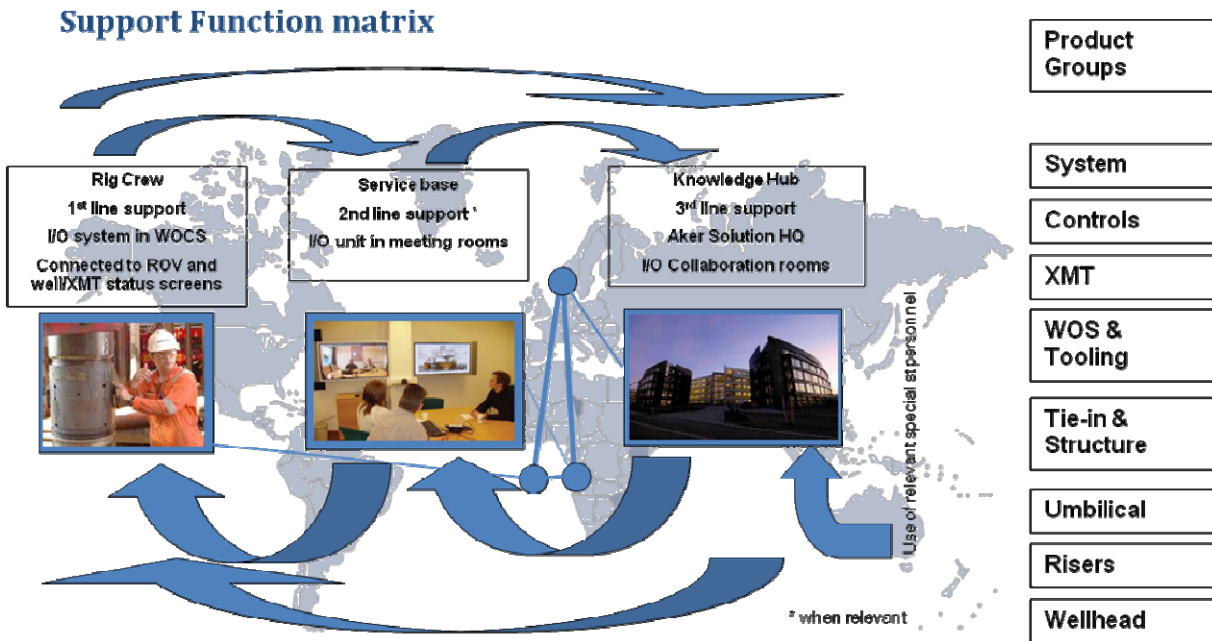
Figure 7: Support function matrix (LT Presentation, 2010)

Service bases are basically autonomous units handling their own projects and fields. Today, there is not much knowledge flow between the bases, except from employees moving around within the organization. LT´s benefit is that the group has updated information on operations on a global level. Experiences can be brought into new projects and other fields.

One of the problems from the service bases point of view is that they have not become accustomed to LT and how they work. There are no specific barriers in the use of LT, but the bases should both have and want a better understanding of where and how they can use this group. There is both a communication line locally on the base that must improve in addition to LT´s prospectus where the bases can see what kind of expertise and applications that are intended for LT. LT`s prospectus will be easier to sell in when they have built up a track record and established a better "foothold" at the individual bases.

It is a criticism of this study that it analyzes an organizational structure that has not quite taken hold and still is a relatively new phenomenon for the organization.

5. Analysis of case study

5.1 Aker Solutions' choice of international strategy

Aker Solutions returned to a regionalized international strategy in 2009, after having followed a global and standardized strategy. This global strategy was drawn up more than 10 years ago. Prior to this strategy, Aker Solutions was regionally oriented (as today), but through a simpler multidomestic strategy.

The main reason for the strategic change is that the global strategy developed into a complex transnational matrix structure. It was quite common for middle managers to have three reporting lines with different roles in each reporting structure. The company experienced an extreme composition of support functions. The argument for this composition was that it enabled the company to handle and coordinate operations in order to ensure both local flexibility and the benefits of standardized global integration and efficiency. The internal bureaucracy increased, too many internal processes developed and the value chain went in circles and loops. The Matrix structure became very difficult to understand and few persons had clear ownership of their role.

This global/transnational strategy became a "matrix monster" which the company could not control. They had to take action and their solution was to return to a strategy with more regionalized focus in order to slim the pyramid and downscale the company by removing unnecessary coordinator functions. Customer relationships significantly improved in a short time after the strategic change, indicating that their revised strategic focus already has produced benefits.

5.1.1 The strategic impact for service bases in SLS

Operational procedures have in the last 10 years changed from a multidomestic geographical focus, to a global focus implementing common standards at all bases. With the new strategy, they now return to a more regionalized focus. Personnel perceive global procedures often as too general, and thereby to difficult to adjust and to follow. Process owners were located centrally, making local adaptation harder.

The understanding of local conditions was often not sufficient centrally. Service bases now observe a positive change in terms of documentation and procedures. Because of existing

global procedures, it is easier to adjust for local conditions than before. The bases have more freedom than before.

Ågotnes has largely been involved in the design of global procedures, since they are a major part of the CoE in operational and service-related work. The procedures are naturally based on customer needs and are adapted to working routines at Ågotnes. Even though more responsibility and ownership is delegated to the various regions, the objective is that the global procedures and working methods still should be followed as far as possible. The improvement is that personnel can handle and adjust more effectively local issues now. Service bases' perception of the strategic change is therefore positive.

Personally, I am skeptical that each local base shall begin managing for themselves, but you have to adapt to customer requirements. The reason for regionalization is that we had one feature that should work worldwide. And you were sitting in Norway and then forgot the rest of the world. Hence, it was the region where the leader was situated which was favored and others were forgotten. It's that simple. If you were going up a level, up and back down to another department located in another country, then it was difficult. It is positive that we have line of responsibility instead of the matrix function (respondent, LT).

Respondents at Ågotnes think that the change happened quite suddenly last year (2009). Support functions previously held globally became local and the base itself had to take responsibility for them. All major procurement processes, IT processes (SAP) and strategic processes were outsourced prior to the strategic change. After the change, the base had to carry out its own purchases, document review and SAP work. India previously handled much of Ågotnes' support.

The base at Ågotnes experience that economies of scale are not exploited as much now as before. Vendors still want to deliver by the global model. The perception at the base in Angola is more positive in relation to more control over own resources and opportunities. An example is the buying of products/tools that are cheaper in Malaysia than Tranby (Norway), or the buying of such products/tools from the external market if necessary. The quote below describes the issue regarding economies of scale vs. more decision-making authority on each service base:

If you speak to Volvo, they will have this volume effect. They have standardization. We are a very project oriented company where every project is affected by what the customer wants.

We have very few standard products so we probably cannot exploit this volume effect fully. What would happen if you try to get this volume effect and you centralize this function at one place? The bureaucracy would increase, priorities might be different and somebody might eventually suffer (respondent, Angola base).

Personnel perceive customer requirements as sufficiently different between service bases and it is difficult to set up a global organizational model. Service bases must have the freedom to make the organization as customer friendly as possible.

Regardless of the organizational model, the different service bases are still interested in sharing of experiences, both within the region and between the regions. Important knowledge must be available to everyone. Such local adaptations that are now possible should not make Aker Subsea less able to share knowledge. It is certainly a challenge not to be too parochial and highly autonomous at the individual base. By supporting different bases worldwide, LT will gain from service bases unique experiences, which can be either spread explicitly or used in other supporting operations more indirectly and tacitly.

5.1.2 Core technology - controlled regionalization for the products

A system in Aker Subsea called "core technology" is developed and is owned by the product groups. The essence of this system is that bases must gain acceptance from the product groups in order to change design on core technology elements of the product.

A challenge from having standardized global products and regionalized operations is that such a situation creates freedom to adjust and adapt the technology, which is often not beneficial. Extensive adjustments and changes to the products are controlled through Centers of Excellence (CoE) authority and the core technology system. The product groups have better control globally and the company retains advantages from the former global strategy. The reasoning is that the company will be global if it runs efficiently.

In the longer run, it may be necessary to provide more authority to SLS for product changes. However, first it is important to create orderliness in the systems and to ensure that they actually have proper "education" about updates and changes so that the true status always is available (the problem about the true status is described in Appendix 1: IT systems and transmission channels.) Once the true status is known, more authority will probably be delegated to service functions. The question will then be whether the authority for minor

changes should be located centrally or opened up for more local ownership at the bases. LT should have a coordinating role and have an overview of the various changes going on.

LT should have enough knowledge to make modifications and take the responsibility because the product groups seem to focus on new projects and are not so concerned with the "old" which are delivered (respondent, LT).

5.1.3 Regionalization of bases and centralization of service support (LT)

LT operates across all regional borders. The strategic change still affects how the group can approach knowledge sharing in terms of how they present best practices and improvements in processes. According to the regional model, LT cannot impose initiatives on bases around the world. Therefore, LT must present best practice examples that are sufficiently appealing to the various service bases. In this way, they will reckon that being a part of this knowledge network is useful. In other words, there is a more global thinking in LT, but a democratic approach to the bases in terms of both implementation and reporting purposes.

LT's mandate is to support the service bases with technical and operational knowledge. Regionalization of the operations at service bases requires more effort from LT. Respondents mean that technical knowledge is not as difficult to disseminate as organizational knowledge is. Technical knowledge more easily filters out local aspects. Support is handled in the same way in India, Malaysia, Angola and Ågotnes. LT members relate to the base in Angola just as much as they do to Ågotnes, although the geographic distance differs. The different bases have different ways of working, related to various customer requirements.

Even in Norway, there were different customer requirements in the past. Now it´s only Statoil, but previously Statoil, Norsk Hydro and Saga had three different requirements (respondent, LT).

5.1.4 Summary on handling the international strategy

Effect on:	What effect:
Aker Subsea	•Scaled-down bureaucracy. •Easier role clarification. •Customer relationship already improved. •The focus is still "thinking globally, acting locally".
Service bases	•More efficient local adaptation. •Better control over resources, greater exposure of opportunities.
Product groups	•CoE authority and Core Technology: Still control over the products. •Hesitant to delegate authority to the service segment regarding change in design.
Lifecycle Technology	•Operates as a global unit/group. •Presentation of best practices even more important. •Technical knowledge easier to transfer than organizational.

Table 1: Summary of Aker Subsea's strategic choice

5.2 Bureaucratic efficiency - preservation of global procedures and processes

Concerning the regionalization of the strategy, SLS is now in a process of looking at the global and regional procedures for operating systems. The purpose is to map what should be mandatory and how much freedom should be left to each region. It will probably be more challenging to get the service bases continuously to follow recommendations made by CoE (SLS/LT and service base at Ågotnes). Although the operations are more regionalized, it is still important to follow global procedures as far as possible. If service bases become increasingly autonomous and self-controlled, they will have less opportunity to take advantage of other's experiences and best practice. Common procedures are therefore a foundation for a successful KG structure.

Global procedures for service (SLS Operation Manual) have been too general and impractical. Less appropriate procedures are not followed up and revised. Under the global strategy, several bases struggled with a lag on many of the global procedures. The advantage of the global standard was that they had an "umbrella" for tasks that should be the same everywhere. SLS has formally moved away from this global thinking but it is important to have a close

dialogue on the handling of procedures and processes because such dialogue gives direction to the bases. Unofficially, this topic was brought up and discussed during Aker Subsea's Management Conference in March 2010. The issue is whether to proceed with global procedures. A proposal for continuation of the global procedures was well received by many bases.

Most operations are the same. They should be the same. And it is very inefficient if we are about to build the same things at ten different places. By having a global process on top that everyone tries to follow, LT will also have a more natural function in recommending best practices to be followed (respondent, LT).

5.2.1 Summary on global procedures

Globale procedures and processes	•Global procedures for service have been too general and impractically developed. •Proposal for continuation of more effective global procedures and execution models is well received by service bases. •Although the operation is regionalized , common procedures need to be the basis for effective knowledge sharing.

Table 2: Summary on global procedures

5.3 Distribution of authority in SLS

5.3.1 LT ' s position in the organization chart

LT's strategy shall be achieved through comprehensive product and project knowledge among the members, relevant training and a network centrality which makes the bases more independent of product groups and reduces response time on requests. LT shall also ensure that experience is shared with product groups and other service bases.

It is a challenge to decide what kind of authority and mandate LT has or should have related to KG. On the organization chart, LT is positioned on the same level as the service bases and has no formal decision-making authority towards the bases. Through the regionalized international strategy, Aker Subsea delegates more authority to the various service bases. LT is thus dependent on strong lateral links, good dialogue and interaction across units. Their role is to gather various experiences in process architecture, and to a lesser extent, to exercise

control over the service bases. The group's lack of formal authority and the fact that product groups are holding on to all decisions on changes in product design, forces LT as a knowledge base to develop persuasive arguments. But is there really a need to control the bases to a larger extent and a need to have a greater decision-making authority on the product side?

The impression from members in LT split concerning the issue of their position on the organization chart. Some respondents agree that it would be easier if LT had more formal authority to overrule the bases if necessary. Now they have to work within the framework set by the bases. Thus, it becomes harder for LT to support the bases in situations where LT observes that the direction is inappropriate. Other respondents believe that more authority for LT could increase the distance between LT and the service bases.

LT being raised "one notch" could have given us more control over how bases operate. On the other hand, such a position could soon have led to more distance from the bases and increased a "HQ-sense". We are nothing but an ordinary service and support function. It is definitely an appropriate location for us given our being in the "Oslo-environment". Not far from Tranby and we have good access to the product groups (respondent, LT).

Most commonly, the knowledge flow consists of suggestions and requests from service bases. These flows are channeled through LT and directed to the management of SLS or product groups. Nor the product groups neither SLS centrally want that the service bases change products and/or procedures unless such changes are brought up with LT and the product groups. It is desirable that changes in product design are handled through LT, not because of the control aspect, but rather because they coordinate better the changes according to what other bases in the world are doing. Today, sufficiently clear guidelines do not exist and service bases only inform LT because doing so is as good practice. To avoid misunderstandings, clear policies are necessary. The company can make such policies without lifting LT on the organization chart.

From the viewpoint of LT employees, the impression is that the bases often wish to manage the tasks themselves and are often reluctant towards LT´s involvement.

You can ask critical questions, but people often go a bit defensive. Often, the issue is that people have done things wrong before which have to be done again, and this is a weak spot seen from a human perspective (respondent, LT).

One reason for skepticism by the bases could be the fear of the unknown. However, once LT overcomes such skepticism, they are likely to create a better tolerance in terms of feedback on how to handle problems.

5.3.2 Clearer roles between service base and LT

The majority of respondents in LT agree that they should have a greater governance authority to ensure that service bases operate according to the best available practice. This authority ensures that customers always receive the best available information and service. Feedback from the service base in Angola is that each service base should have the final word regarding what is best practice, but that they are, of course, open to suggestions. The issue concerns which unit has the final word if there are discrepancies.

At the Kakinada base (India), LT has been involved from the outset in projects for the customer Reliance (Reliance KG-D6 and MA-D6) and has run weekly meetings with engineering personnel from the base and the customer (Reliance). LT has been able to show excellent response on technical challenges along the way through effective lines of communication and clear roles, keeping response time low. Reliance has been very interested in getting quick answers from LT as a central service function in Norway. LT has often been contacted in order to discuss recommendations from the service base and to check that the answers are "aligned".

Cooperation with Reliance and with the base in India has been very positive and useful. The main reasons are that we had regular meetings with active participation from both sides and follow up of actions, resulting in a fast response time (respondent, LT).

One issue that delays the response time, creates confusion and prevents knowledge sharing concerns authority. What is LT supposed to do versus what they can do? LT members have experienced many different ways of operating that they did not agree with, or that they might have corrected. However, the authority to make corrections does not correspond to their position today, and even less after the strategy changed from a global to more regionally focused one. The change in strategy is unfortunate for LT as a central service function because knowledge is not channeled in a satisfactory manner. Thus, chances of repeating the same mistakes on other bases increase.

LT has struggled with its response time towards the base in Angola. Main reasons for this struggling have been confusing lines of responsibility and inadequate lines of communication

between the customer, the service base and LT. There have been misunderstandings regarding expectations about who is supposed to bring technical offers to the customer. However, the general impression from the base in Angola is that they desire for such communication lines to be clarified before a job. In some cases, the customer wants the service base as a single point of contact. In other cases, it will be natural that LT has a direct contact with the customer.

Knowledge flow and assistance are different. LT's contribution to the project in India is likely to be defined as assistance, their role as that of an executor towards the customer. The question is how much knowledge base members in India share during the contributing process. In my view, LT is supposed to have a coordinating role in SLS to ensure the responsibility for the products´ lifecycle. Today, there are ambiguities regarding coordination, procedures and follow-up. LT should express clearer the fact that their role is to facilitate and coordinate knowledge. Such a role could both strengthen base personnel's knowledge and help solve the authority problem.

5.3.3 Separation of power

Since LT was established, there has been some governance-related friction between the group and Ågotnes. SLS centrally and Ågotnes are in positions of CoE authority. Ågotnes firstly perceived LT as a bureaucratic department and an unnecessary feature. The LT group made more sense when it was required that there should be engineering support for service bases with few engineers. Engineering-wise, the employees at Ågotnes think that it is quite clear that they will handle the North Sea while LT should handle engineering support to other fields worldwide.

The product groups should be the coordinating units. Our perception of LT's authority is that it is equal to ours, but outside the Norwegian Continental Shelf; they support service bases by providing engineering assistance to Angola, Nigeria and India. Just as we support our fields like Kristin, Morvin etc. (respondent, Ågotnes base)

Respondents from both LT and the service base at Ågotnes indicated that issues regarding what is "mine" and "yours" have been discussed in numerous meetings. Lately, communication between LT and Ågotnes has significantly improved and cooperation develops in the right direction. LT has contributed personnel to the base and improved interaction between the product groups, in order to enhance co-operation. The base at Ågotnes is the largest

contributor financially to the SLS, has the greatest expertise, and has the largest number of engineers. Such financially advantage do not mean, however, that they continuously operate according to best practice.

As a major part of CoE on operational service, Ågotnes believe that they could manage the responsibility of supporting other bases. LT believes that Ågotnes has more than enough to do in providing support for their own operations and field of responsibility (North Sea). The service bases have to be customer oriented. Customer characteristics differ greatly on a global scale. Therefore, a customer-oriented service base is probably not suited for having a global coordinating function.

Ågotnes directly approach the product groups with requests and do not see the effectiveness of terminating an already established communication line. LT is not established enough to be regarded as a more effective intermediary.

I see that LT would like us to go to them with all our product related questions too, but we feel this is a delaying intermediary. We will go directly to the product groups with our issues, and LT should do the same with their requests. Otherwise, LT can easily become an additional bottleneck (respondent, Ågotnes base).

However, the product group interviewed for this study would like a single contact – and dialogue system to relate to – but since Ågotnes are in a unique position with regard to engineering power and expertise, they would not make themselves dependent on LT.

Among other things, we wanted to have a single contact system into our product group. SLS Ågotnes has so many talented engineers that it was agreed that they could arrange this themselves as a separate autonomous unit, while other bases go through LT with their requests. Then you have two systems that allow different approaches towards the product group (respondent, product group)

The other service bases generally bring their inquiries to LT. In other words, two communication lines and two systems were developed initially: one line and system for Ågotnes and its customers, and one line and system for LT and its customers (the rest of the service bases). These communication lines should be completely aligned, which also is required by the recipient of the requests (product groups). A single system ensures that requests are gathered and systematized, and that several similar incidents can be

simultaneously dealt with effectively. Further cooperation on channeling of requests towards the product groups and on support should therefore be developed through active dialogue.

5.3.4 Summary of authority in SLS

LT`s position the organization chart	•Currently no formal decision -making authority towards service bases. •Shared impression about their position on the organization chart. •LT depends on strong lateral links, good dialogue and interaction across units.
Clearer roles between service bases and LT	•LT wants greater Governance authority to control and ensure that services bases are operating in accordance with best practice. Does not have this authority today. •Issues regarding authority and mandate delay response time, create confusion and hinder knowledge sharing. •Need a better understanding of the intention after handover of a project; who takes over the coordination role in SLS to continue focusing about the responsibility for the lifecycle of products? •LT should focus on improving their role as a facilitator and coordinator for knowledge transfer instead of focusing on their role as an executor.
Power Struggle	•Different approaches to the various bases, in terms of capacity and competence on the individual base. •Instead of focusing on what is "mine" and "yours" the different units should rather exploit LT's potential and what they can actually contribute with. •Further cooperation on channeling of requests towards product groups and support should be developed through active dialogue.

Table 3: Summary of authority in SLS

5.4 Project team organizational structure: SLS/LT involvement in project

This section seeks to evaluate one of LT's success factors: *Commitment and follow up from SLS units – have to ensure proper service order agreement, hand over and start up – are still overall responsible vs. customer through service contract.*

The bulk of activities in Aker Subsea are project related and it is therefore important to have an organizational structure whereby service entities are involved both during the project and after the project is delivered to service bases for further operations. An SLS service manual should therefore have a model regarding service involvement in projects. Involvement under

the previously followed Project Model for Aker Subsea stopped when the project was handed over to the aftermarket/service base and the customer (same time). Therefore, the model did not cover how to install, test and operate.

5.4.1 Project Execution Model (PEM)

Ågotnes has developed a framework for service during a project. This framework is a continuation of Aker Subsea's project model to cover the service life of products. A similar framework applies to recertification projects, which do not have product deliveries but rather maintenance and follow up. This new framework is called Project Execution Model (PEM).

Under such PEM, a SLS Coordinator will be represented throughout the project period and SLS staff will be much more involved than before. Service personnel are present from the beginning of a project to achieve two main objectives: First, to bring SLS experience into as many project phases as possible (Design Reviews, testing etc.). Such personnel may come from service bases or from SLS centrally if certain SLS staff need such experiences. Second, to ensure that base personnel are prepared when they get the product and know how it should be run and installed.

The worst thing a customer can see when he has a rig coming in a week is that the vendor is running around arguing about products and installation until the last minute and "fighting fire" (respondent, LT).

Knowledge and experience regarding service and maintenance will be routed back through two channels: (1) directly to the product groups and (2) through the project. LT is a participating and coordinating group from project start, to ensure that knowledge flows between service base, project management and product groups. LT also holds knowledge and skills that can be brought into the different parts of the project.

Goliat Project (Hammerfest/Barents Sea, Norway) is the pioneer project where a SLS project coordinator has been involved from the start. Members from LT are also integrated in the project and they are intended to participate and follow up throughout the project. LT´s role will be especially important when the project is handed over to the service base. Through this project structure one sees much more clearly the effect of LT and that the group will possess knowledge about the products and practice in the project. The organizational chart below describes the SLS Coordinator's position in the project structure.
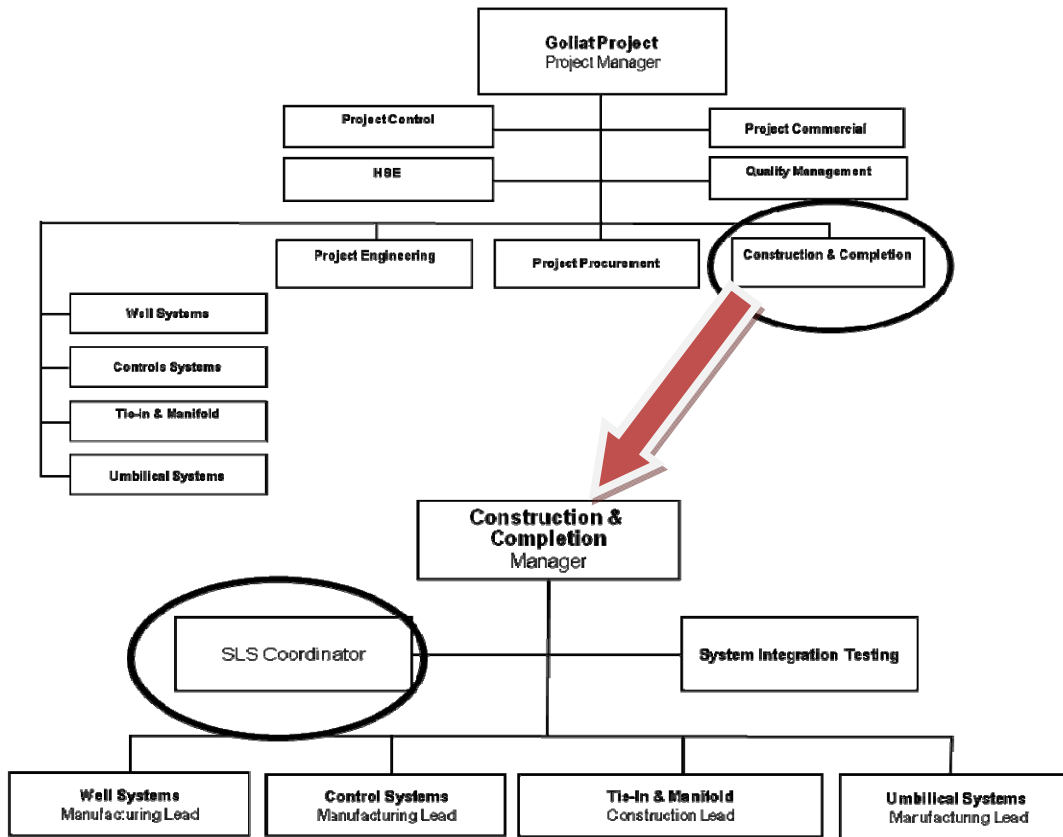
Figure 8: Project structure with SLS coordinator (LT Presentation, 2010)

5.4.2 New project structure - increased knowledge flow and lifecycle mindset

Few people have participated in a complete project cycle. Manager in LT, Per Christian Eriksen, has been involved in a complete project cycle. He participated in the Dalia project (Angola) from its beginning, from building subsea trees at Tranby to the installation in Angola. Eventually, he gained much knowledge about the project and became a kind of "knowledge hub" for those who came later into the project. Mr. Eriksen witnessed the replacement of three project managers. New project managers did not have the unwritten history and therefore they often approached Eriksen on various issues, such as statements from the customer. Some customer personnel were present or involved throughout the project period and even a few years later. In such situations, the customer knew more about different Aker-related issues than the Aker staff did, which led to greater acceptance of what the customer claimed.

Theoretically, there should be a formal handover by the project management when the products are handed over to the base. Until now, the dialogue between the service base and

the project has not been maintained after the products were delivered. The tendency has been that the aftermarket (service base) has been handed over the project. However, project personnel have not had time and capacity to deal with it anymore. Support and sharing of knowledge have ended precisely when the service personnel's needs have begun. Previous handovers also lacked documentation concerning the type of products delivered.

After the Dalia project's handover to the Angola service base, lines of communication between project and service base were almost completely cut. Feedback from personnel who had participated in the project often was that this project was delivered and done for their part (respondent, LT).

This communication and support issue is now to be resolved by having an SLS coordinator in the project. Smooth handovers shall be ensured through SLS actively participating in design reviews and involving service considerations in projects. Participation in testing (System Integration Test) will also ensure that offshore personnel and personnel who will operate the products from the service base have experience on the relevant products. All products are tested together onshore by personnel who later will operate the products offshore. Previously, offshore personnel have been brought into projects for testing just before handover of the project and its products. In some cases, offshore personnel helicoptering to the field were browsing manuals for the first time. Such lax procedures in coordinating common knowledge make it difficult for offshore personnel to receive the necessary knowledge and skills that allow them effectively to perform their duties.

To improve the flow of the products throughout their lifecycle, two approaches are considered. First, we consider the earlier involvement of service personnel in the project. Service personnel should take part in the reviews, experience how the products are developed and bring operational experience into the projects. The second approach is that personnel who developed the products in the project should also take care of post-handover service issues. Thereby, personnel with previous experience in the project will handle such issues. These approaches create consensus about the importance of and about priorities concerning the products throughout their lifecycle.

Aker Subsea has begun to implement additional elements of this mindset in projects. If they succeed, this operating approach will be an incredibly powerful way to give Aker Subsea

employees an "efficiency boost" and to simultaneously increase the customer's level of satisfaction.

This way of coordinating operations requires close follow-up, communication and strong commitment from both product groups and service bases. Long-term thinking is absolutely the ambition, but the main challenge concerns availability of resources. Training and supervision throughout the project is a major economic issue. Both time and finances limit the testing regarding the capacity of test teams. The hope is that the Goliat project structure provides a visible value-added effect internally so it is easier to use the same model/structure on new projects. Then the engineers in SLS will handle the operational issues such as writing installation procedures and testing procedures, while product-group engineers handle production related work like design and documentation. The appropriate integration of expertise from various disciplines will help to define ownership and roles. If they manage having a close dialogue between various disciplines in the project, the vision of "the preferred partner subsea" is strengthened through increased socialization and team task cohesion. The project structure is shown below:
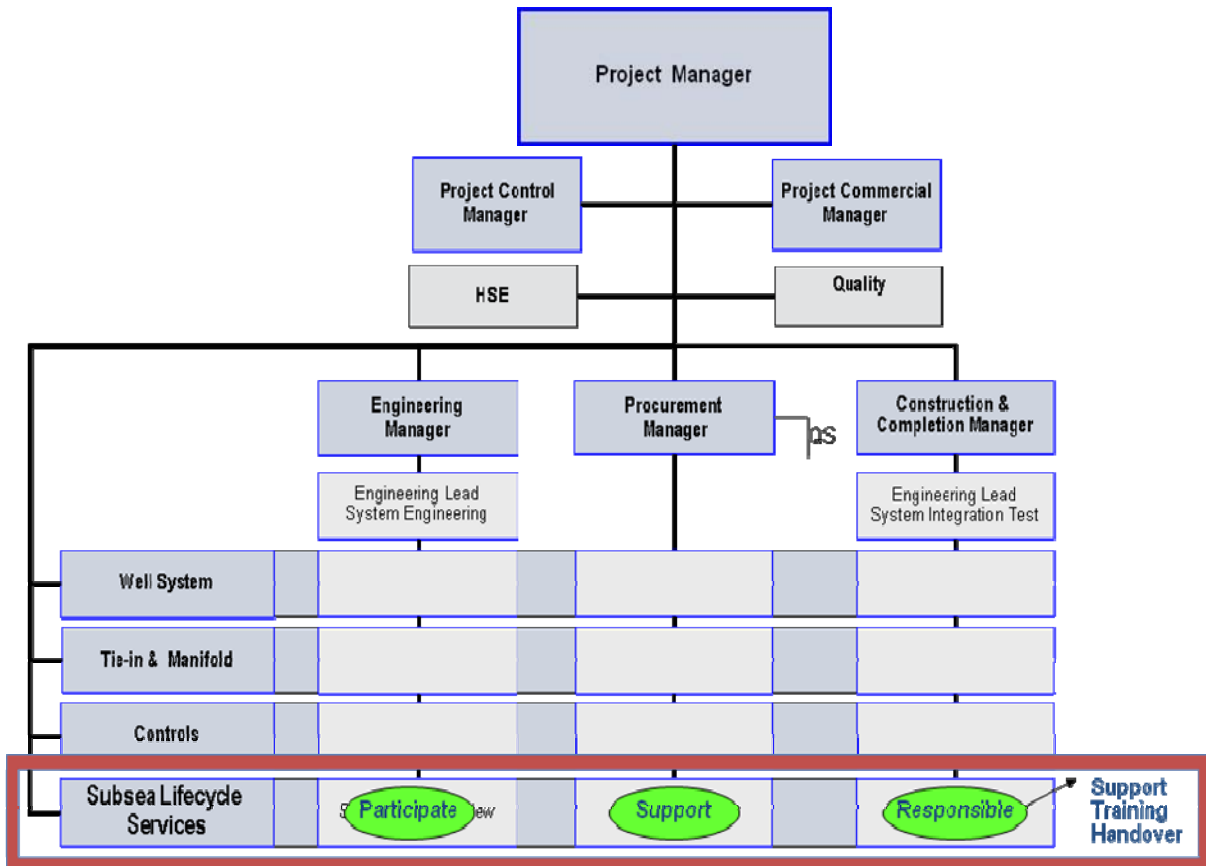

Figure 9: Project structure with SLS integrated (LT Presentation, 2010)

The figure below shows in detail SLS involvement in the various steps of the project.

Figure 10: SLS/LT involvement in project development (LT Presentation, 2010)

These figures illustrate the main point in the new value-chain thinking: "from cradle to grave". The attitude towards Aftermarket (now called SLS) has often been "to get the product out the door from the manufacturing and sent down to the service base so they could take over down there".

The problem with previous handovers is that the products and maintenance procedures have not been in SAP. The latest project was Gimboa, where nothing was available in SAP. Then it had to be installed in SAP. This is very frustrating. There is something called "out of sight out of mind" and no one would take hold of it. The project delivery should have installed it in the first place. It turned out that we had to install it ourselves in Africa. The world goes on, and at the next project it might be better (respondent, LT).

Among other things, on the Gimboa project there was lack of procedures to make demobilization of the products in the workshop for maintenance. The agreement in principle was that this should be done centrally at first, but the work has not been done and followed up even though the job is paid for and should be implemented (respondent, Angola base).

These quotes explain the attitude of the aftermarket, which has been the reality until now.

The wish is therefore that a number of different functions at the service base should be involved earlier into design view/review: to play ball with those who are doing the work on the project side in Norway, to support them and give them our experience from day one. Then we probably avoid much of the "hicks-ups" and the problems we have experienced regarding previous handovers (respondent, Angola base).

Respondents at Ågotnes have pretty much the same opinions as those stated above, and previous handovers have been messy with many missed deliveries.

Projects have often delivered more than they thought they were going to and shut down the project, while SLS has had a different expectation of what is needed from the projects in order to install the products. It has often been the case of test or operational procedures with the products. The project has often seen these as service bases' responsibility, while we have had expectations to get this during the handover. Handling of documentation and responsibility processes have often been inadequate (respondent, Ågotnes base).

According to the theoretical framework on organizational structure, Aker Subsea will, through their new project management, integrate better with the business system/routine operations. Knowledge obtained through the project is stored at SLS/LT as a knowledge base and later used and shared at service bases.

The structure then covers the different layers, as described in the theory of Hypertext organizational structure, and also creates close links between them. However, Aker Subsea is far from implementing this structure efficiently.

Challenges regarding the execution of projects will also be discussed further under the section covering goal congruence.

5.4.3 Summary of project team organizational structure

General findings	•The bulk of the activities of Aker Subsea is project based, therefore, important to have an organizational structure where the service involved to a greater extent. •Previous project manual in Aker Subsea stopped when the project was handed over to the aftermarket/service base and customer.
Project based operation (PEM/SEM)	•SLS Coordinator represented throughout the project period and SLS staff will be much more involved. •Service personnel integrated in the project will transfer knowledge and experience regarding maintenance and services to both project and product groups. •Goliat project is pioneer project for this structure.
New project structure gives more efficient knowledge flow and lifecycle mindset	•Previous handovers lacked documentation concerning the type of equipment that was delivered. •Early involvement of service personnel in the project will provide experience with the product and bring in operational experience. Product support later is better clarified. •Progression: More and more elements of this thinking is implemented. Potential for an incredibly powerful way of working that will give employees of Aker Subsea an efficiency boost, while the customer will find that their vendor operates more complete. •Main challenge for the full implementation is resources and economy. The wish is that the Goliat project provides a visible value creation which makes it is easier to use the same model in new projects.

Table 4: Summary of project team organizational structure

5.5 Preservation and sharing best practice: voluntary or more mandatory
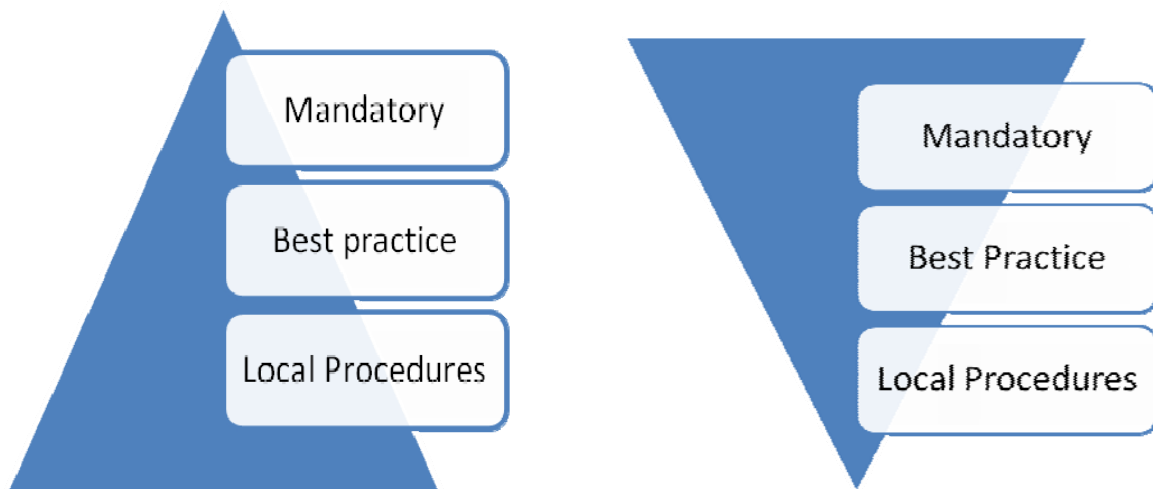
Figure 11: Illustration of handling best practice

The ability to make best practice shareable and enforceable depends largely on the issues described above regarding Aker Subsea's strategic approach and organizational structure. To achieve an effective coordination and facilitation of best practice, the organizational structure must play a key role given that regionalization of bases makes developing global best practices more difficult. Service bases find themselves having different levels of capacity and knowledge and will therefore need a facilitator for practices that have been successful in other locations. LT plays an important coordinating role both in knowledge sharing and in creating a commitment to sharing and introducing of best practice.

The question is how much effort they would put into sharing experiences; will each individual project or service base determine the level of effort?

5.5.1 Sharing of operational experiences

Respondents generally indicated that documentation of operational experience should be mandatory. One challenge is that offshore personnel who often experience important problems and situations leave as soon as they finish their job. There is little time for documentation and consequently important knowledge is lost.

The service base at Ågotnes has decided to include a *seventh* man on the offshore crew who is supposed to be an administrative head. Areas of responsibility will be updating SAP, writing reports and describing experiences. This person will report to the service base. (Only the

project leader reports to the customer.) Knowledge regarding issues and challenges offshore is a type of knowledge that is very important to developing effective service.

This seventh-man position will be challenging to implement in Angola because of limited access to Internet offshore. Moreover, the respondents' impression is that the customer probably would not pay for this service. This initiative allows sharing of experiences more systematically for the offshore personnel. Respondents generally indicated that they do not use enough time on evaluation of experiences.

Especially in what was previously called Aftermarket you often ended up in such unstructured and informal situations. An example is working on a project that runs with good intention. Suddenly another project and new tasks are generated. To go back and clean up old tasks and create lessons learned (which is a very important aspect) have not been handled as it should (respondent, LT).

Consistently following best practices for different tasks will be easier if workshops and lessons-learned meetings are made mandatory and if such regulations are then enforced in project contexts. Thus, lessons learned should have an important role prior to, during and after each project. In the short term, lessons learned may be regarded as resource-intensive but such an effort will maintain oversight and structure for both preservation and use of best practices.

We try to establish best practice and provide lessons learned. This is difficult because much happens along the way and we do not have a uniform and a good structure for the collection of best practice as I see it today. I think LT could be a coordinator for this if they are able to go deep enough in the subject because it is very often on the detailed level that the good lessons learned are located (respondent, Ågotnes base).

Knowledge and relationships you get through workshops or lessons-learned meetings are invaluable. These meetings are also arenas where different disciplines can come together, where knowledge sharing starts out as an informal socialization process and is later more formally documented as best practice.

I don´t think sharing of experience is yet a high priority. We have enough with our daily problems and suddenly a new project arrives and we are not prepared (respondent, Angola base).

Aker Subsea must reserve time and resources for this effort in order to get effective and efficient sharing of experiences that to use in subsequent operations. The general feedback from both service bases and LT is that they do not use lessons learned from previous operations well enough. For example, they document hurriedly with inputs from bases in order to complete the project.

Everything is very urgent and that is right to an extent because it is very expensive having a rig waiting for service personnel. However, one should actually be able to introduce the right things as a practice so they don´t need to go through it again (respondent, LT).

One thing is to deliver the products; another thing is to deliver the documentation. In fact, the latter is the biggest challenge (respondent, Ågotnes base).

LT has a natural coordinating role with respect to members' experience in various operations worldwide. Members from LT who have been involved in various projects are natural representatives at lessons-learned meetings and workshops both to provide technical feedback from similar operations and to preserve experiences for future projects. Central SLS, and preferably LT, should consistently focus on the fact that shared knowledge actually is used. at When projects start up the lifecycle mindset must be established, i.e. each project must be followed up from "cradle to grave".

5.5.2 Summary of preservation and sharing of best practice

General	•Facilitation and dissemination of best practice depend on the development of the international strategy, organizational structure and global procedures. •Service bases on different levels Capacity-wise and knowledge-wise and will therefore need LT as a facilitator of best practice. •A crucial question is who should decide how strict implementation; SLS/LT , Project or service base?
Sharing of operational experiences	•Should be mandatory. •Offshore personnel are not able to provide adequate feedback. •Workshops and lessons learned more mandatory in the project contexts, LT as a participating and coordinating group. •Large potential for improvement. Sharing of experiences should be a priority and resources should be allocated to this. •Lifecycle approach and the whole picture must be established at the start of the project so that each project gets this "cradle to grave" thinking.

Table 5: Summary of best practice handling

5.6 LT's coordinating effect as a Cross-Functional Integration team

The analysis of LT's coordinating effect as a knowledge base is directly connected with the theoretical framework of a Cross-Functional Integration team (CFI team). Each factor will be analyzed separately.

5.6.1 Goal congruence in Aker Subsea

On a superior level, the different units are working towards the same strategic objectives. Nevertheless, the units often have conflicting agendas. One of the differences between the working environments in product groups and service bases is that the product groups (mainly situated in Oslo) are used to longer projects. Service bases are more familiar with ad hoc customer issues almost daily. LT is both aware of and familiar with the service bases' working environment. The main challenge in creating stronger goal congruence is that the service bases are often handling "firefighting" and "quick fixes" instead of striving for a more holistic overview. Their operations could contain useful knowledge for others in SLS or Aker Subsea as a whole. There is more operational culture in the service bases, while there is more

project culture in the product groups and HQ. These mindsets creates some environmental differences.

There are cultural differences in the sense that Ågotnes repairs while Oslo builds (respondent, LT)

It challenges a service base to be involved and committed to operations and projects beyond their fields. Each base has daily challenges that are customer specific, but the bases should also see the value of their individual achievement as a positive impact on the collective in SLS. This concept is challenging for LT's part to marketing towards the service bases. If SLS as a whole manages to achieve such a common mindset, the opportunity for sharing experiences between service bases and LT will strengthen. Will to develop common goals often fails because of time and costs. The trend is that blinders cause an individual focus on each project. Regionalizing the strategy actually reinforces this view as it focuses increasingly on the governance of individual projects and less on responsibility beyond their own region.

Until now, the responsibility to the supply chain has been more or less static. Project personnel are thinking of the project period and not adequately ensuring that the service bases should succeed in the handover and the continuation of the products and installations. The product groups have also been autonomous in relation to other product groups and "mentally finished" with their responsibility process when the product was delivered to the customer and service base.

It´s clear that when we have delivered the product, the mindset is to a certain extent that we are done with it. This is what we want to steer away from (respondent, product group).

Goal congruence needs to develop around creation of commitment and work towards the total bottom line. In the short term, perhaps changes and restructuring that lead towards common improvements are more costly for some individual units. This friction on how to allocate time, effort and attention should be resolved by finding common improvements that will not only provide economic benefits but also improve communication and goal congruence for Aker Subsea as an organization.

LT is measured not only on financial numbers but also on interaction with bases and on successful missions. It is definitely inspiring to have such a group within the organization, a group allowed to experiment with new patterns of knowledge flow.

Many organizations need a major corporate cultural shift to change the employees' attitude towards sharing of knowledge. The establishment of LT is probably not effective enough to create commitment, to form a common platform in the entire organization. Respondents believe that the top management, established in 2008, has focused on how the various units should think strategically about common goals and about how to implement such thinking.

In SLS there is an ongoing learning process regarding how individual contribution could benefit other units around the world. Service bases have not focused enough on this before. This continuous learning process forces the service bases to focus on more than just the bases' needs and practices. Common understanding and interests will also be crucial for developing best practice and the lifecycle approach.

Mini-Case: Cultural differences and corporate culture at the service base in Angola
The freedom resulting from Aker Subsea's strategic change has given greater responsibility to the service bases. They control more than before concerning how they follow global procedures and processes. It is crucial that they have access to other bases' experiences and knowledge. The corporate culture is a key contributor in developing common goals and interests for knowledge sharing. Corporate culture is for some, however, a sensitive issue. I got the impression from several of the interviews that the corporate culture in Aker Subsea should be reinforced at bases abroad, and in my case in Angola. The base in Angola has many nationalities working together. Different nationalities have different approaches to the work. However, feedback indicates that having numerous nationalities working together does not pose any cultural challenges at the service base in Angola.

Some of the local Angolans have attended a half-year training camp in Norway. Their learning about the Norwegian community in such a short time is insufficient to create a common identity and interests in business life. Therefore, the learning process must be continuous.

You don´t become Norwegian overnight. It´s a long way before you start thinking like Scandinavians (respondent, LT).

Significant effort has already been made to close the gap between national culture and corporate culture at the service base in Angola.

The first question that needs to be answered is: Are they [Angolans] ready to be changed? Are they ready to be reformed? It is a balancing act to keep our company values alive and also get the best out of our workers (respondent, Angola base).

People connected to Aker Subsea in Norway/Europe often struggle to understand the challenges of operating a service base in Angola compared with operating one in Norway. Those who experience this either by working at the Angolan base or being connected with it in another way, realize how challenging it is to work in Angola compared with working in Norway in terms of infrastructure, local conditions and culture.

When we are in a meeting with personnel from Norway, they are on a completely different level than us. And that is true. We are struggling with the cultural differences and challenges every day and to make things go smoothly, while in Norway this is not a very big challenge and you can more easily step into the details and go deeper into the technical aspects (respondent, Angola base).

Both project management and LT must have understanding of different approaches to tasks in other countries. In that way, service bases in other countries will appreciate more their support. In a MNC like Aker Subsea, managers must exploit the opportunities in the diversified cultures.

There is no"one size fits all", always unity and diversity. You have to keep the company culture alive and you need to make sure that you get the best out of the diversity you are faced with. If you try to change them, you will probably meet so much resistance that you will make them counterproductive (respondent, Angola base).

At the base in Angola, 80% of the 200 employees are local Angolans. Many workers have family (cousins, uncles, etc.) also employed at the base. Regardless of such family relationships, it is important that all employees have a good understanding of work expectations. Respondents to this study also mention language as a barrier, especially in interaction with the local Angolans.

A vague company culture would be a barrier to knowledge sharing because it develops large differences between the individual service bases and the support function.

Proposed initiative: Collaboration through a Project between SLS/LT and HR

Most of the respondents cited that Aker does not take sufficient responsibility for training employees in cultural matters and in language before sending them abroad as expatriates. Knowledge sharing and creation is harder to achieve if such relational factors are not taken into account. One suggestion is that LT, in collaboration with the HR department, take the initiative to establish a cultural project for Aker Subsea with the purpose of educating future expatriates and foreign locals about commitment to and knowledge about the company culture, and about community of practice and language. Such a project could achieve relational effects like broader understanding and exploitation of a diversified variety that exists in this company.

5.6.2 Interpersonal cohesion and task cohesion in LT

These factors deal with LT´s success factors regarding Communication: *(1) Easy & clear process for ordering of work/getting support and (2) Clearly defined roles and responsibilities.*

Interpersonal cohesion limited by transfer pricing of LT support?

LT transfer prices their support towards the service bases. The transfer pricing system do not affect he product groups in their interaction with LT. They nevertheless set aside resources and labor to the group. LT, however, decreases the product groups' costs in terms of systematizing and coordinating inquiries. So far, LT has done a lot of work that has been overhead on the team's budget. An example of such work is upfront support, like presentations and public meetings.

LT has sufficient knowledge and access to resources, which makes them the preferred service support source and far more effective than cheaper labor. Compared to external engineering services sold in Norway, LT's services are certainly competitive on price. Anyway, the indicated use of LT causes financial strains for the service bases. The expectation of high quality is therefore great. The service bases are more excited about the result LT members are able to generate. A relevant question is whether such pricing of services may cause a reluctance to communicate openly and to share knowledge. It is difficult to define the transfer pricing as any barrier in this context, but respondents from service bases have reacted to this.

Hopefully, the company will budget central knowledge support in each future project avoiding large overhead costs at the service bases. This solution will eliminate financial friction between service bases and LT.

Types of tasks

Members in LT experience products and projects at various places in the world. Eventually, they will be able to see common features and common problems in the various fields. It is important for LT as a group clearly to signal/indicate what their members are intended to do according to their expertise. Until now, LT has largely taken care of all emerging requests as an attempt to promote them and to create goodwill and acceptance among the service bases. Their capacity has in certain times been fully booked. Respondents from LT explain that they are more selective now. Basic tasks dealing with daily operations are not tasks that LT envisages to support in the future. If inquiries regarding common operational tasks continue, service bases must consider hiring more staff at the bases.

LT has continuously supported Ågotnes service base with 3–4 resources over the past year. LT shall be a buffer for competence and capacity. If the base at Ågotnes has a persistently great need of resources, it is important that they recruit to meet this need as long as the expertise exists. In the longer term, LT must be able to handle more projects abroad. We were able to support Ågotnes so much the first time largely due to the relatively low activity globally (respondent, LT).

LT acts as a reactive group and is hesitant to become involved at service bases. A local viewpoint of the Angolan base is that understanding and goodwill from LT is needed to achieve effective support. The service base would like to develop a common agenda with LT based on cooperation, advices and inputs.

5.6.3 Competence and capacity in LT

One of LT's success factors is whether they possess demanded skills and capacity: *LT commitment – Services are performed, handled and solved in a professional way – capacity & competence.*

Generally, most LT respondents state that their group should possess a comprehensive competence. The aim is to train the members so the whole group appears more versatile than today. LT must show that they can handle most operational and technical inquiries, which previously have gone directly to the product groups.

Generally, LT members feel that they partially fulfill competence requirements. LT must acquire a higher level of competence to act as a knowledge base, and training has to increase. This issue also concerns the above discussion regarding LT's routine tasks handled at each service base. The aim is to increase LT's level of competence through: working with product groups on missions, (internal) training by the product groups, having members involved in testing of products and increasing offshore training.

The knowledge and experience is also centralized within LT (respondent, Angola base).

The service base at Ågotnes thinks that knowledge from LT is often good design knowledge and practical "how it should be" knowledge, whereas what they often need is "how it works in practice" knowledge. The service bases are constantly in dialogue with the customer. The customer may have different requirements and expectations than those planned for in Aker Subsea.

A CFI team seek to integrate experience from different disciplines and they must form a common ground to initiate social and cognitive processes in the team. When this common platform is established, different approaches to the problem may be useful to reach an effective solution. Members from LT bring one type of knowledge and extract a different type. Common knowledge and understanding are created of both design and practice. This is also what Grant (1996) means in his theoretical statement: *common knowledge allows individuals to share and integrate aspects of knowledge that is not shared between them.*

Feedback from the product group indicates that there is still a way to go concerning role clarification and concerning who intends to have most competence and capacity. Such clarification will affect the long-term strategy. The product groups would like to have the

product liability and to create strategies for the products in the long term. The aim should be to find out how the strategy elements of the service bases. SLS/LT and the product groups could be handled together to emphasize the relationship in their strategies.

Ideally, the product groups make products suitable to the market, but suddenly the technology turns and they are stuck with products that are unsuitable for launch. The product group must be more involved than they have been in order to capture these elements in long-term strategic thinking. This is also the issue for the service units. It is important to create forums and good processes; this actually means that the strategy will be strong for the company. The impression is that there is a different approach to strategy that causes challenges in some places (respondent, product group).

They (LT) ask relevant questions, go out and fix the problem. They have more frequent contact and easier entry at the bases (respondent, product group).

5.6.4 Importance of LT's network centrality

The SLS organization is not too large to form informal networks. LT's main contacts with the bases are dependent on a concentrated sample of contact persons. LT members create informal networks when they are supporting the bases.

Informal networks are the best networks you have. Personnel who begin directly in Aker on bases have naturally not built up networks and will not have the same opportunity when they haven´t worked in the "basis". For us who have been in the business for some years, we have the network intact. On this basis, we have two categories of employees: those with Aker history and others (respondent, LT).

Members in LT have strong positions in various networks and they can access, participate and control information flow. Their superior position in the network means they will have contact with many people within their subject field(s) internally in the organization and possibly with customers and suppliers. Information together with the member's existing knowledge and commitment is valuable tacit knowledge (know-how) and members should share this internally and between service bases.

We are expected to deliver the extra mile; to go the extra mile you must have a personal touch, you must have the human factor and the network (respondent, Angola base).

There is no explicit mapping or sharing of networks between LT members. Sharing is rather effected more indirectly by identifying who they think can be an "icebreaker". A better mapping of such icebreaker positions in product groups and other functions would be an improvement for LT. Rating systems of competence would often be too casual but rather a "worth knowing" tool where contact persons are identified and their relevance to various issues.

The company must preserve knowledge internally and this is certainly a big challenge. The informal network is only in addition to the formal structure. The formal structure takes care of the fact that people have different tasks at different times and the awareness that a lot can happen during a project or operation. Responsibilities and roles may change. The lack of dialogue between service bases makes LT and the members' central location even more important.

Feedback from the product group interviewed for this study indicates that Aker Subsea is currently establishing a global technology network. The purpose of establishing such a professional network is to take care of disciplines traditionally uncovered by the product groups. LT has a natural role in such a network as a contributor to effective communication and dialogue between the units. Such a "semi-formal" network is likely to make stronger relationships between the service bases as well.

To rely simply on the system's safeguarding all aspects without networking is something I don´t believe in. We have clearer roles and ownership; now there is an issue of fine-tuning so that everyone is aware of what the various roles possess. There is some "path-treading" to be done, but clear roles and ownership in addition to a good informal network on top of this is a good approach (respondent, product group).

Respondents from the product group believe that it is very advantageous that LT has good access to them and that many members of LT have knowledge or experience from various fields/product groups.

5.6.5 Potential for transformational leadership in LT

LT wants to raise members' competence and skills to a level that they easily could step in as task force leaders on demand. The management in LT should develop members' technical knowledge in addition to developing the aspects that deal with customer handling,

presentation and instruction. So far, the head of the team and managers have handled these leadership tasks. To some extent it can be justified as sensible use of time and resources, but these leadership tasks eats up time that could have been used to solve technical problems. The LT management should still focus on developing LT as a knowledge group and on the strategic work related to this. And not focus on being a participating actor in operational tasks. The management should strive for better overview, predictability and longer-term focus than other group members have. A team leader who has overview of developing new products and/or service procedures will be able to steer towards a more effective integration of various functions, maintain dialogue with various projects, foster collaborative projects between service bases and product groups, monitor and control the information flow in and out of LT and negotiate with heads of bases and products. Such a leadership style will probably enhance team members' commitment to their duties.

LT depend on their reputation as technology experts. If the group is able to demonstrate that, they have a value-added effect, other members will accord them an informal balance of power over time.

In our system, the persons who manage to accomplish something and solve problems always possess freedom of movement (respondent, LT).

The administration of activities for LT members is a challenging process due to fluctuating contract periods, normally ranging from three weeks to six months. Being detached from the operational tasks will provide the management greater opportunities to initiate clear goals and expectations through a closer monitoring and inspirational motivation. Increased supervision by the management will probably influence the effectiveness of members' learning. Members' ownership and sense of responsibility will increase if members are given tasks that involve leadership of task forces and handling challenging situations towards the customer.

Managers possess the effectiveness possessed by the unit they lead (respondent, LT).

5.6.6 Proposed initiatives
Three initiatives are proposed to improve informal networking, coordinate knowledge flow more effectively and stimulate sharing of knowledge in the company.

Improved networking and strengthening of competence - mentor program

A mentor program is not highly developed in Aker Subsea. Today, a mentor program covers only the management level.

In the initial phase for new employees, there is a "buddy system". It is possible to develop this system further. The idea is to connect less experienced staff with knowledgeable and experienced people. Such relationships strengthen the network position of the less experienced and create mutual understanding and communication among different functions and areas. Experienced people can convert their tacit knowledge to collective knowledge through discussion in the mentor program. Such mentor programs could work both locally and globally.

It's like football with the kids. It is not that there are some good and some bad players, but it is a lack in belief. Those people who are very skilled are of course good technically, but they also have faith in what they do (respondent, LT).

LT has started to focus on some of the elements covered by a mentor program. Experienced members have responsibility internally towards the more inexperienced. Such a connection between individuals with the purpose of sharing experiences and knowledge is in principle how a mentor program works. Regardless of what LT has started, a mentor program in Aker Subsea could be formalized and prepared at a interdisciplinary level. A clarification of objectives for such a mentor program could more effectively stimulate sharing of knowledge.

Competence and network building - engineering exchange

This initiative looks at a rotation model regarding exchange of engineers between service bases, product groups and LT. Such a rotation model would elaborate interaction, increased coordination and common understanding of efficient and effective knowledge sharing. Connected to the theoretical framework of CFI team, it is possible that employees who have experience from a central support function will serve as knowledge brokers and motivators to bring back knowledge that can be shared.

Until now, rotation of personnel has been random and demand-oriented in the short term. Since there are often relatively short and unpredictable rotation periods, exchange of competence does not provide certain competence gains. Firstly, a short exchange period would probably result in much haste and little time to adapt, evaluate and share knowledge.

Secondly, unsystematic rotation will be unmotivated in the long term. A systematic and controlled rotation system will more quickly produce diverse expertise.

By the organizational change and the creation of LT in June 2009, the group was assigned people from various product groups. The composition, therefore, covers the various disciplines. Some of the members have experience overseas and offshore experience. But those members who have no offshore experience should get that experience. Previously, there was such a rotation system among engineers. They had 6–7 months offshore after they had been at Tranby (manufacturing) a year; then they were placed into the system in which they were intended to work. This rotation system should probably continue, especially concerning offshore experience. The feedback is that it is the restructuring in the company that has weakened the continuity of this rotation system (respondent, LT).

This initiative is a far more expensive and challenging coordination initiative than a mentor program is. However, such involvement in various fields will have good effects, in terms of both sharing knowledge and creating a common understanding of the entire value chain.

The service base at Ågotnes has already started a process, together with product groups, regarding how they can handle such an exchange program. The service base feels that such an exchange program should have been a global HR function. The initiative from the base at Ågotnes is based on contacts in their own network and on a random dialogue with projects to get permission to provide engineers for training and learning. Such exchange programs are not unique, and many companies have similar arrangements (e.g. FMC and Statoil). Today, such a program does not exist but is demanded by both LT and service bases.

Strengthened commitment to sharing of knowledge - symbolic bonus scheme
Today, there is no performance-based remuneration in Aker Subsea below the third level in the organization chart. The closest Aker Subsea gets to a bonus system is an expatriate agreement whereby employees get compensation for completing a contract abroad. A decade ago, bonuses were much more widespread in the company. Eventually, the bonus became an expected part of the employees' salary. One reason may be that the bonus was probably based on the wrong performance indicators. The impression is that a new comprehensive bonus system would not be practicable or defensible on a cost basis. According to respondents, bonuses can be less comprehensive. Many possibilities exist to create bonuses as incentives for increased sharing and dissemination of knowledge. One

example is to create smaller rewards that motivate and revive the sharing process. Smaller rewards and recognitions could increase reporting improvement proposals and suggestions for best practice. Such a reward system is supported both by members in LT and by service bases. A symbolic reward will probably create more unity than discord.

5.6.7 Summary of LT as a coordinating CFI team

LT´s coordinating effect as a CFI team	
Common interests in Aker Subsea	•Difficult to achieve, the goal is that each unit sees that individual achievement can have a positive impact on the collective in SLS. •The friction on how to allocate time, effort and attention should be resolved by focusing on common improvements that affect the total. •The establishment of a CFI team as LT is probably not enough effective to create commitment to form common interests in the entire organization. •Needs a corporate cultural shift to change the employees' attitude towards knowledge sharing. •Mini-Case about cultural differences and corporate culture at the service base in Angola.
Team Cohesion in SLS	•Development of counterproductive Interpersonal cohesion are slowed down with transfer pricing of LTs support. Not any barrier for use and probably an effective precaution for productive support. •Task cohesion and the development of LT members' competence depend on their involvement at bases and the type of work. •LTs roles and the mapping of expertise is a suggestion for improvement.
Functional Expertise and Common Knowledge, LT	•Composite experience and covering all product areas. •Should possess a broad expertise. Today: some possess expertise in certain subject areas, a few versatile. •Good design knowledge and practical "how it should be" knowledge, the base often needs "how does it work in practice" knowledge. Must provide a better understanding of each other. •Still a new team and lacks some experience with the individual bases
Network Centrality, LT	•Important with relationships and personal awareness in a large organization such as Aker Solutions and Aker Subsea •LTs superb positions for quick access to information and knowledge. This must be exploited. •No explicit effort on sharing or mapping others' network, possible improvement: Overview of "Icebreakers" •Informal network are only in addition to the formal structure
Transformational Leadership, LT	•The management too much involved in the operational work. Should focus more on dialogue with other units, long-term strategic work and facilitating for their own team members. •Strong correlation between transformational leadership and development of members' expertise and that they are comfortable with bigger Task Forces.
Proposed initiatives	•Mentor program •Exchange of Engineers •Symbolic Bonus Scheme

Table 6: Summary of LT as a coordinating team

6. Conclusion

This study has analyzed knowledge governance (KG) in Aker Subsea. The analysis focuses on how the company is approaching a change in international strategy from one of being a global transnational actor, to one of having a regionalized focus with Lifecycle Technology (LT) as a central coordinating function for service support. The study suggests that the different units in Aker Subsea are becoming more consistent. However, there is still a way to go to merge the various units' strategic objectives.

Aker Subsea is establishing a governance structure that could be very effective if they manage to implement and incorporate it effectively. We observe already positive trends in their project structure. Clearly, in project handling they are involving and aligning product development and service to a greater extent than before. Additionally, LT as a central cross-functional service team would be able to coordinate and follow up service involvement in various projects.

On the operational side in SLS, there is a challenge regarding how to distribute authority between service bases and LT. The objective should be a structure whereby service bases have freedom to execute their operations in relation to customer requirements. SLS/LT centrally should concentrate more on facilitating, coordinating and ensuring that knowledge flows both vertically (product group-LT-service base) and horizontally (service base-LT-service base). This knowledge flow deals with preserving and diffusing best practice as well as tailoring procedures and processes towards the various service bases.

LT's coordinating and interacting effect as a cross-functional integration team (CFI team) has been analyzed with respect to both inter-team factors (goal congruence and team cohesion) and intra-team factors (common knowledge, functional expertise and network centrality). These factor-based assumptions were largely taken into account when establishing LT, but are still not fully developed. LT's expertise must over time evolve them to emerge as highly value-added for the service bases. LT must increasingly exploit this value-adding position between the product groups and service bases to increase coordination. LT's ambition is to be a knowledge base through sharing relevant knowledge and experience. Product groups and LT will develop and disseminate globally applicable solutions, while the service bases deal with local adaptations.

Considering network centrality, LT's location is strategically good in terms of close interaction with product groups. There is still potential for increased understanding of the use of LT and interaction with service bases through better networking. Such an understanding is also a factor that will develop when Aker Subsea SLS implements the PEM/SEM model for project involvement.

It is clear that Aker Subsea's choice of an international strategy affects how the organizational structure is adapted for efficient approach to KG. This KG deals with both the knowledge flow between the units and the coordination properties of a CFI team such as LT. Today, the respondents in this study do not think there are enough resources and setup to implement all aspects of the new project structure.

Aker Subsea should continue implementing aspects of effective KG in other projects. The aim and ambition is in place. Their planned organizational structure could be an incredibly powerful way of working, simultaneously having effect both internally and towards the customer.

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Appendix 1: Description of IT systems and transmission channels in Aker Subsea

In order to develop effective processes and organizational structure an important key word is **TRUE STATUS**; the products are updated, maintained and followed up. The aim for this study is not to analyze the IT systems in detail but it is useful to give a description of the systems available today for KG purposes. The analysis also refers to SAP in different contexts. This section is even though not that relevant for my case study and therefore enclosed in Appendix.

SAP

The IT system used in Aker is SAP. SAP is described often as the heart of the operation. Documentation, product descriptions, procedures, certificates, and different calculation are available in SAP. Changes and upgrades on the products are fed into the system by onshore personnel. Needs for the system are directed to IT manager for Aker Subsea and the inquiry will eventually be lifted up into Aker Business Services which is the IT department in Aker Solutions. This is the way to go if you want changes and upgrades on the system.

My impression is that we don´t have any impact on SAP (respondent, LT).

After the system was rolled out (not before) SLS has played a larger role regarding issues during the development of "SAP Next Level". SLS has represented needs from service bases but have not had enough power. In addition, there have also been challenges around different needs within SLS. The base at Ågotnes would openly like a system that is more functional for their use. They have specific wishes especially in engineering. Other bases have different wishes.

The needs are often more or less the same at bases but often there are different SAP setups and use for it. There has not been enough coordination. We (LT) have no defined area of responsibilities and therefore dependent on that people sees the effect of us being involved. This is not a successful structure (respondent, LT).

This random involvement is not a successful structure and there is clearly necessitate centralizing and collecting information about the needs to create a common system that possesses the widest choice from all bases. SLS is one of the units that use SAP most as end-

users. The projects use SAP for purchasing but SLS is completely dependent on life cycle information in SAP and its true status. Contemporary information in SAP is essential for service personnel who use SAP for many years after the project is completed. LT holds an important coordinating role, and as a driving force to promote and collect needs of the system.

The whole point with SAP is to find the way out of the woods eventually and also find out which way you went out of the woods. Today this is pretty much impossible. A lot of people are "buzzing" around in the woods doing something. Lost in SAP ... (respondent, LT).

There is also developed a system in SAP which is used to find information about errors and deficiencies of various types of products. This system is called NCR (Non Conformancy Reporting System). This system is relatively new and was fully started at Ågotnes in June/July 2009. A learning process is going on where one gets training on how to enter good NCR´s. The desire is to get the operators at the bases also to report improvements. Today this system only reports errors and defects.

One major challenge is that there often are made changes to the product which is not fully updated in SAP. This information should have been available immediately. People´s carelessness with updating makes true status not available and much extra work for those who solve problems offshore. This friction explains the challenge on responsibility and loyalty to the entire lifecycle.

The barrier is that the operating personnel at the base are using the system too little. They have been trained on the system but many of these people have worked for many years and based on experience, they have climbed the hierarchical ladder. Many people have resistance to IT and further development in this area is a challenge. There is also little demand for the use and therefore many do not use this (respondent, LT).

It has to be ensured that both experienced and inexperienced engineers are pulling in the same direction towards an IT system that provides information flow and efficient use. This is achieved by setting the requirement that the system is used correctly and additional training and follow-up on IT skills.

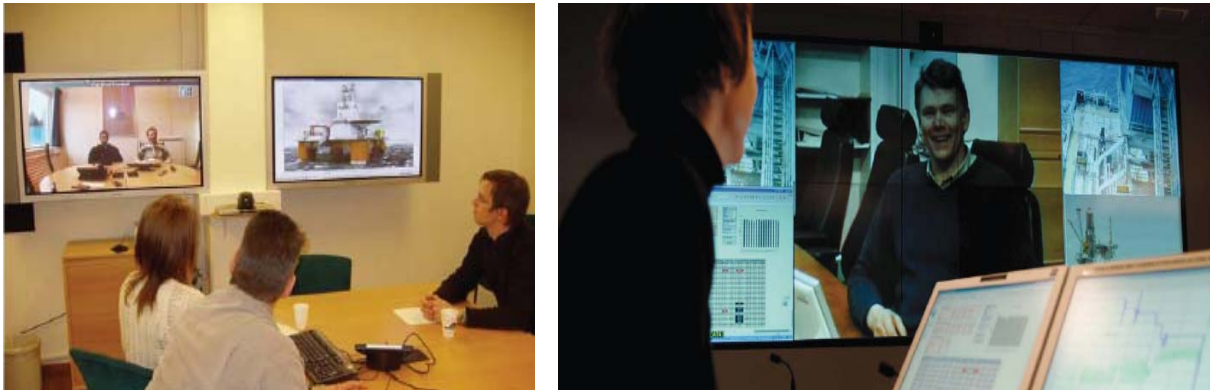## Integrated Operation: communication between offshore and onshore

Figure 12: Illustrating pictures of Integrated Operation (LT Presentation, 2010)

Integrated Operation (IO) is the concept of communication between offshore and onshore (base and HQ). This is a communication line that SLS has largely influence over but is still lacking structure and technology. Today's communication between onshore and offshore is basically handled by phone and e-mail. Knowledge from individual tasks offshore is not appropriately shared and experiences are often not returned to shore. Experiences logged offshore are not utilized enough and returned to base and LT. Operations move on with no reason for improvements and best practice. LT is first informed when an error or a problem occurs.

At the base in Angola the communication providing offshore personnel access to operating system is not developed. Based on the infrastructure communication is handled by e-mail or telephone. This is a major constraint in how they communicate, report and handle updates on products. The same challenges have been experienced between onshore and offshore at Ågotnes. Now, however, they are moving in the direction that SAP will be used more offshore too. They have also invested in products for a more efficient integrated operation system. Through live transmissions using videoconferencing products on large screens they are able to have standard meetings with offshore personnel where engineers and project managers can run morning meetings regarding daily operational processes, go through critical points and procedures. Such an IO system will reduce operational costs and also result in a better flow of information and knowledge in both directions; Offshore and Onshore. This effort started in 2010 at Ågotnes.

MySubsea

This IT system is a portal which is provided to customers and external companies. External parties can buy a license to get access to a limited part of Aker Subsea´s SAP (their project area). Here you will find various documentation, product descriptions and certification. There is still a way to go to get rolled out MySubsea and preliminary it is only used in the UK for Controls projects. But this tool will be appreciated by the customer and possibly create better dialogue between external parts and Aker Subsea.

First interactive

First Interactive is a simulation system that runs simulation and training of offshore personnel on control systems offshore. The ambition is to take this IT tool one step further so that it is linked to operations offshore live. When products are running out and being installed onshore personnel can monitor the simulation.

Database for sharing operational experience

Various projects have previously developed common experience databases, but such databases have not been followed up after project termination. Today no experience databases are continuously operational. Many different systems for sharing of experiences have been tried out, but have not turned out successfully. People have not known where to enter or what to write. This has led to what is described in the theory as "garbage in, garbage out" and reported experience has not been used by others for similar tasks. Different questionnaires have been developed in project contexts without success. There has been a mismatch in the extent of required experience in relation to what has been experienced in operations. Feedback from service bases, however, is that there certainly is a need for a common database where they can retrieve information and knowledge.

As described in the section on SAP a NCR system in SAP is developed for deviation control where you can find the history of products and tooling used in different operations. Any errors and defects detected are registered here. But this system does not take care of operational history and suggestions for improvements. Operational knowledge is demanding and should definitely be preserved and shared to promote development that creates competitive advantage.

By the end of 2009 a database called *Lesson learned* was launched. The database is accessible via the intranet, covering (unlike previous databases) operational history from both projects and service. One of the biggest challenges for this being a success is turning people's impression of such databases and actually start using them. To achieve this, the system must be structured, searchable and usable. The problem is not lack of access to information but the quality on the information.

It is too early to give any adequate analysis of whether this database will be any success. The reason is that the database is brand new as well as the intended structure around workshops and lessons learned meetings. The database relay on having such structures and forums where experiences are discussed and put into a bigger picture. This database is not currently very "heavy" marketed. The plan is to slowly begin using it now before it is launched properly.

The optimal IT model

Figure 13: The optimal IT model

The optimal IT model is not yet properly installed in Aker Subsea and there are many challenges related to communication between offshore and onshore. In addition, there are also challenges of having available true status on documentation in SAP, which results in a lot of

extra work for the individual service worker, regardless of whether you work in Angola, Ågotnes or LT. A system that integrates offshore and onshore service base and central support is a critical need for SLS in their development towards better knowledge sharing and preservation.

An ambition for the future is that operations are transferred virtually with a close dialogue between first to third line of support (as illustrated in figure 7). The technology exists to a large extent today. But it is not easy to get SAP to talk the same language as the other communication tools. This link is critical to have access to all documentation on products used. The idea is that you can go through MySubsea (external and customers) or First Interactive to get access to when and where the products is manufactured, repaired, used offshore, etc. Much the same model as in the automotive industry and which should be implemented in a high-tech organization as Aker Subsea. The customer also demand this true status on products used on the rig. In addition, a system for effective knowledge sharing of operational experience is established.

Other transmission channels

Most of the respondents in this study believe that it is best to meet each other face to face and build relations. Socialization gives a better perception on whether the recipient understands what you say. Because of the distances between service bases and LT it is difficult with such face to face meetings very often. The respondents' point of views is to prioritize face-to-face meetings when having workshops or at project start. Then it will be easier to continue with video conferencing and telephone meetings because you have got a good impression of who you are working with and a better understanding of each other. Videoconference is a channel that SLS uses to a large extent and are willing to use even more in the future. So far it has worked poorly with Angola due to technical problems and delays on the line. Towards Ågotnes there is only positive feedback in connection with the use of videoconference.

There is a mixed response regarding the respondent´s impression of using e-mail for sharing knowledge. Some believe that this is a powerful medium where you can share documents and other technical details. The disadvantage of e-mail is that text can be interpreted from its original context because of reading only what is related to yourself or your group.

Through the intranet you can find procedures and a sharing tool called SharePoint. SharePoint is actively used on the intranet as a kind of work list. Work is published and different people process the tasks and post their work online.

Geographic distance is still considered a challenge by the personnel involved. Essentially it's about having members from LT working nearby, bring them to customer meetings and work under the same premises. This is also because face-to-face interaction is preferred. For projects which cover travel costs this is a challenge cost-wise. It is not always sure that the customer would find it natural that they should cover this cost. In the long term the objective must be to an even greater extent using videoconferencing as a tool for sharing knowledge and support. But this depends of course on the scope of the task and the importance of presence at the service base.

Appendix 2: Description of relevant projects mentioned in the study

Sonangol Gimboa
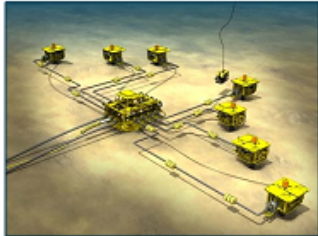
High focus on local content through contract with national oil company.

|	
Location:	Angola, West Africa
Award year:	July 2006
Status:	Completed in August 2008
Scope of work:	Seven trees, one manifold, controls, workover, umbilicals, tools, tie-in and service
Work sites:	Oslo, Tranby, Aberdeen, Indonesia, Malaysia and Luanda
Water depth:	480-620m
Pressure:	5 000 psi

AkerSolutions

Total Dalia
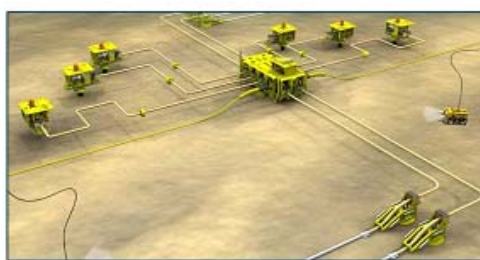
Proving Aker Solutions EPC capability in deepwater development

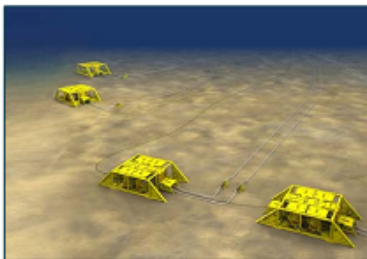|	
Location:	Block 17 offshore Angola
Award year:	2003
Status:	Ongoing
Scope of work:	71 subsea trees with wellheads, nine manifolds, controls, risers, work-over systems and related connection systems
Work sites:	Oslo, Tranby, Luanda, Houston, Aberdeen, Moss,
Water depth:	1 200 to 1 500m
Pressure:	5 000 psi

AkerSolutions

Reliance KG-D6
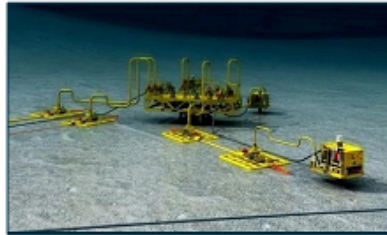
One of the world's largest subsea contracts ever awarded

Location:	Bay of Bengal, India
Award year:	May 2006
Status:	Ongoing
Scope of work:	19 subsea trees, six manifolds, DWPLEM, controls structures, umbilicals, tie-in connection system, tools and service
Work sites:	Aberdeen, Oslo, Tranby, Moss, Kuala Lumpur and Mumbai
Field specifics:	Range of field is 7 500km²
Water depth:	700 – 1 700m
Pressure:	10 000 psi

AkerSolutions

StatoilHydro Kristin

Overcoming high pressure and high temperature challenges

Location:	North Sea
Award year:	2002
Status:	Ongoing
Scope of work:	15 trees, wellhead systems, four templates and manifolds including HIPPS, controls, connection system and tools, workover system, intervention tooling and umbilicals
Temperature:	168°C
Water depth:	360-380m
Pressure:	15 000 psi

AkerSolutions

Appendix 3: Interview guide

Four different interview guides are used in the study: (1) LT employees, (2) employees at service bases, (3) the management in LT and (4) respondents from the product group. Most of the questions have been the same but some issues have had different approaches for each group of respondents. This interview guide gathers all questions.

KG structure and the establishment of LT

Everyone

1. How was the support and knowledge flow handled earlier?

2. Is it true that the establishment of LT as a centralized unit detached from the business units is helping to facilitate and coordinate knowledge and is this unit considered supportive for all the bases and product groups? Thus Aker Subsea?

    a. Was the responsibility for sharing and storing knowledge left to the individual bases or certain employees even though the development of the organizational knowledge base always has been considered important for the organization? A common desire for a collective and integrated effort across departments?

3. LT should help overcoming the "silo effect" around the service bases and product groups. Has centralization helped to improve standards and efficiency in operations and created to a better dialogue between the product groups and bases?

4. Is the size of the organization challenging in order to create good informal network?

    a. Is it preferable to have a more formal structure for support and knowledge sharing (depending on roles) rather than an informal and person dependent approach?

Service Bases

5. What do you think is new with the concept of LT?

    a. Is the support and involvement by LT appreciated at your base?

6. Have bases had any influence on how the LT organization should be structured and organized?

LT Management

7. Could LT be characterized as a shadow organization with "dotted lines" which goes a little bit across command lines?

8. What was implemented through the introduction of the LT?

    a. Key elements, coordination and management measures already in place before the formation of LT?

    b. Were any previous support functions combined in LT?

    c. Create a timeline of the various activities that have taken place after the establishment LT.

9. Is it Odd Egil Haug (Vice President) who owns the LT strategy?

    a. Included the strategy formulation an assessment of the organization's strengths and weaknesses regarding Knowledge flow objectives, identification of organizational knowledge needs, and a roadmap for the development of tools and practices in order to support bases and product departments?

    b. Have there been any follow-up regarding the strategy and do you keep steady course?

10. Could the group have had a higher status by collecting more expertise in LT?

    a. What kind of expertise should LT possess? Expertise, coordination skills, broad and general competence?

KG processes

Everyone

7. Common interests between bases and HQ (work toward common goals)?

8. Felt any differences after Aker Solutions changed from a global strategy to a more regional?

    a. Last year all the procedures were more mandatory (global), everything was more global. Gone back to being five regions where each region has more freedom to do what they want within a certain framework and Aker Subsea set the values, etc. Within the SLS they also have certain procedures that everyone must follow (reporting, procedures).

9. What is your experience with the success factors of LT:

    a. LT commitment - Services are performed, handled and solved in a professional way - capacity & competence

        i. As a capacity and competence hub

b. Commitment and follow up from SLS units - have to ensure proper service order agreement, hand over and start up - are still overall responsible vs. customer service through contract.

    i. More focus on and responsibility for the entire value chain

    ii. Training and follow-up, especially in the handover process from project to base

Service Bases

10. Do you see the usefulness of sharing experiences within the SLS by using LT?

11. How to implement best practice? Voluntarily?

    a. In a way, more global thinking in LT but a quite democratic approach to the bases?

12. Does LT manage to create effort and commitment at your base?

    a. Willingness to share when you pay for the service?

    b. Do you feel that it is too expensive to use LT? (NOK 700-900 per hour)

    c. Have you considered buying/bought this capacity/support externally?

13. How is the difference in knowledge sharing when LT is located at the base and when it is supported from distance (Oslo/Bergen)?

LT staff

14. LT thinks more globally and operates across borders. This means that one must focus on the way things are presented and disclosed. According to the regional model LT cannot impose things to bases outside their CoE just because it is determined in Norway. Therefore it is important to present a best practice useful for the bases. How does this democratic process work?

15. Is LT able to create effort and commitment at the various bases?

    a. Willingness to share with the bases when they pay for your service?

    b. How do you see that it costs money for service internally? High threshold for use?

LT Management

16. What projects have been introduced so far regarding increased knowledge flow between the units?

17. Considered a partnership with the HR department with a goal of developing learning modules and obligations to the bases?

a. Could LT be working closer with HR in order to level cultural differences?

Communication and coordination processes

Everyone

18. Do you feel recognized for the work of sharing knowledge?

    a. Proposal for how to promote and premiere sharing initiatives?

    b. Incentive programs?

19. What do you think of a mentor program between base/LT/product groups/ management?

20. What is your experience with the success factors of LT:
    a. Easy & clear process for the ordering of work/getting support
    b. Clearly defined roles and responsibilities internally
    c. Clearly defined roles and responsibilities vs. external customer bases

21. Enough integrated with IT systems? Development of the systems and transfer and integration of knowledge based on experience (SAP, MySubsea, First Interactive + Offshore and Onshore)

22. What about sharing the transmission channels used? Face to face, intranet, video conference, phone, e-mail. What is preferred?

Service Bases

23. How is knowledge shared between the base and LT/HQ?

    a. Dedicated key personnel who are responsible (Engineering points of contact)?

    b. How do you report on improvement potentials?

        i. Monthly meetings that go through local, regional and global AKSO activities, technical problems and improvements?

    c. Should the workshops, meetings and monitoring/reporting be more mandatory?

24. How efficient to share experiences with others and how susceptible to others' experiences? (inflow/outflow)

25. Some power struggle between the bases?

26. Cultural and geographical barriers to overcome?

Product Group

27. How do you utilize and use the experience brought by LT?

    a. Are experiences routed back to them and is there a better dialogue between the bases and product groups?

Leadership (LT staff)

28. Enough support from top level and effectiveness in LT? How do you make implementations and are there formal management teams where LT has a natural position?

    a. Initiatives that has a larger organizational impact, must be approved by higher organizational level? Thinking of warranty handling which is largely designed by LT and implemented through CEO Aker Subsea. Other examples?

29. How much authority and responsibility among the employees in LT?