Knowledge processes and capabilities in project-based organizations

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Keywords
PBO, project, knowledge process, capabilities, end-user, real estate sector, PMO, knowledge governance, bridging boundaries, critical realism

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Sofia Pemsel

Abstract

The beauty of projects lies in their ability to integrate different knowledge bases and expertise in novel ways. Projects, though, are temporary in nature and this has consequences for the organization that uses them as a business strategy to improve its efficiency. Project-based organizations are representative of this organizational form and can either be standalone or subsidiary organizations within a larger corporation. In project-based organizations the majority of products or services are produced through projects for either internal or external customers. Nevertheless, project-based organizations are characterized as loosely coupled systems with independent sub-units resulting in sparse internal knowledge processes and capability development.

Real estate organizations are often composite organizations where one part is project-based with a temporary perspective, and the other parts perceive the organization to have a longer term perspective, represented by facility management, asset management, maintenance, operational services etc. Real estate organizations thus often maintain a long-term relationship with customers and end-users, although are frequently found to be lacking in their management of end-users. Moreover, they are often found to have inadequate competence in project management and in connecting their business and project networks, resulting in inefficient use of resources.

The present research investigates how practices in project-based organizations impact upon internal knowledge processes and capability development with the aim of fulfilling end-users' needs and requirements. The research question is formulated as follows: *how do project-based organizations' underlying mechanisms impact on internal knowledge processes?* This is investigated through a knowledge-based view of project-based organizations and explores it from the bottom up through the organizational hierarchies, that is, from the interaction with end-users in projects, through the project management office and up to top-management and its knowledge governance strategies. The research adopts a critical realism perspective, holds knowledge processes as the unit of analysis and combines literature reviews with 14 qualitative case studies and a final qualitative sample survey, and is published in five peer-reviewed research

journal papers. The empirical dataset consists of 100 semi-structured interviews, 17 workshops and meetings with researchers and practitioners, plus document analysis.

The thesis is divided into two parts: Summary of the research and Appended papers. The Summary part of the thesis provides a synthesis and reflection of the findings in the papers through (a) developing six knowledge governance strategy profiles of project-based organizations, (b) extending existing contingency framework of P- and M-form corporations, (c) proposing a tentative multilayer knowledge governance framework for knowledge processes and capabilities of project-based organizations in the real estate sector and (d) suggesting an interplay focus among identified factors and layers in the proposed framework to comprehend emerging knowledge processes in PBOs.

Referat

Det vackra med projekt ligger i deras förmåga att integrera olika kunskapsområde och expertis på nya sätt. Projekt är dock temporära till sin natur, vilket medför konsekvenser för de organisationer som nyttjar projekt som en företagsstrategi för att uppnå effektiviseringar. Projektbaserade organisationer representerar en organisationsform som nyttjar denna företagsstrategi. Projektbaserade organisationer kan vidare antingen vara en självständig organisation eller en del av en större korporation. I projektbaserade organisationer produceras en majoritet av företagets produkter och serviceerbjudande i projekt, antingen för interna eller externa kunder. Trots hoppet om ökad effektivitet karaktäriseras dessa organisationer ofta av att vara svagt sammankopplade system med självständiga delenheter. Detta tenderar att resultera i bristfälliga interna kunskapsprocesser samt utveckling av organisationsförmågor (eg. capabilities).

Fastighetsföretag är ofta sammansatta organisationer där en del är projektbaserad med ett kortsiktigt/temporärt tidsperspektiv och där övriga enheter, såsom facilities management, kapitalförvaltning, fastighetsförvaltning etc., har ett längre tidsperspektiv. Fastighetsföretag har därför oftast långsiktiga relationer till kunder och brukare. Dessvärre är fastighetsföretag ofta funna bristfälliga i sin hantering av, framförallt, brukare. Dessutom har studier visat att de även är bristfälliga i sin projektledningskompetens samt i att sammanfoga sina affärs- och projektnätverk, vilket resulterar i ett ineffektivt nyttjande av interna resurser.

Forskningen, denna doktorsavhandling bygger på, undersöker hur individers agerande i projektbaserade organisationer påverkar interna kunskapsprocesser och utvecklingen av organisationsförmågor, såsom att uppfylla brukarnas behov och krav. Forskningsfrågan är formulerad enligt följande: *hur påverkar projektbaserade organisationers underliggande mekanismer de interna kunskapsprocesserna?* Detta undersöks genom en kunskapsbaserad syn på projektbaserade organisationer. De projektbaserade organisationerna utforskas från de lägre organisatoriska nivåerna till toppen, dvs. från hanteringen av brukare i projekt, genom projektkontoret och upp till företagsledningen där

företagets strategier för governance av kunskap sätts. Forskningen ser världen, och hur kunskap är beskaffat, genom en kritisk realists ögon, tar kunskapsprocesser som analytisk enhet och kombinerar litteraturstudier med 14 kvalitativa fallstudier och en avslutande kvalitativ undersökning. Dessa studier är publicerade i fem artiklar i forskningsjournaler. Det empiriska materialet består av 100 semistrukturerade intervjuer, 17 workshops och möten med forskare och företagsrepresentanter samt dokumentanalyser.

Avhandlingen består av två delar: en kappa samt vidhängda artiklar. Kappan tillhandahåller en syntes och reflektion av vidhängda artiklar genom (a) utvecklandet av sex strategiprofiler för governance av kunskap i projektbaserade organisationer; (b) en utvidgning av existerande föreslagna contingency ramverk för P- och M-formerade organisationer; (c) föreslår ett preliminärt multinivåramverk för governance av kunskap avseende kunskapsprocesser och förmåga att komma från intention till resultat i de olika situationerna projektbaserade organisationer möter i fastighetssektorn; samt (d) föreslår ett växelspelssynsätt mellan identifierade faktorer och lager i det föreslagna multinivåramverket för governance av kunskap. Detta görs med syftet att öka förståelsen för hur kunskapsprocesser uppkommer i projektbaserade organisationer.

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1. Introduction

This chapter presents the background of the research, introduces the phenomenon of knowledge processes in organizations and project-based organizations in general, and in project-based organizations in the real estate sector in particular. In addition, the research focus of the thesis is outlined. The chapter ends with a guide to, and display of, the entire thesis.

1.1 Background and research context

1.1.1 Knowledge in organizations

Knowledge and learning processes are vital assets for businesses performance, survival and the ability to meet changes in the market and in meeting customers' and end-users' needs and requirements (Levitt and March, 1988; Huber, 1998; Connell et al., 2001). Knowledge processes refers to knowledge transfer, sharing, integration and creation among individuals, groups and organizations[1] (Grant, 1996b; Okhuysen and Eisenhardt, 2002) (further discussed in Chapter 2). Organizations thereby need the capabilities to create and utilize knowledge (Nonaka et al., 2000). Organizational capabilities refer to adapting, integrating and reconfiguring skills to meet internal and external demands, conditions and changes (Teece et al., 1997; Davies and Brady, 2000; Eisenhardt and Martin, 2000). The organization learns through acquiring and adapting its capabilities over time (Dosi et al., 2000). Organizations consequently need strategies to develop capabilities for governing knowledge management efforts. But there is still little knowledge of how governance initiatives impact knowledge processes and how existing knowledge constrains,

[1] In the literature, the terms firm, organization, company and enterprise are used interchangeably, even though they are not the same. For consistency in the text, the word organization is used unless there is a particular need to use another term.

or enables, the request of mechanisms for governance (Foss, 2006). Although this aspect of knowledge and knowledge management has not been investigated sufficiently, interest in knowledge and knowledge management has been rather strong over the years. Research on knowledge has become less philosophical and more pragmatic. Researchers attempt to find solutions and explanations of how organizations can improve their management of knowledge and why their attempts prove efficient or otherwise. The growing numbers of scientific research journals witness the interest in knowledge management aspects, for instance: *Journal of Knowledge Management; Knowledge and Process Management; Journal of Knowledge Management, Economics and Information Technology: and Journal of Knowledge Management Practice*. In addition, other management and social journals, for example *International Journal of Project Management and Organization Science*, have almost one paper in every volume devoted to knowledge and learning-related aspects.

Management theory is eclectic and pragmatic (Johnson and Duberley, 2000; Sanchez, 2001) and a synthesis of many disciplines (Wren, 1994) but has been dominated by a view of functionalism. That is, knowledge is assumed to be an objective, transferable commodity (Nonaka, 1994; Marshall and Brady, 2001; Fernie et al., 2003; Mariotti, 2007) resulting in an emphasis on transfers of information and data (Marshall and Brady, 2001; Mariotti, 2007). The functional assumption has been criticized by researchers for being unproductive, as it considers the organization to be passive and static (Nonaka, 1994; Marshall and Brady, 2001), and humans as passive receivers similar to computers (Sveiby, 1996; Marshall and Brady, 2001). The critics of this functionalistic view advocate that learning and knowledge should be regarded as a social and dynamic process (Lundvall, 1992; Mariotti, 2007) that requires human action, interpretation and understanding (Sveiby, 1996). These distinct views of knowledge and learning can be partly explained by various disciplines having different purposes and interests in their research and their view of, for instance, organizational learning (see Table 1.1).

Table 1.1 Examples of theoretical perspectives on organizational learning.

Theoretical perspective	**View of learning**
Sociological	Learning is the result of social practice with the focus upon relations (Sense, 2004)
Economic	Learning is the flow of knowledge leading to improved performance with the focus upon improved profits and market competiveness (Bontis, 2002)
Behavioural	A change in actions as a result of learning (Huber, 1991; Sense, 2004)
Cognitive	Information processing view of organizational learning that includes a lower operational level and a higher conceptual level (i.e. single and double-loop learning) (Sense, 2004)
Cognitive and behavioural	Emphasizes the links/synergies between the individual cognitive learning with collective changed behaviours (Sense, 2004)

From Table 1.1 it can be assumed that learning and knowledge processes in organizations require both individual and collective reflections. The relation between knowledge creation vs. knowledge creating and individual vs. organization is defined as follows: an organization can define the means and support for knowledge creating processes and activities; however, knowledge creation occurs through individual and collective interaction and reflection, which may be independent of such means and support (Nonaka and Toyama, 2005). Organizations, therefore, need strategies on how to manage knowledge and learn efficiently. Strategies are set through the governance of knowledge in an organization and are implemented through the management of knowledge. Governance of knowledge thus involves *"... choosing organizational structures and mechanisms that can influence the process of using, sharing, integrating, and creating knowledge in preferred directions and towards preferred levels"* (Foss et al., 2010, p.456). Management and governance theories concerning knowledge-related aspects have become less functional during the last decades. For instance, the knowledge-based view of organizations considers knowledge to be dynamic (Simon, 1991; Kogut and Zander, 1992; Nonaka, 1994; Grant, 1996b) and an organization's most vital resource (Grant, 1996b). This theory has grown out of the resource-based theory, developed by Penrose (1959), and has a more dynamic view of knowledge than, for example, transaction cost theory (cf. Williamson, 1995), which treats knowledge as more static and transferable, and is a common theory used in regard to governance of organizations.

Knowledge processes arise at different levels, subunits and interfaces in the organization. Organizational knowledge is incorporated in the routines and capabilities of an organization (Grant, 1996a), and shapes and accumulates an organization's memory. Learning processes have been found to be inhibited if the organization is too fragmented into subunits, or too conservative (Levitt and March, 1988). Previous research has found that different organizational structures tend to be dominated by different kinds of knowledge types (i.e. explicit or tacit, individual or collective – see Chapter 2) depending on their emphasis of activities (Lam, 2000). Organizations vary widely and their structures, goals and contexts impact the kind of knowledge processes that are desirable, that is, are knowledge transfer, sharing or integration processes required?

Previous research has found that organizations, no matter whether they are structured as functional, matrix or project-based (Hobday, 2000) struggle with knowledge processes. However, they do this for different reasons. Functional organizations are found to be knowledge silos (Prencipe and Tell, 2001), matrix organizations are inefficient in identifying and creating value out of existing knowledge (Van den Bosch et al., 1999) and project-based organizations (PBOs) consist of isolated islands in a loosely coupled system (Orton and Weick, 1990; Lindkvist, 2004). Additionally, many modern organizations are, in fact, a combination of the aforementioned structures, often labelled composite organizations (PMI, 2004).

1.1.2 Knowledge processes in projects and project-based organizations

The beauty of projects[2] lies in their ability to integrate diverse knowledge bases and expertise. Projects are designed however for an intentional death, that is, the project ceases (Söderlund, 2011). This temporality results in projects seldom having time to develop strong organizational memories (Levitt and March, 1988), and those memories that are developed, often in the shape of routines, are not reused. So even though projects are strong in integrating

[2] A project is a *"unique process, consisting of a set of coordinated and controlled* ***activities*** *(3.1) with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources… NOTE 4 The project's organization is normally temporary and established for the lifetime of the project. NOTE 5 The complexity of the interactions among project activities is not necessarily related to project size."* (ISO, 2003, p.6) (emphasis in original)

knowledge from distinct contexts, it is difficult to integrate knowledge from projects to other contexts, for instance to the organizational and industrial setting in which it is incorporated (Söderlund, 2011).

Projects are often implemented as an organizational strategy to complement and improve business productivity (Lundin and Söderholm, 1995) but the level of project focus in organizations differs. Hobday (2000) classified organizations from functional to project-based, depending on the degree of project focus. The terminology differs in previous research and some researchers discuss project-based firms (Lindkvist, 2004; Whitley, 2006), others, project-based organizations (Turner and Keegan, 2000) or project-based companies (Huemann et al., 2007) with slightly different meanings. A project-based organization (PBO) as a concept is here regarded to be an overarching term, and the most accepted term, which includes project-based organizations, project-led organizations, project-based firms and project-based companies in line with Thiry and Deguire's (2007) treatment of the term. PBOs are here defined as organizations in which the majority of products or services are produced through projects for either internal or external customers. The PBO may therefore be a standalone organization or a subsidiary of a larger corporation (Turner and Keegan, 2000) but characteristically, in both cases, it is one organization that conducts many projects (Artto et al., 2011).

From a knowledge process perspective, projects are designed to coordinate knowledge, learning and communication, wherein the actors are interdependent of each other (Söderlund, 2011). The projects in turn are often incorporated in a PBO, characterized by dynamic boundaries and contexts, with a culture of empowering its staff, close interaction with customers and a high degree of team work in projects (Huemann et al., 2007). This often results in a fragmented structure in which coordination is difficult but vital from a steering and efficiency perspective. One way to coordinate knowledge processes in PBOs is through the establishment of a project management office (PMO). A PMO is a formal layer in PBOs, which through its complex relations, links strategy, projects and structures together (Aubry et al., 2007), and spans at least three organizational layers: top, middle and project. Previous research has suggested that PBOs often implement PMOs without a clear direction and vision of what role they want the PMO to play; they simply adopt existing PMO archetypes without considering organizational needs (Aubry et al., 2010a). So even though PMOs are implemented there is no guarantee that they have the capacity to achieve cross-project learning and knowledge flows, that is, become an efficient knowledge broker. Most studies of PMOs tend to take a top-down governance perspective (see for example Dai and Wells, 2004; Desouza and Evaristo, 2006; Hobbs et al., 2008; Julian,

2008; Aubry et al., 2010a; Aubry et al., 2010b), albeit that in-house knowledge processes among project managers have been found impacted by a prevailing culture of non-interference and independence (Eskerod and Skriver, 2007). This culture most likely impacts the knowledge brokering capabilities that the PMO needs to possess, addressing the need to investigate PMOs from the project managers' perspective.

Another coordination challenge in PBOs is the need to manage both business and project networks efficiently to achieve both short-term and long-term benefits. The two networks are interrelated and the stakeholders in the networks often have diverse goals and institutional backgrounds (Artto et al., 2011). Artto et al. advocate a need to further research learning capabilities in PBOs, that is, learning within and between permanent and temporary organizations and, in particular, inside-project learning.

Accordingly, PBO operations incorporate complex coordination involving the bridging of multiple internal and external organizational boundaries. From a learning and knowledge perspective in PBOs, it can be concluded that there is a need to (1) further investigate interrelations between business and project relationships and; (2) incorporate the lower parts of the organization to make knowledge governance and management initiatives productive from the top, over a short and long-term perspective.

1.1.3 The real estate sector

Real estate organizations vary in structure, but are often composite organizations (in the sense defined in PMI, 2004) with a subsidiary project-based part and a permanent functional or matrix part. The latter covers, for instance, real estate development and facilities management. The real estate organization has to manage both business networks (i.e. long-term maintenance and operational activities in the facilities as well as customer relationships) and project networks (i.e. short-term project relationships).

Real estate organizations (as the client or owner of a construction project) commonly have internal project managers who are involved in, and who conduct refurbishment schemes as well as new build projects. Today, clients play an important role in the sector as they control and lead changes, and additionally sometimes act as project managers (Widén et al., 2008). The role of the client in the real estate and construction sector has, however, changed over the years and varies across countries. For instance in the UK, clients are nowadays expected to play an active role in the development of their projects,

whereas in the past, the architect would have exercised this role (Cole-Colander, 2003). The role in the UK today has consequently become more comparable to the situation in the Nordic countries.

Real estate organizations operate under special circumstances when it comes to projects, as they have to adopt a longer lifecycle perspective than ordinary projects. This means that the real estate organizations, besides conducting the projects, are often responsible for operating the outcome for a significant period. The interactions and knowledge exchanges with other departments in the organization, for example facilities management, mean that it is essential to obtain appropriate input at an early stage of the project (BSI, 2010). However, clients' actions have been characterized by short-term thinking (Cole-Colander, 2003), broken feedback loops, neglect of end-user needs and requirements, and lack of a lifecycle perspective of the building (Vischer, 2005). Additionally, a Swedish study advocates the emergent need for clients to become more knowledgeable in (a) managing end-users and (b) improving their project management competence (Lindahl and Ryd, 2007). Management of end-users has also historically been characterized by various shortcomings. In the 1970s, it was found that end-users tended to become hostage to the client during the occupancy phase. End-users' opinions did not really matter, as anything discussed did not fall within their area of expertise, whilst professional advisors seldom made an effort to help end-users understand what was being discussed (Mumford and Sackman, 1975). This unwillingness to understand the other party, visible in poor communication and dissatisfaction, was also found in another study: *"[users] who discover problems with their use of facilities are apt to keep their frustration to themselves rather than blame the providers of facilities. In turn, providers tend to suggest that users need to be 'educated' into ways of 'correctly using' facilities, so that the facilities can perform as anticipated when they were designed"* (Kernohan et al., 1992, p.16).

Leiringer and Cardellino (2008) discuss the important role managers play in making their organizations implement new strategies, structures and processes to cover their many external stakeholders, which requires that managers are masters of rhetoric. In line with this, not only does this command of rhetoric need to apply to interaction with end-users, but also in interactions with other stakeholders. Previous studies of projects in the construction and real estate sector show that the interactions are influenced by competing professional norms and values among architects, engineers, surveyors and builders (Bresnen and Marshall, 2011); but rarely are clients included. Projects are, from a real estate perspective, seldom addressed in research when discussing construction projects. The latter are mainly large infrastructure projects at one end of the scale, or speculative projects undertaken by a builder who, upon completion,

sells the building (see for instance Bresnen et al., 2004; Miller and Hobbs, 2005). There are a few exceptions however. Jones and Lichtenstein (2008) classify smaller architectural and construction projects as complex and highly reciprocal in network alliances. The network alliances are deemed to result in a socially-embedded environment, where knowledge of practice and roles are strongly institutionalized due to repetitive interaction among partners. However, their study mainly focuses upon design-build contracts and on the building contractor side of construction projects, not the client side.

In summary, the client plays a significant role in the real estate sector since it is the client who, to a large extent, sets the agenda for the projects and the sector, with contracts and collaborations, and so links together the project/industrial partners with end-users. The real estate sector has seldom been emphasized in research on PBOs (see Table 1.2) with the exception of Gann and Salter's (2000) study that included clients. However, the focus is not on the client's organization, but the input from it, to construction projects. The studies in the table do not provide an exhaustive literature review of PBO research, but do include some of the most commonly-cited empirically based papers. Theoretical studies such as Thiry and Deguire (2007) and Whitley (2006) are excluded from the table. There is therefore a need to investigate knowledge processes in the real estate sector, in order to find client knowledge process strategies so that end-users' needs and requirements can be more efficiently met, and so that the client can take more informed, enlightened and competent decisions. Moreover, most research on PBOs is set in the private sector and not in the public sector (Artto et al., 2011). This also calls for a need to investigate real estate organizations in the public sphere.

Table 1.2 Examples of company types that are reflected in empirical research on PBOs.

Company type/sector	Authors
Architectural practice	(Winch and Schneider, 1993)
Building contractor, process engineering, mechanical engineering, scaffolding, and repair and maintenance services	(Bresnen et al., 2005)
Building contractor	(Bresnen et al., 2004)
Communication, computer and information system companies, research organizations, engineering construction contractors, manufacturers	(Turner and Keegan, 2000)
Complex product systems	(Hobday, 2000)
Complex product systems	(Davies and Brady, 2000)
Complex product systems	(Prencipe, 2000)
Consultancy and marketing organizations	(Alvesson, 2005)
Design, engineering, construction organizations and their clients and suppliers	(Gann and Salter, 2000)
Engineering contractor	(Clark and Colling, 2005)
Film industry	(DeFillippi and Arthur, 1998)
Information, communication and entertainment system company	(Eskerod and Skriver, 2007)
Product development manufacturing company	(Lindkvist, 2004)
Software, aerospace, defence, flight simulation and power generation sectors	(Prencipe and Tell, 2001)
Telecommunications, information systems, computers, financial services and engineering, procurement and construction	(Keegan and Turner, 2002)

1.2 Research focus

1.2.1 Research positioning

The previous sections in this introduction have identified a number of areas in need of further investigation.

- Knowledge governance theories require development, as they do not differentiate between different types of organizations or sub-organizations within a larger organization.
- Many knowledge management theories assume organizational permanence. Nevertheless, a significant number of studies have been conducted on projects and a number on PBOs, concerning learning and knowledge processes; but the theories are still rather fragmented and need further elaboration.
- There is a need to improve understanding of the interrelation between business and project relationships in PBOs from a coordination perspective.
- There is a need to incorporate the lower parts of the organization to make knowledge governance and management initiatives productive from the top, both from a short and long-term perspective.
- There is a need to improve the understanding of real estate organizations' knowledge processes based on external sources, such as end-users, as well as internal sources.

From these areas, it is evident that knowledge processes in PBOs are complex phenomena with multiple perspectives in need of investigation. The distinctiveness of the real estate sector is that the project outcome, often a building or a reinvestment in a building, has a long lifecycle. For efficient long-term performance, it is vital to have competent management of the interrelation between business and project networks, and stakeholders such as end-users.

Organizational problems are, simplistically, either cooperation or coordination problems, and learning and knowledge processes are most beneficially analysed from a coordination problem perspective, in accordance with Grant (1996b) and Söderlund (2011). From a coordination perspective, project management becomes *"the act of ensuring communication and information-sharing among involved actors in a project"* (Söderlund, 2011, p.50). This is the sense of Grant's (1996b) knowledge-based view of the organization. Management's purpose in adopting this view is to establish coordination mechanisms necessary for knowledge integration activities among individuals, to bridge vertical and horizontal organizational boundaries. Grant (1996b) further suggests that boundaries should be analysed in terms of the relative efficiency of knowledge utilization.

In accordance with these views, it is interesting to understand how coordination mechanisms impact internal knowledge processes in composite real estate organizations with a particular interest in the PBO. Aubry et al. (2007) stated that studies on PBOs: (a) focus solely on structural problems instead of seeing them as a natural part of organizational development; and (b) in many cases lack a theoretical foundation, with the exception of those that adopt an economic perspective. From a theoretical perspective, there is a need to develop existing theories of PBOs from a knowledge-based view of an organization. Moreover, it is important to investigate the conditions and contingency factors that impact internal knowledge processes and the relation they have to knowledge governance and knowledge management practices and strategies in this organizational form. From an empirical perspective, it is necessary to investigate how knowledge processes are bridged over organizational boundaries through business and project networks in this organizational setting. PBOs have to coordinate knowledge processes from actors drawn from distinct organizations in their operations, in order to be able to create and maintain attractive products and services for their customers and end-users, and so achieve long-term benefits.

The areas revealed as being in need of further investigation suggest a qualitative examination of the coordination of knowledge processes in PBOs. Few studies exist in the real estate sector and this context differs from, for example, film, telecommunication and manufacturing industries. The real estate sector is characterized by:

- an often long-term relationship with customers and end-users;
- the long-term ownership of the building through its lifecycle; and
- the need to interrelate the project and business networks to feed knowledge gained from these relationships back and forth, to achieve productive strategies and operations.

Due to these contextual aspects of the real estate sector, the frequent reporting of insufficient management of end-users and their needs and the focus on coordination, this research investigates knowledge processes through a bottom-up approach to the PBO. With a bottom-up approach, the investigation refers to the management of end-users' needs and requirements, which follow the internal knowledge process up through organizational layers (see Figure 1.1).

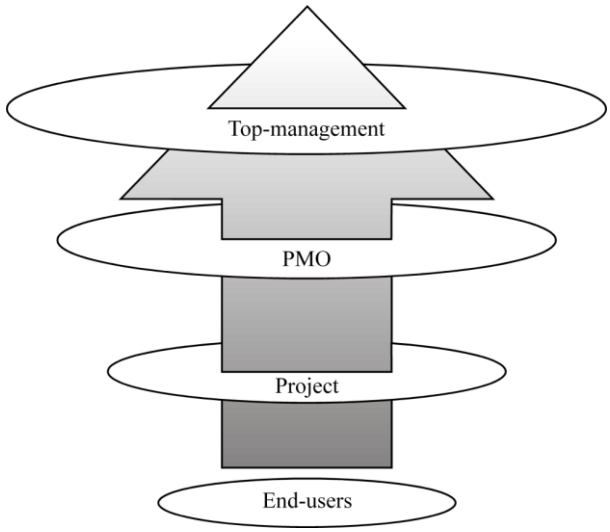

Figure 1.1 The organizational levels of analysis in this doctoral thesis.

Most organizational studies take a top-down perspective, assuming that macro-levels impact micro-levels and their hierarchies; but there are exceptions. Bottom-up studies assume that individuals have emergent properties that are noticeable at higher levels (Kozlowski and Klein, 2000). For example, Marion and Uhl-Bien (2001) explored leadership in complex organizations from a bottom-up perspective. They argued that top-down coordination refers to coordination by a central authority while bottom-up refers to emergent events that occur because of normal, uncoordinated interaction among constituent units. The reason for exploring the organization bottom-up, instead of top-down, is often the wish to explore the top-of-mind issues (Overton-de Klerk and Oelofse, 2010), for example customer relationship management. The bottom-up approach is thereby appealing as it: (1) avoids becoming detached from operational facets; (2) recognizes the coordination of knowledge processes together with the special interest of management of end-user related aspects; (3) recognizes the appropriateness of adopted knowledge governance strategies and management activities and initiatives in PBOs. The intention is to gain better understanding of the underlying mechanisms of knowledge processes in PBOs, to establish the cause of insufficient end-user management. In order to investigate this phenomenon, four organizational interfaces have been chosen as they provide an opportunity to follow the knowledge process up through the organization. More specifically, the knowledge process starts with the management of end-user organizations, either known or unknown, and goes

up through the project and into the PBO. In the PBO it moves up through the PMO to finally, the top-management and governance of knowledge (as showed in Figure 1.1). The focus of this research is mainly on the management of interfaces, that is, how PBOs learn to manage boundaries between subunits, in order to ensure efficient knowledge processes throughout the organization.

1.2.2 Research question

The research question is formulated as follows: *how do project-based organizations' underlying mechanisms impact on internal knowledge processes?*

Mechanisms are here referred to as conditions and contingencies that trigger and shape, that is, either enable or constrain, the development of social structures and events and thereby impact knowledge processes in organizations.

1.2.3 Aim and objectives

The aim of this research is to investigate the impact of PBOs' underlying mechanisms on internal knowledge processes, with the addition of attention to the fulfilment of end-users' needs and requirements. The objectives of this research are as follows.

1. Examine the management of end-users and their requirements in regard to construction projects when end-users are known.
2. Evaluate the management of end-users and their requirements in regard to construction projects when the end-users are unknown.
3. Establish how boundaries are bridged in the interface between the end-users' organization and the project organization.
4. Investigate the capacity of the project management office to act as a knowledge broker in PBOs.
5. Determine if common patterns exist in regard to knowledge governance practices in PBOs.

1.2.4 Delimitations

This research is set in three countries – Sweden, Finland and Australia – and mainly in the real estate sector. The study of PMOs, however, includes other industries for comparative purposes. This research is further set both in the private and the public sectors. The research design and choice of companies are explained and discussed in Chapter 3.

First, organizational problems can be divided into coordination or cooperation problems: this research focuses on coordination aspects. More specifically, the focus is on managing knowledge processes between subunits in PBOs and how PBOs build up required capabilities. Whilst the research includes the individual level, it does not attempt to develop behavioural, cognitive or psychological theories of, for example, how people learn; neither does it investigate the development of individuals' attitudes over time in a specific organizational setting, nor investigate how individuals' IQ and EQ impact upon learning. The research takes a knowledge-based view of the organization. It investigates strategies and capabilities for bridging organizational and knowledge boundaries, both internal and external, in order to achieve the required knowledge processes.

Second, the focus is mainly on PBOs in the real estate sector, which are often subsidiary PBOs. Most studies in the construction sector focus upon contractor PBOs as they are standalone, and regarded by some as 'purer' forms of PBOs. This can be regarded as valid since a comprehensive theory of knowledge processes in PBOs is still noticeable by its absence. This may cause one to question the choice of focus upon 'blurry' real estate PBOs. However, the real estate PBO is an under-investigated, but important, actor in the sector, and by bringing in more 'blurry' forms of PBOs, therein lies an opportunity to understand the 'purer' ones as well.

Third, the focus is on stakeholders not shareholders. The research concerns the following stakeholders.

- External stakeholders: end-users and managers/architects with expert knowledge on managing end-users.
- Internal PBO stakeholders: project manager, PMO personnel, middle and top managers.
- Stakeholders from the other parts of the composite organization: top managers and middle managers who influence project management despite their main task being in the functional/matrix part of the organization.

Other stakeholders such as contractors, subcontractors, designers, technical engineers and sponsors are excluded. The choice of end-users was based on PBOs having both business and project network relationships with these stakeholder groups. Additionally, end-users are the last in the chain of interactions.

Fourth, in accordance with the objectives and identified stakeholders, only the knowledge processes related to them are investigated (see Figure 1.2). The first two objectives, 1 and 2, represent the interface between end-users and PBOs. Objectives 1 and 3 investigate the interface between end-users and project participants, and objective 2, the interface between unknown end-users and PBOs. Then the research focuses on internal interfaces in the PBO between the project managers and the PMO personnel (objective 4) and lastly executives and project managers (objective 5).

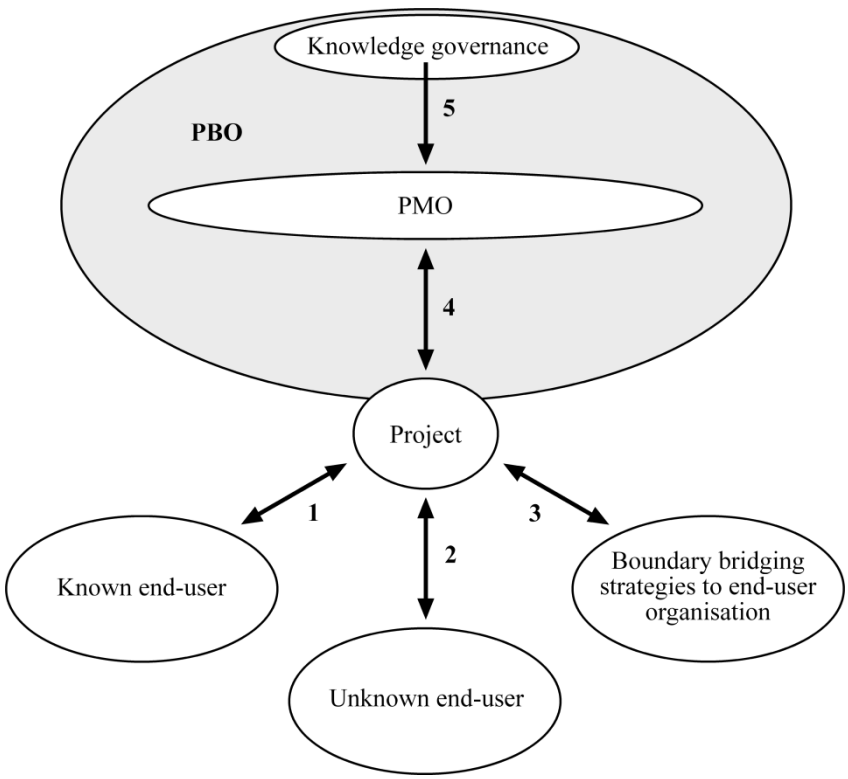

Figure 1.2 The relation between objectives 1-5 and interfaces in the PBO.

1.3 Structure of the thesis

This thesis is structured in two parts: Part I is the summary and Part II contains appendices (see Table 1.3).

The summary starts with this introductory chapter in which the empirical and theoretical relevance and research focus of this dissertation is discussed.

Chapter 2 further discusses and explains key theoretical themes and concepts investigated in the five papers in the appendices. More specifically, the chapter provides a return to previously examined theories in the studies. However, the theories are considered in the light of the insights acquired from the entire research process.

In Chapter 3 the research design and consequences of choices for the quality of accomplished research are discussed.

Chapter 4 provides a summary of the studies, the conclusions and insights, and their contribution to addressing the research objectives.

Chapter 5 brings together the conclusions from conducted studies into a comprehensive picture through analysis and discussions. The aim is to provide a theory/portrait of underlying mechanisms impacting upon internal knowledge processes in PBOs.

In the final chapter, the objectives and research question are re-examined and, in addition, a discussion on the implications of the findings is presented with suggestions for further research.

The appendices contain five papers on which this dissertation is based, and an overview of interviews and workshops conducted in the research.

Table 1.3 Overview of Part II of the thesis (appendices).

Appendix	Journal	Status	Main focus
Paper I Managing the needs of end-users in the design and delivery of construction projects	Facilities	Published	Managing known end-users in construction projects from a real estate organization perspective
Paper II Creating knowledge of end users' requirements: the interface between firm and project	Project Management Journal (PMJ)	Published	Managing unknown end-users in real estate organizations
Paper III Bridging boundaries between organizations in construction	Construction, Management and Economics (CME)	Published	Knowledge brokering strategies between PBO and end-users in a project setting
Paper IV Project management office a knowledge broker in project-based organizations	International Journal of Project Management (IJPM)	In press	Knowledge brokering between projects and PBO
Paper V The governance of knowledge in project-based organizations	International Journal of Project Management (IJPM)	In press	Knowledge governance mechanisms in PBOs
Interviews and Workshops	-	-	Overview of conducted interviews and workshops

This research contributes to the existing body of knowledge through the development of existing theories of internal knowledge processes in PBOs by (a) taking a knowledge-based view of an organization and (b) setting the study in the context of the real estate sector. It also contributes by an increased understanding of how contingencies impact upon knowledge governance and knowledge management initiatives in PBOs.

2. A knowledge-based view of project-based organizations

This chapter provides a literature review of key concepts used in this thesis. It starts with a discussion of knowledge processes and a knowledge-based view of an organization and continues with knowledge boundary strategies, then concludes with a reflection upon knowledge governance strategies in PBOs.

2.1 Knowledge-based view

The knowledge-based view of organizations is founded on the resource-based view of organizations, which regards them as heterogeneous with respect to their resources, capabilities and endowments (Teece et al., 2000). The knowledge-based view regards knowledge as the most vital resource. Organizational knowledge includes: *"… how to organize and manage projects, coordinate different problem-solving activities, determine goals and incentives, allocate resources and assign personnel, and resolve disputes"* (Pisano, 2000, p.132). Capabilities are what happens between intention and outcome (Dosi et al., 2000) and organizational capabilities refer to adapting, integrating and reconfiguring skills to meet internal and external demands, conditions and changes (Davies and Brady, 2000). Endowments reflect what the organization does well, but are not always beneficial as endowments are sticky in the sense that they can hamper renewal (Teece et al., 2000). The three concepts – knowledge, capabilities and endowments – are therefore felt to be intertwined, due to the many overlaps in their definitions.

An organization possesses a number of distinct capabilities, for instance dynamic, operational, functional, strategic and project capabilities (Davies and Brady, 2000; Eisenhardt and Martin, 2000). The value of competitive advantage of, for example, dynamic capabilities lies in strategically creating, integrating, recombining and releasing resources (Teece et al., 1997;

Eisenhardt and Martin, 2000; Helfat and Peteraf, 2009). Organizations therefore need knowledge of how to build and develop their capabilities and they need capabilities to initiate knowledge processes that can develop new knowledge. Put differently, as expressed by Söderlund et al. (2008, p.518): *"...capability building then seems very much to be a matter of both repeating and concurrently exploring new knowledge areas".* Capabilities, knowledge and endowments are consequently also closely connected to organizational learning, as organizations can be regarded as learning through acquiring and adapting their capabilities over time (Dosi et al., 2000) either through exploration or exploitation processes (March, 1991). Thus, Teece et al (2000) argue that dynamic capabilities and competences cannot be acquired, they must be built, which takes time due to impact from factors such as cultures, values and organization. Moreover, Teece et al. (2000) argue that organizations' competences and dynamic capabilities can be determined through their processes, positions and paths. Process refers to routines, or patterns of current practice, that is, coordination, reconfiguration and learning; position refers to its current endowments, assets, base of customers and external relations; and path refers to available strategic alternatives and attendant dependencies. Learning processes in organizations are often social and collective activities, involving both organizational and individual skills. The learning process generates organizational knowledge that resides in, for instance, new patterns of activities, that is, routines (Teece et al., 2000). Organizations have static routines that regulate on-going activities and dynamic routines that include the search for, selection and implementation of, new routines over time; but whether organizations learn from experiences or not, and how they learn and develop their routines, differs (Pisano, 2000). Organizations thereby develop organization-specific capabilities characterized by a high degree of tacit and embedded knowledge. Sharing or integrating organizational knowledge with subunits or external organizations is therefore often demanding (Appleyard et al., 2000). Transferring, sharing, creating or integrating knowledge in groups and across organizations requires distinct processes. These knowledge processes need, for example, to be adapted to the nature of the knowledge and the purpose of the assignment (Grant, 1996b; Hansen, 1999; Okhuysen and Eisenhardt, 2002; Foss et al., 2010).

Polanyi (1983) observes that knowledge has both tacit and explicit dimensions since we can know more than we can tell. Cook and Brown (1999) argue that tacit knowledge is a tool for action needed for know-how, know-when, know-why etc. Polanyi (1983) considers the tacit and the explicit parts of knowledge to have different natures which cannot be converted into the other. While others believe that all knowledge has a little of each (see papers IV and V in

Appendix IV and V respectively). The tacit dimension of knowledge consequently leads to knowledge creation processes requiring more interactions, as contextual understanding is necessary to be able to absorb what is communicated. Grant (1996b), for example, argues that transferring knowledge is not an effective approach when it comes to integration of specialized knowledge. If knowledge has to be integrated, formal coordination mechanisms need to be combined with informal ones (Grant, 1996b). However, previous research has shown a lack of coherent vocabulary and definitions of knowledge processes (see Paper V, Appendix V). Depending on the organizational task studied, different knowledge processes are emphasized in previous research. For example, in projects, knowledge integration is often emphasized due to the need for collaboration among team members with different expertise. As discussed in Paper V, Appendix V, knowledge can be created in groups through two distinct processes with different antecedents and outcomes, namely knowledge sharing and knowledge integration. Knowledge sharing is a problem solving process that consists of identifying and expressing uniquely held knowledge (Hansen, 1999; Okhuysen and Eisenhardt, 2002). Knowledge integration also involves a process of sharing individual knowledge within a group, but with the intention of combining it in order to create new knowledge (Okhuysen and Eisenhardt, 2002). Knowledge transfer, as a concept, is mainly used when knowledge is regarded as an object that can build up an organization's knowledge stocks (Alavi and Leidner, 2001). Nickerson and Zenger (2004) however emphasize the need to adopt the knowledge process to the problem, leading them to propose knowledge transfers for directional search where a common language is unnecessary. This view of knowledge transfer is here suggested as a question of transfer of information and data without the need for contextual understanding. Consequently, from an overall capability perspective, an organization, through its top-management (or executives), has to be competent in managing and governing both knowledge integration and sharing processes, as well as information transfers in order to achieve efficient knowledge management, in line with Grant (1996b) and Grandori (2001).

The knowledge-based view of an organization is appealing from a knowledge process and capability perspective as well as a PBO's perspective because (Grant, 1996b):

– knowledge is viewed as an organization's primary resource which challenges shareholder value maximization and power focus, and instead focuses on efficient coordination of knowledge possessed by individuals; and

– offers a theoretical basis for understanding the development of organizational forms and structures, such as abandonment of bureaucracies and adoption of delayering and team-based structures.

Foss (1996) argues that many of the early attempts to analyse the organization from a knowledge-based view are too greatly influenced by Williamson's transaction cost theory. This is unbeneficial from a knowledge perspective as it mainly focuses on value maximization and the power of shareholders, to the extent that organizational problems are simplified to incompatibility of individual goals (Grant, 1996b). Traditionally, economic theories, for example, have referred mainly to boundaries as contractual agreements and have been a question of moral hazard and opportunistic behaviour (Foss, 1996). For example, Kogut and Zander (1996) argue that communication networks are qualitatively unaffected by boundaries and adopt a prisoners' dilemma game approach to moral hazards, incentives and justice. Even though the earliest attempts at a knowledge-based view of an organization tried to adopt a coordination problem approach, they did not abandon their cooperation problem approaches altogether (in the sense of (Grant, 1996b) and (Söderlund, 2011) as explained in the introduction). However, this research takes a coordination perspective and adopts a broader view of boundaries than contractual views. This, as with previous research, has also regarded boundaries as emerging from organizational structures (Brown and Duguid, 1998; Carlile, 2002; Pawlowski and Robey, 2004), cultures or competences (Boland and Tenkasi, 1995; Swart and Harvey, 2011). Moreover, bridging boundary notions are characterized by collaboration, interpretation, translation and use of boundary objects in order to reach mutual understanding and improve collaboration and communication (see Paper III, Appendix III), which is much more in line with coordination problems.

Previous research on knowledge-based views of an organization, adopt distinct interpretations of knowledge. The fundamental knowledge types are Polanyi's (1983) tacit-explicit dimensions which have later been adopted into social contexts and actions. Very few researchers argue that knowledge is either tacit or explicit and research one or the other, but not both: most researchers espouse a multidimensional view. For example, Collins (1993) adopted a social and behavioural perspective and discussed the degree of symbolically explicit forms and socially local tacit requirements to comprehend the knowledge, differentiating between embrained, embodied, encultured, embedded and encoded knowledge. Blacker (1995) further elaborated these concepts and suggests that embrained knowledge refers to knowledge dependent on conceptual skills and cognitive abilities; encultured knowledge refers to the process of achieving shared understandings; embodied knowledge refers to

action orientation, partly explicit but mainly tacit; embedded knowledge refers to knowledge that resides in systematic routines and; encoded knowledge refers to information conveyed with signs and symbols. Lam (2000) discusses four of these concepts from a tacit/explicit and individual/collective perspective and claims that embedded knowledge is tacit and collective, embodied is tacit and individual, embrained is explicit and individual, and encoded is explicit and collective. However, despite Collin, Blacker and Lam's differences, they elaborate with similar concepts, such as double-loop learning and emphasizing the need for distinct processes to create and understand different knowledge types. Adopting a knowledge perspective thus impacts upon conclusions and suggestions. For example, Alavi and Leidner (2001) mapped-out how knowledge views impacted upon emphasis of knowledge management activities. Their review suggests that knowledge has been viewed as: (a) data and information; (b) a state of mind issue; (c) an object; (d) access to information; (e) a process, or; (f) capability. They propose that, for instance, if knowledge is viewed as data and information, management initiatives suggest that individuals should receive as much information as possible and this would result in more knowledgeable and competent individuals.

In summary, previous research on a knowledge-based view of the organization is characterized by contradictions, but also commonalities due to distinct views of knowledge (Table 2.1). The knowledge-based view, from Table 2.1, suggests that in order to understand the organization the focus should be upon knowledge. Additionally, a dynamic view of knowledge, humans and organizations is a prerequisite when analysing from this perspective. Knowledge creating processes gives the organization capabilities and the skills to act. The contradiction starts with the view of knowledge, which is that knowledge transfers are not regarded as productive by previous research for the following reasons: (a) knowledge transfers are most often regarded as concerning information or sometimes encoded knowledge; and (b) knowledge is often regarded as dynamic, embedded and containing a tacit dimension in practice. These knowledge types are seldom transferrable and can only be shared or integrated. However, researchers who objectify knowledge disapprove of this line of reasoning and propose that knowledge can be transferred as an object. Researchers adopting a dynamic knowledge view have distinct opinions concerning efficiency. Some claim that it is possible to create efficient knowledge processes while others state that it is impossible. Those claiming that it is impossible still indirectly discuss it through the emphasis on strategies and competitive advantage. A business perspective often involves aspects such as sales, qualitative results and effectiveness (Aubry et al., 2010b), implying that some researchers might emphasize the qualitative results rather than

effectiveness. Consequently, it can be stated that the knowledge-based view of an organization is a view rather than coherent theory, in line with Nickerson and Zenger (2004). But the view highlights an interesting departure for analyses of an organization, as it aims to analyse advantages and disadvantages in organizations with regard to development of knowledge processes and capabilities. This corresponds with the aim of this research, which is to investigate knowledge processes in PBOs.

The notion of a knowledge-based view of an organization among researchers is not fully unified and differences exist as illustrated in Table 2.1. The researchers are logically unified because a knowledge-based view of an organization should focus upon knowledge in organizations, that is, the unit of analysis. Moreover, the theories are often driven by a business perspective of capabilities and profits. The world and knowledge are often regarded as dynamic, leading to a process view of knowledge that is often adopted to complement the business perspective. The differences deal with the view of knowledge transfers, that is, if it is an appropriate concept, whether knowledge creation can be designed to be efficient or not and whether or not boundaries impact communication in networks.

Table 2.1 Major commonalities and contraries in the knowledge-based view of an organization.

Commonalities
Focus on knowledge Knowledge is viewed as an organization's primary resource (Grant, 1996b; Wiklund and Shepherd, 2003) The organization is a knowledge-creating entity (Nonaka et al., 2000)
Business perspective Competitive advantage is gained by skills, knowledge, capability to exploit and explore knowledge (Nonaka et al., 2000; Wiklund and Shepherd, 2003) Improve capacity to act inside and outside the organization (Sveiby, 2001) Increase profit by continually discovering new knowledge or combining existing knowledge (Nickerson and Zenger, 2004)
Dynamic view Knowledge is dynamic and related to human action (Nonaka et al., 2000; Sveiby, 2001) Humans and organizations are dynamic and constantly interact with their environment (Nonaka et al., 2000) Allow for an open mind concerning development of organizational forms and structures since knowledge is in focus (Grant, 1996b) Knowledge cannot be managed but enabled (Sveiby, 2001)
Organizational knowledge processes as units of analysis Activities, strategy, structure and culture are vital to understand how the organization produces knowledge (Nonaka et al., 2000) Routines, group problem solving and decision making, sequencing, rules and directives (Grant, 1996b) Problem solving perspective of the organization (Nickerson and Zenger, 2004) Knowledge strategies in organizations include both internal and external structures of the organization (Sveiby, 2001)
Process and capability Knowledge creating/generating processes and capabilities (Grant, 1996b; Nonaka et al., 2000; Nickerson and Zenger, 2004) Capability in the sense of creating and utilizing knowledge (Nonaka et al., 2000) *"There is (still) little understanding of how organizational control impacts processes of knowledge sharing (transfer), integration, and creation. Conversely, understanding of how existing stocks of knowledge ('capabilities') constrain the application of mechanisms of organizational control, is lacking."* (Foss, 2006, p.4)

Table 2.1 Continued.

Contradictions	
Knowledge transfer	
Transferring knowledge is not efficient to integrate knowledge (Grant, 1996b) Some knowledge is too embedded and tacit to be able to be transferred (Nonaka et al., 2000) Knowledge transfer is appropriate for directional search. (i.e. low problem solving complexity and explicit knowledge) and knowledge sharing requires a common language (i.e. knowledge 'tacitness' and complex problem solving process) (Heiman and Nickerson, 2002; Nickerson and Zenger, 2004)	Knowledge transfer is not unidirectional, it tends to improve competence and lead to co-creation of knowledge (Sveiby, 2001)
Efficiency	
Efficient coordination of knowledgeable individuals (Grant, 1996b) How to organize to efficiently generate knowledge and capabilities (Nickerson and Zenger, 2004)	Knowledge creation is an uncertain activity which cannot be predictive or efficient (Nonaka et al., 2000)
Knowledge boundaries	
Boundaries emerge from organizational structures (Brown and Duguid, 1998; Carlile, 2002; Pawlowski and Robey, 2004), cultures or competences (Boland and Tenkasi, 1995; Swart and Harvey, 2011). A certain level of common knowledge plays a vital role in bridging boundaries (Grant, 1996b) Hazards for knowledge sharing are: that humans are constrained to learn or self-interested and/or opportunistically self-interested (Nickerson and Zenger, 2004)	Communication networks in an organization are qualitatively unaffected by boundaries (Kogut and Zander, 1996)

In summary, a knowledge-based view of an organization suggests that knowledge is the organization's most vital resource and considers it from a business perspective. Knowledge creation is often regarded as an interplay

between process and capability in the organization. It provides the opportunity to analyse how and why organizations are operating to meet changing demands on both a strategic and an operational level. Previous literature, moreover, suggests that knowledge processes have distinct antecedents, which need distinct knowledge processes to succeed in creating knowledge. Furthermore, a coordination perspective is useful when analysing knowledge and learning.

The knowledge-based view of an organization, thus far, contains indistinct notions and elements. For instance, researchers have not yet agreed upon how to deal with the concepts of efficiency and knowledge transfer as well as the impact of knowledge boundaries. To conclude, the knowledge-based view of an organization provides some interesting ideas and an empirical contribution, but a comprehensive theory is still lacking.

2.1.1 A knowledge perspective of project-based organizations

PBOs cover a variety of organizational forms including those of a temporary nature, such as projects for the performance of certain tasks (Lundin and Söderholm, 1995; Turner and Müller, 2003; Sydow et al., 2004; Thiry and Deguire, 2007). A PBO (sometimes analysed as a P-form corporation) operates on two levels: the project and the PBO. The expected benefits from implementing this organizational form are that these two levels should work jointly and that new ideas and challenges which the project faces, and can later learn from, are transferred to the PBO (Söderlund and Tell, 2011). PBOs are however often found to be loosely coupled systems where the parts have a high degree of autonomy (Dubois and Gadde, 2002; Lindkvist, 2004); yet, how can they create organizational capabilities and learn? The intrinsic conditions of PBOs result in a situation where the PBO has to manage both temporary and permanent organizational units with distinct means and goals.

First, projects are an opportunity to integrate diverse knowledge bases and expertise (Söderlund and Tell, 2011) and are often characterized as temporary organizations. The project participants thereby act in an embedded inter-organizational environment, as they come from diverse organizations (Sydow et al., 2004), for example, the PBO, supplier organizations and end-user organizations. Different contexts reflect and create different valuations implying that both project participants and PBO employees develop different relationships and norms in distinct contexts. The individuals can thereby be regarded as involved in a political process in which distinct goals, norms and relations are evaluated. Consequently, some goals, norms and relations are

regarded as more prominent than others (Hosking and Morley, 1991), resulting in a tension in PBOs *"between the autonomy requirements of project participants and their embeddedness within organizational and inter-organizational settings that demand integration of project activities within organization command and control routines and/or inter-organizational efforts"* (Sydow et al., 2004, p.1476).

Second, due to the variety of organizational forms, projects conducted by PBOs can sometimes be staffed mainly by internal resources and sometimes solely the project manager: the rest are external human resources (Gann and Salter, 2000). The management and governance strategies in PBOs have been found to impact upon the size of projects and numbers of customers the PBO has, and whether the PBO is a standalone organization or a subsidiary of a larger corporation. This implies that it is vital to adapt business strategies to different businesses within a larger corporation, as it has been found inappropriate to try to find one that fits all (Turner and Keegan, 2000). Whilst it is inappropriate to use the same business strategy for every business unit, this does not imply that subunits should not coordinate their knowledge resources. As stated in Chapter 1, PBOs should benefit from an efficient coordination of their business (long-term) and project (short-term) network (Artto et al., 2011). For instance, Gann and Salter (2000) advocate the importance of integrating project and business processes to manage innovations in PBOs in the construction sector. The innovation perspective is also highlighted by Whitely (2006) who found that development of innovations and organizational capabilities are impacted by the coordination activities and goals and outputs of the organization.

Söderlund et al. (2008) suggest that PBOs improve their project management capabilities through learning processes impacted by a combination of the three learning mechanisms: relating and reflecting for exploration, and routinizing for exploitation. Exploration refers to searching for new knowledge, for example development of new products or ways of working; while exploitation, for instance, refers to refinement of existing procedures and routines (March, 1991).

In summary, previous research has highlighted a number of contingency factors that impact the development of knowledge processes and capabilities in PBOs, and these are presented and summarized in Table 2.2. Table 2.2 presents (a) the areas of investigation, (b) the major contingency factors from a knowledge perspective in PBOs, (c) the adopted knowledge views and (d) the authors of the investigations. The areas of investigation in previous research show that the focus has mainly been on the relations PBO-to-project, project-to-project, the

capability of PBOs to change, grow, control, manage and govern themselves or PBOs in relation to more traditional organizational forms (see Table 2.2). The dimensions under investigation have been characterized by a focus on learning and knowledge to improve efficiency, control and business mechanisms in order to find the means for improving knowledge sharing. The adopted knowledge views in these investigations are in general pluralistic. With reference to Collins, Blacker and Lam's discussions of knowledge types, the conducted research in Table 2.2 appears to be freely mixing concepts, processes and constructs, with the exception of those adopting a functional and economic perspective. However, the concept of embedded knowledge and embedded processes appears to be emphasized in almost every study. In line with suggestions by Sydow et al.'s (2004), previous research appears to wholly embrace the understanding that in PBOs *"generation of new knowledge as well as accumulation of learning may take place within project teams, between project teams, at the level of the firm, and certainly also between firms"* (Sydow et al., 2004, p.1482) resulting in the often adopted multiple knowledge view and units of analysis, when analysing knowledge creation in PBOs (see Table 2.2).

Table 2.2 Previous research on PBOs from a knowledge perspective.

Investigations	**Dimensions or contingency factors**	**Knowledge view**	**Author**
Learning and development in project-based enterprises	Human and social capital, learning by watching and asking, development of individual and industry memory and lack of organizational memory	Knowledge is regarded to be tacit, explicit, individual and collective. Often in need of close interactions	(DeFillippi and Arthur, 1998)
Management of innovation within project-based and service enhanced organizations, that is, integration of project and business processes	PBOs, project supply networks, projects (client, owners, users), technology support infrastructure, regulatory and institutional frameworks and knowledge flows	Knowledge is explicit and tacit as well as individual and collective	(Gann and Salter, 2000)

Table 2.2 Continued.

Investigations	Dimensions or contingency factors	Knowledge view	Author
Management operations in PBOs, correlation between (a) functional, hierarchical, line-management organization's functions and (b) the PBO's functions	Governance, operational control, management of human resources, management of knowledge and learning, and innovation and management of customers. Contingent factors: number of customers and size of project	Process management view: boundaries to customer organizations can be bridged with brokers, promoters or long-term close interactions, implying knowledge is complex and embedded	(Turner and Keegan, 2000)
Characteristics in PBOs that impede learning in and from projects	Variation, selection and retention Time pressures, centralizations and deferral	Partly constructivist approach adopting Nonaka's notions. Organizations are regarded as communities that enable or impede individual learning, and systems that learn from experiences, routines and information	(Keegan and Turner, 2001)
Project to project learning and development of learning landscapes	Individual, group and organizational level Experience accumulation, knowledge articulation and knowledge codification	A cognitive process perspective. Knowledge is regarded as meaning, implying a contextual component and a need to interpret information either individually or collectively. It is also regarded transferable and capable of being codified and stored	(Prencipe and Tell, 2001)

Table 2.2 Continued.

Investigations	Dimensions or contingency factors	Knowledge view	Author
The growth and control of PBOs	Patterns of growth, patterns of control and their implications for knowledge generation, capture and transfer	Knowledge can be generated, transferred and captured in a process, but is sometimes too localized. Builds up organizational capabilities	(Gann and Salter, 2003)
Shaping and embedding of new management practices in PBOs	Decentralization, short-term emphasis on project performance and distribution of work practices	Knowledge exploration is impacted by contextual factors, that is, degree of embeddedness in the environment	(Bresnen et al., 2004)
Knowledge governance in PBOs	Cumulative and disruptive learning, organizations, communities, trust, personal networks, capabilities, professional ethos, information channels, loyalties, social logics, organizational principles and cultures	Different epistemological perspectives, emphasizing a need for a differentiated, dynamic and embedded view of the PBO and its processes rather than functionalistic	(Grabher, 2004)
Governing PBOs from market-like processes within hierarchies' perspective	Cooperation (hierarchies) vs. coordination (markets). Dependence on knowledgeable individuals: 'who knows what' and self-organization of their work. Economic incentives	Different epistemological perspectives. Knowledge processes are regarded embedded in need for interaction to create new knowledge but also analyse knowledge processes with economic governance theories and vocabularies	(Lindkvist, 2004)

Table 2.2 Continued.

Investigations	Dimensions or contingency factors	Knowledge view	Author
Project-based learning and its relation to the wider organization	Learning boundaries, project autonomy, knowledge integration and practice-based nature of learning	Adopts a pluralistic epistemological approach to improve the understanding of complex social phenomena	(Scarbrough et al., 2004)
Development of organizational capabilities in PBOs	Coordination activities and singularity of outputs	Economic perspective: knowledge is capabilities and achieved through coordination of skills and tasks in organizations	(Whitley, 2006)
Improvement of integration between PBO and project	Horizontal integration, vertical integration, integrative project governance structures	Knowledge integration requires development of common language, implying that knowledge to some degree is regarded as embedded	(Thiry and Deguire, 2007)
Dynamics and learning in project ecologies	Disruptive and cumulative learning, cognitive distance, recombination, repetition, stakeholders and networks	A differentiated, dynamic and embedded view of the PBO and its processes	(Grabher and Ibert, 2011)

Table 2.2 Continued.

Investigations	Dimensions or contingency factors	Knowledge view	Author
Challenges related to local search and learning, temporary decentralizations, time orientation and system wide transfer of knowledge in M- respectively P-form corporations	Market conditions, output type, user involvement, time orientation, system of production, economic rational, technology type, primary type of interdependencies, nature of task, dimensions of knowledge and problem character	Knowledge is regarded as capabilities, competences and ability to be integrated among individuals if boundaries are crossed	(Söderlund and Tell, 2011)

It appears as if the researchers were not satisfied with merely improving the comprehension of the phenomenon; additionally, they want to find solutions and make predictions of what is happening in reality. The many shapes of PBOs and the contextual variations appear to make it hard to find generalizable claims. This implies that theories of knowledge in PBOs have potential for further development and investigation. Moreover, it calls for further development of the term PBO into a number of distinct organizational labels, in order to find better explanations of what is happening.

Sydow et al. (2004) claim that PBOs need to be analysed from at least four perspectives: organizational units, organizations, inter-organizational networks and organizational fields. Organizational units apply where the organization is embedded in a functional or business unit. Organization refers to a project-led organization or project-based enterprise. The kind of network within which the PBO is incorporated, may impact its coordination mechanisms and is of significance. The field refers to contextual factors such as industries, sectors, countries and prevailing business systems (Sydow et al., 2004). To illustrate the accuracy of this statement a comparison is made between some of the contingency factors for M-form (multidivisional) and P-form (project-based) corporations (see Table 2.2) in regard to real estate organizations.

The P-form corporation is equal to a PBO and an M-form corporation is one with (semi-) autonomous units (Söderlund and Tell, 2011). The P-form corporation perspective is based on studies in manufacturing (Söderlund and

Tell, 2009), which is also the case for the M-form perspective (Söderlund and Tell, 2011). Organizations in manufacturing and real estate sectors, operate in distinct contextual settings, which may impact what contingency factors are important when characterizing a real estate organization. Real estate organizations are sometimes composite organizations with the result that individuals in different organizational sub-units possess various time perspectives on the building and its end-users. Projects are focused on deadlines, while the maintenance and operational time perspective is continuously implying a mix of P- and M-forms. Additionally, even though the real estate market changes, it is more stable than new product markets, that is, it corresponds with the M-form. These contingency factors thereby open up opportunities for real estate organizations to establish some kind of organizational memory concerning end-user knowledge. Hobday (2000) discusses a particular strength of PBOs in terms of the close contact with the customers and the associated high degree of customer satisfaction. This is also the case in real estate organizations, where the management of known end-users requires skills concerning customized solutions and productive user-producer relations (see Paper I, Appendix I). The real estate organization, from this contingency factor, correlates with the P-form corporation as suggested by Söderlund and Tell (2011). However, other strategies are needed when end-users are unknown and the organization builds facilities mainly on speculation (see Paper II, Appendix II). From the perspective of user involvement, in the latter case the organizations are classified as M-form corporations rather than P-form corporations, in line with Söderlund and Tell's (2011) classification.

When it comes to interdependencies and technology type, real estate organizations correspond rather well to the P-form. Construction projects are characterized by a high degree of interdependency to proceed; however, internally in the PBO, the degree of interdependence is less between departments. Interdependencies mainly occur in the initiation and delivery of projects and through project control meetings. The interdependencies emerge in reciprocal project work and therefore correspond to the P-form. When it comes to technology type, real estate organizations correspond to the P-form, that is, engineering (and non-routine work).

Concerning product and market, the outputs are designated for a specific market, and moreover the products are often customized on a cluster level, corresponding with a P-form corporation. For example, apartments and residential areas are often designed for families, singles, couples or seniors. It is, however, rarely a question of mass production, as it is for M-form corporations. Thus few franchise corporations exist that develop and sell

concepts of products to producers, which are approaching mass production or indeed repetitive production (see Paper II, Appendix II).

As stated in the introduction, a gap exists in the theory of knowledge processes and capabilities in PBOs concerning the situation in the real estate sector. The contingency factors concerning dimensions of knowledge specialization, problem character and nature of task will be considered again in the discussion chapter and compared to this study's empirical data. The P- and M-form analyses open-up the chance to grasp underlying mechanisms that impact internal knowledge processes in PBOs if related to real estate.

In the following sections the theoretical frameworks from the five studies are reviewed from a knowledge-based view of PBOs.

2.2 Bridging boundary strategies

The previous section has shown that PBOs and their projects have been found to be loosely coupled and characterized by an inter-organizational network. This supports the areas in need of further development as stated in Chapter 1, such as a need to improve the interrelationship between business and project relationships in PBOs from a coordination perspective. The aim is to improve both internal knowledge processes and knowledge processes from external sources such as end-users. These preconditions, from the knowledge-based view of an organization, mean that the PBO needs strategies to enable knowledge processes and intermediate capabilities to bridge boundaries and achieve productive interaction among individuals in its operations (see Table 2.1). Boundaries are viewed in broader terms than merely contractual, and are regarded as emerging from organizational cultures, structures and areas of expertise (see Table 2.1). These presumptions create the underlying reasoning behind the following literature review.

Organizations have boundaries that distinguish the inside from the outside and membership from non-membership. Boundaries can exist between, for example, organizations, sub-organizational units within the same corporation, cultures and areas of expertise. Theories on boundary bridging suggest that if an organization bridges boundaries, it opens up organizational learning and improved efficiency (see Paper III, Appendix III). It is therefore mainly a question of coordination of activities and relationships, which is in line with the intention of this research. In relating to the knowledge-based view of an organization, a PBO can improve its knowledge processes through the strategic

use of different boundary roles and activities, if the organization has developed the capabilities for it. Alternatively, as expressed by Eisenhardt and Martin (2000, p.1108): *"... there are more or less effective ways to execute particular dynamic capabilities, such as alliances, strategic decision making, and knowledge brokering".*

Previous research has developed and investigated (a) a number of strategies to bridge organizational boundaries, such as syntactic, semantic or pragmatic approaches, that is, either collect more information, engage a translator or develop practices (Carlile, 2002); (b) different brokering roles, that is, capabilities and strategies for bridging boundaries; and (c) brokering objects, that is, artefacts and commonly known symbols that visualize what has to be communicated (see Table 2.3). In Table 2.3 the roles are divided according to the interface they are supposed to bridge. Many of these attempts are however overlapping, and a number of labels are used for almost the same activity and/or role (see Paper III, Appendix III). In the following two sections, boundary bridging strategies will be further discussed from the perspective of a knowledge process and knowledge-based view of the organization. Special intention is given to boundary bridging of end-user organizations.

Table 2.3 Boundary bridging concepts, their roles and activities (see further Paper III, Appendix III).

Boundary concepts and organizational level	**Roles and activities**
To top-management	
Ambassador	Lobbying for support, resources and protecting the group of interest
Internally or organizations performing a task together	
Task coordinator	Align groups to perform a task
Knowledge broker	Person is external to the organizations that need to bridge boundaries. Brokers translate, coordinate, align perspectives and participate
Translator	Non-participating, external mediator who translates and interprets between groups with different use of language
Knowledge transformers	Facilitate adaptation of information to organization's routines, limit risk of misinterpretation
Facilitators	Promote relationship building between peer departments
Boundary organization	Creates a triadic role structure between organizations that manage governance, membership, ownership and control, support collaboration
To external markets/organizations	
Scout activities	Inspect and ensure external demands are met to stay competitive
Guard activities	Control information flows to external organizations
Boundary spanner	Negotiates and represents the organization externally, belongs to the organization it represents
Relationship promoter	Solves inter-organizational conflicts and supports interactive learning processes
Gatekeepers	Bridge information or communication barriers, build relationships independent of, for example, a project
Process promoters	Bridge information or communication barriers, build relationships dependent on, for example, a project
Key account managers	Promote relationship building, share learning in collaboration with customers

Table 2.3 Continued.

Boundary concepts and organizational level	**Roles and activities**
Boundary objects and encounters	
Boundary objects Repositories Ideal types Coincident boundaries Standardized forms	Facilitate interconnections between organizations when bridging boundaries
Boundary encounters	Visits, meetings and conversations

Competent management of end-users and their requirements can bring both short and long-term benefits for the organization. The productive coordination of knowledge differences between sub-organizations may decrease transaction costs and increase value adding activities (Santos and Eisenhardt, 2005; Hakansson and Snehota, 2006). Even so, long-term and short-term goals are often conflicting and different organizational strategies concerning organizational design are used, which complicates coordination. Additionally, previous research has found that PBOs in general tend to concede carefulness in the management of the lower organizational level, that is, the projects are allowed to maintain a high degree of autonomy. This circumstance has been found to complicate knowledge coordinating initiatives (Swart and Harvey, 2011). Nevertheless, PBOs would probably benefit from the competent coordination of end-user related knowledge in order to productively (a) manage known end-users and their requirements in projects, (b) manage unknown end-users in projects, and (c) coordinate knowledge processes between the PBO and, for example, the marketing and the maintenance and operation departments.

2.2.1 Known end-users

Management of end-users, both over the long and short-term, involves crossing diverse boundaries in order to understand end-users' real needs. Integrating knowledge efficiently among individuals with distinct expertise and backgrounds, often requires some degree of common knowledge or common ground. Common knowledge can be established with a common (a) language, (b) symbolic communication, (c) commonality of specialized knowledge, (d) shared meaning and/or (d) recognition of individual knowledge domains

(Grant, 1996b). In Paper I, Appendix I, a number of tools and methods for managing known end-users and their needs and requirements are presented. These tools are necessary as the relationship between the partners is often unproductive due to different boundaries, such as culture, experience and area of expertise. The literature review in Paper I suggests that existing methods in various ways attempt to increase collaboration and communication between professional advisors and end-users (see Appendix I). The implication is that the intent of methods and tools is to increase the degree of common knowledge among partners and thereby improve knowledge processes (in accordance with Grant, 1996b) so that suitable products and relationships can be developed.

The tools and methods suggested are collaboration forms and forums, such as workshops, study tours, observing end-users working and building of mock-ups (see Appendix I). From the perspective of knowledge type, these activities can be regarded as encultured knowledge, that is, a process of achieving common understanding with the intention of comprehending end-users' embrained and embodied knowledge, through the establishment of embedded knowledge, that is, developing routines among professionals (in accordance with Blacker, 1995). It has also been found that these methods often only cover one phase of the process and that they provide guidance on how to initiate processes but not how to act upon the results, the discussions and the interactions that are generated. Some of the methods are criticized for being too complex to be useful in practice (see Appendix I). Previous research reviewed in Paper I, Appendix I, reveals the tendency to: (a) blame complexity instead of embracing it; and (b) employ an absence of routines for managing gained insights, that is, how to embed the knowledge. The literature review in Paper III, Appendix III, focuses upon the process of managing known end-users and building up knowledge bridging capabilities to improve interactions. When connecting the two literature reviews in Paper I and III (Appendix I and III), knowledge gaps emerge. The identified methods and techniques (i.e. workshops, study tours, observing end-users working and building of mock-ups) in these two studies, mainly focus upon boundary objects and encounters, and only indirectly explain and emphasize the capability necessary for distinct bridging roles to smooth the coordination process throughout the project (see Table 2.3). Previous research also reveals a lack of capabilities for bridging and coordinating knowledge differentiations. Swart and Harvey (2011) suggest that knowledge boundaries define the self-sustained knowledge cores required to access and use the complementary and interconnected knowledge in, for example, a project. In order to bridge boundaries the project team needs to have distinct knowledge areas to jointly solve complex problems but still some degree of overlapping knowledge bases to communicate efficiently. This

implies that even though boundary encounters and objects are vital parts in boundary bridging endeavours, since they have potential to give access to knowledge and information, there is no assertion of knowledge creating or coordinating processes if the areas of expertise are too distinct.

In summary, there is a need to further investigate how capabilities are developed concerning bridging roles, and how to make use of and coordinate generated knowledge when managing known end-users. Strategies and considerations for developing exploitation and exploration capabilities concerning managing end-users require further investigation.

2.2.2 Unknown end-users

The literature review in Appendix II provides a discussion on the value creation process from information on unknown end-users' requirements collected through surveys and evaluations, that is, explicitly written information (see Appendix II). Knowledge of major customers in a region is often explicitly-articulated, generalized knowledge. This knowledge brings declarative know-about information; for example, which customers prefer an office with a sea view. Moreover, this information may, through marketing forecasts, bring conditional know-when information. This information also has potential to add value to pragmatic information, such as best practices and marketing reports (Alavi and Leidner, 2001), if suitably managed. The information, thus, has to be conveyed with signs and symbols to become encoded knowledge, and later encoded knowledge has to be incorporated into systematic routines, that is, become embedded (Collins, 1993) and be a part of the organizational memory (cf. Huber, 1991) to bring value. The intention is therefore often to recombine encoded knowledge and create cumulative learning processes. However, the future value of encoded knowledge or information stored in modules, like databases, is highly uncertain (Grabher and Ibert, 2011).

Nevertheless, collected information has the potential to engender knowledge processes in PBOs and improve their exploration and exploitation capabilities. Paper II, Appendix II, discusses this from two perspectives: (a) a cognitive, organizational and societal framework; and (b) an autopoietic system. The framework attempts to connect knowledge types to organizational operations and dominant learning outcomes. The autopoietic system perspective provides an abstract way of trying to understand why a system self-produces and reproduces itself, that is, learns and adapts to new information and situations, or not. Communication is regarded as a vital component to avoid

disintegration of the system (see Appendix II). These two perspectives emphasize the need for actively ensuring that information is collaboratively processed further, either to avoid system disintegration from an autopoietic perspective or superficial learning due to the dominance of control, efficiency and encoded knowledge (Appendix II). Even though projects are often characterized by dynamic learning (Lam, 2000), the overall PBO is characterized instead by a loosely coupled system (Lindkvist, 2004). The risks of disintegration and superficial or narrow learning are therefore present, as PBOs tend to have difficulties in creating shared understanding and common knowledge bases among subunits (Swart and Harvey, 2011). Organizations can simplistically choose between either a syntactic, semantic or pragmatic approach when bridging boundaries, that is, either collect more information, engage a translator or develop practices (Carlile, 2002). The downside of solely collecting more information is apparent, as it does not ensure that interpretation skills are improved. The second approach has greater potential to transform information into encoded knowledge that later becomes embedded. The knowledge transformer's bridging role has the potential to improve the adaption of new information into routines (see Table 2.3). The third strategy, that is, developing practices, opens up the prospect of improving know-how, know-why and know-when knowledge. If this bridging strategy is the goal, the PBO should focus upon shaping and embedding new management practices in PBOs (see Bresnen et al., 2004, Table, 2.2). This, in accordance with Bresnen et al., would require improved collaboration between temporary and permanent units in especially subsidiary PBOs to overcome a short-term emphasis and embed the knowledge in the PBO, which is not often found. Additionally, in line with Grahber and Ibert (2011), the organization needs to comprehend learning mechanisms for distinct learning processes. If cumulative learning is the goal, a recombination of stored encoded knowledge is appropriate; but if disruptive learning is the goal, recombination is not viable.

In summary, it is suggested that managing unknown end-users involves a two-step process: encode information into knowledge, and later embed it in the organization, which then needs to be adjusted to appropriate learning ecologies, that is, cumulative or disruptive. This is problematic for subsidiary PBOs since they are often disintegrated or characterized by superficial or narrow learning.

2.3 Knowledge governance strategies

Governance is derived from the Latin word 'gubernare' meaning 'to steer'. In organizations, governance provides a mental framework for decision-making and behaviour within a society's cultural, ethical and moral standards. In practice, this means that governance integrates the organization through bringing together the company's management, its board, shareholders and other stakeholders. Governance is conducted through the provision of strategies, structures and by ensuring that objectives are set, and met and can range from being consultative to law-making (Müller, 2011). The aim of project governance in PBOs is *"to ensure a consistent and predictable delivery of projects within the limitations set by corporate governance or its agreed upon subset in contracts with external partners"* (Müller, 2011, p.306). PBOs commonly incorporate four institutions for governance of projects, namely the board of directors, steering groups and sponsors, project management offices (PMOs) and programme and portfolio management.

In accordance with Söderlund (2011), projects and PBOs are either considered from a cooperation or coordination perspective. Project governance theories often belong to the cooperation perspective where the managerial problems are considered to stem from insufficient motivation and incentives. While knowledge management theories mainly adhere to the coordination perspective, this implies that managerial problems are regarded as stemming from insufficient interdependencies and communication. However, knowledge governance is immature and the research attempts carried out on this phenomenon mix concepts from both the cooperation and coordination perspective. This may be required since attempts to 'steer' knowledge is not regarded by some researchers as manageable, only enabled (see Paper V, Appendix V). The following two sections further investigate knowledge governance from two perspectives: first, the PMO as a knowledge broker in PBOs, that is, how the PMO enables knowledge processes between projects and between a project and itself. Second, the results of a literature review of knowledge governance strategies and practices in PBOs are discussed.

2.3.1 Project management office

In Chapter 1 it was found that there is a need to improve the understanding of how PBOs can incorporate lower parts of the organization to make knowledge governance and management initiatives from the top productive, over both a

short-term and long-term perspective. Prencipe and Tell found one of the greatest challenges in PBOs is to achieve knowledge processes between PBO and project, and between projects (Prencipe and Tell, 2001). The PMO has the opportunity to facilitate and support these processes if it possesses brokering competence (see Paper IV, Appendix IV).

Aubry et al. (2010b) present seven images of a PMO, based on a research study in the IT sector. The seven images are (Aubry et al., 2010b):

- an organizational entity;
- a contributor to organizational performance;
- a typology of PMOs;
- the product of power and politics;
- part of the organizational history;
- dynamic and transient entities; and
- interaction with forces.

The first three images relate to the PMO itself and the following four to the PMO in its context. This implies that the PMO can exist in a variety of structures and hold various foci. PMOs can contribute to the organization's performance through internal processes of control and information sharing (Aubry et al., 2010b). The PMO has been found to impact collaboration, accountability and skills in the organization. However, as Aubry et al. discovered, too much focus on compliance can be counterproductive and, instead of making it easier for the project managers, the PMO becomes a burden through bureaucratic requirements.

Many of the PMO roles and functions correspond with the knowledge boundary bridging roles presented in Table 2.3, for example:

- PMOs are often implemented and restructured according to a need for mediation among diverse organizational tensions (Aubry et al., 2010b);
- PMOs have the potential to coordinate knowledge and other resources between upper management and their projects (Kerzner, 2003; Walker and Christenson, 2005; Liu and Yetton, 2007); and
- PMOs can contribute to organizational learning, development of capabilities and management of interfaces and strategies (Aubry et al., 2010b).

The PMO thereby has potential to act as a knowledge broker and reduce detachment and tensions among departments. A knowledge broker is a person external to organizations that are in need of boundary bridging in their interactions. The PMO's personnel are external to the project organization and external to the top-management, but internal to the PBO. From an internal perspective, PMO functions are more in line with the concepts of facilitator and boundary organization. These include the promotion of relationship building between peer departments in managing governance, membership, ownership and control, and in supporting collaboration generally (see Table 2.3). Due to these multiple bridging roles, PMOs have been found to adopt multiple shapes depending on what the PMO is supposed to achieve (Aubry et al., 2010b). Yet it has been found that PMOs have also been implemented without clearly stated aims and goals, which have made them inefficient (Aubry et al., 2010a). In order to become a knowledge broker, the PMO has to adopt appropriate techniques and methods to knowledge types properly, which requires knowledge of antecedents for generating different knowledge processes in the organization (see Paper IV, Appendix IV).

In order to succeed as a knowledge broker, individuals in the PMO have to be skilful in translating, coordinating and aligning perspectives and participating in the process (see Table 2.3). This would, for instance, require insights into how project managers share knowledge and how they prefer to learn and operate. Previous studies of the PMO as a knowledge broker tend to focus on PMOs from the upper management perspective, neglecting the project managers' needs. Also, previous studies on project managers tend, with a few exceptions, to focus upon finding characteristics and success factors from a leadership perspective. These studies are interesting and valuable, but since the PMO puts effort into improving knowledge processes and learning loops, further understanding of project managers' knowledge sharing and learning behaviour in relation to the PMO functions needs investigation (Paper IV, Appendix IV). PMO functions are closely connected to, and often overlap, PBOs business processes. Business processes are the intra-organizational activities that link the different parts of a PBO (Gann and Salter, 2000). Business processes can either be customer, administrative or management processes (Van Der Merwe, 2002). The business processes consequently involve activities such as sharing directories, assuring the quality of documents and use of central libraries, the ability to transfer technical data across the intranet, speeding-up information flows, as well as updating current practices (Gann and Salter, 2000), which are also stated as being PMO functions (see Paper IV, Appendix IV). The result is that the PMO has the opportunity to connect business and project networks in the PBO, especially if the PMO

adopts the role of a coach (suggested by Desouza and Evaristo, 2006) and succeeds in aligning perspectives among partners. That would however require that PMO personnel support the generation of encultured and embedded knowledge in PBOs. This suggests that PMO personnel in their brokering roles have to be skilful in creating and adopting appropriate knowledge processes for different situations, and also reinvent and develop their own capabilities (in line with the findings from the literature review in Paper IV, Appendix IV).

2.3.2 Knowledge governance strategies and practices in PBOs

Is it possible to govern knowledge, that is, to steer knowledge, when some researchers suggest that it cannot even be managed but merely enabled (see Sveiby, 2001)? Müller (2011) discusses governance in organizations and remarks that they can range from being consultative to law-making, which may imply that knowledge governance should take a consultative rather than a law-making approach. From a knowledge-based perspective, the organization should adopt delayering strategies, team-based structures and strategically create internal interdependencies, as it has been shown to have the potential to stimulate knowledge creation (Grant, 1996b). How can this be achieved in PBOs that are team-based in their projects and where subunits tend to be isolated islands with their people cherishing autonomy and independence?

Business processes are interrelated to governance as they can be seen as the implementation and operation of the governance strategies that glue the organization together (Gann and Salter, 2000). Further business processes need to be connected to the project processes in order to improve the exploitation of internal knowledge. Knowledge governance strategies consequently have to cover these issues, as knowledge governance involves *"... choosing organizational structures and mechanisms that can influence the process of using, sharing, integrating, and creating knowledge in preferred directions and towards preferred levels"* (Foss et al., 2010, p.456). Previous literature has investigated knowledge governance in organizations and offers a number of notions of what knowledge governance is and should be (see Table 2.4, and further Paper V, Appendix V).

Table 2.4 Knowledge governance notions, derived from the literature review in Paper V, Appendix V.

Knowledge governance mechanisms, practices and strategies	**Authors**
Knowledge governance mechanisms Cognitive failures of knowledge governance mechanism are identified as knowledge differentiation, complexity and conflict of interests. Proposes a multiple boundary view of the organization wherein the boundaries may include internal and external relationships.	(Grandori, 2001)
Governance of intellectual capital Essential for knowledge intensive organizations' survival.	(Keenan and Aggestam, 2001)
Knowledge governance in project ecologies Trust, reputation and professional ethos impacts knowledge sharing and integration	(Grabher, 2004)
Knowledge governance mechanisms Quasi-hierarchical command for tacit and sticky knowledge. Constructed interaction for articulable knowledge. Coordinated transactions for codified knowledge. Emphasis on the importance of vertical and horizontal Coordination activities in organizations to govern different knowledge creating processes.	(Antonelli, 2006)
Relational governance mechanisms Steering committees, project groups, expert committees and face-to-face meetings at top-management level.	(Hoetker and Mellewigt, 2009)
Formal governance strategies Appropriate when planning and implementing knowledge management strategies.	(Kannabiran and Pandyan, 2010)
Relationship-based employee governance mechanisms. Trusting relationships is a governance mechanism that encourages employees to invest and contribute in organization-specific knowledge activities. More mechanisms are needed, like the impact of motivation (especially from executives) on exploiting organization-specific resources.	(Wang et al., 2009)

In Chapter 1 it was also found that knowledge governance theories need further development as they, for example, do not differentiate between types of organization or sub-organizations within a larger corporation. Paper V,

Appendix V, consequently reviewed existing literature on knowledge governance in relation to the PBO and developed five propositions.

- Formal governance mechanisms are less effective than relational ones for knowledge governance practices in PBOs.
- Knowledge governance mechanisms used in PBOs reflect executives' knowledge of antecedents for knowledge creation processes.
- For PBOs to be efficient in knowledge governance, their knowledge governance mechanisms need to be adjusted to appropriate their learning landscapes.
- Knowledge brokering activities are suitable knowledge governance mechanisms for managing knowledge differentiation and conflict of interests in PBOs.
- Executives' relational governance impacts knowledge exploitation in PBOs.

Due to the dynamic and multidimensional nature of knowledge, it is suggested that the governance of knowledge needs a more distinct approach than project governance. Knowledge governance cannot, as with project governance, ensure a consistent and predictable delivery, but rather needs to provide a mental framework for decision-making and behaviour within a society's cultural, ethical and moral standards (in the sense of Müller, 2011) that embraces knowledge as the PBOs most vital resource.

If knowledge is viewed as the organization's most vital resource, what contingency factors are appropriate to consider when developing knowledge governance strategies in PBOs? In effect, the PBO acts in an inter-organizational environment with diverse goals and priorities among actors. In returning to Table 2.2, it is evident that a multidimensional approach is necessary, as the dimensions to consider for establishing knowledge processes and the development of capabilities in PBOs are numerous; but which ones are essential from a knowledge governance perspective? Moreover, is it appropriate to mix coordination and cooperation activities in theories and investigations and, if so, what are the implications? Many questions exist due to the many knowledge gaps that are in need of further investigation with respect to the knowledge governance of PBOs.

2.4 Conclusion

This research adopts a knowledge-based view of PBOs and has an intertwined knowledge view between process and capability. The intention is to understand what capabilities are needed to achieve knowledge processes and how knowledge processes create capabilities to act. From the literature review, six core concepts emerge: knowledge, knowledge processes, capabilities, boundaries, knowledge governance and PBOs. These concepts are defined as follows.

Knowledge is regarded as a multidimensional (i.e. it contains tacit and explicit dimensions) and dynamic concept, which exists in five forms: encultured, embrained, encoded, embodied and embedded. The focus here lies in organizational knowledge that is*"… how to organize and manage projects, coordinate different problem-solving activities, determine goals and incentives, allocate resources and assign personnel, and resolve disputes"* (Pisano, 2000, p.132).

Knowledge processes refers to transferring, sharing, creating and integrating processes. From an organizational perspective, organizations need to have knowledge of when to implement endeavours that encourage appropriate knowledge processes, that is, know: (a) the preconditions for each knowledge process; (b) how to support/manage/govern them; and (c) what the expected knowledge outcomes of these processes should be.

Capabilities are regarded as what happens between intention and outcome in organizations, which is a very broad interpretation. Organizations have a number of capabilities, some general and some organization-specific, which develop, change or are refined over time. This research mainly focuses on capabilities the organization has to build up strategically in order to coordinate knowledge processes competently and efficiently, both internally and externally, and thereby manage end-users' needs and requirements.

Boundaries refer to constructs that emerge in collaborations and interactions among individuals with distinct experiences, knowledge-bases and expertise. These boundaries are both enablers and barriers. They are enablers, as the interactions may enlighten and broaden an individual's perspective and knowledge-base. They are barriers, as interactions may be hampered due to misinterpretations and conflicts resulting from the inability to (a) take the other party's/parties' perspective and goals into consideration, (b) understand the other party's/parties' organizational cultures and norms and (c)

communicate with a common language and/or on the same level as the other parties.

Knowledge governance involves *"... choosing organizational structures and mechanisms that can influence the process of using, sharing, integrating, and creating knowledge in preferred directions and towards preferred levels"* (Foss et al., 2010, p.456). Knowledge governance is thereby integrated with other governance initiatives in the organization, for instance corporate and project governance.

PBOs are defined as organizations in which the majority of products or services are delivered through projects for either internal or external customers. The PBO may be a standalone organization or a subsidiary of a larger organization. In the latter case, it is often part of a composite organization.

This literature review has identified the following areas in need of further investigation.

- Development of capabilities concerning bridging roles and exploitation and coordination of generated knowledge when managing known end-users in PBOs.
- Strategies and considerations of developing exploitation and exploration capabilities concerning managing end-users in PBOs.
- Processes for transforming information into encoded knowledge and further into embeddedness in the PBOs.
- Strategies and practices for PMOs to connect business and project networks in the PBO.
- Strategies and practices to generate encultured and embedded knowledge through the PMO in PBOs.
- PMO personnel, in their brokering roles, have to be skilful in creating and adopting appropriate knowledge processes for different situations and also reinventing and developing their own capabilities.
- Contingency factors for developing knowledge governance strategies in PBOs.
- The appropriateness of mixing knowledge perspectives.
- The consequences of mixing coordination and cooperation activities in theories and investigations.

This literature review is revisited in Chapter 5, where it is compared with, and developed in the context of, real estate to obtain an improved understanding of the underlying mechanisms in PBOs.

3. Research methodology

This chapter presents the philosophical lenses this research has adopted and discusses how the research has been conducted.

3.1 Structure of the chapter

Existing philosophies in science are based on different grounds and regard the world and knowledge differently. Adopted philosophy therefore needs to be clarified to be able to interpret and judge research results (Morgan and Smircich, 1980). In the following subsections, I will argue for the choices made from: (1) the ontological and epistemological perspectives which are the philosophies; (2) the rationale of the approaches, strategies and choices; and (3) the techniques and procedures (see Figure 3.1). This is followed by a discussion on the quality of this research and its limitations. Each section starts with a broad explanation of the section's topic and then narrows down to this specific research.

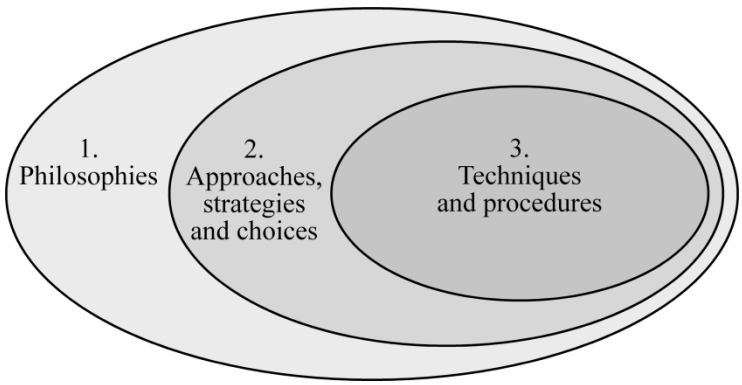

Figure 3.1 The chapter's logic, inspired by the research 'onion' (Saunders et al., 2009).

3.2 Philosophies

"The Chinese philosopher is one who dreams with one eye open, who views life with love and sweet irony, who mixes his cynicism with kindly tolerance... He is seldom disillusioned because he has no illusions, and seldom disappointed because he never had extravagant hopes. In this way his spirit is emancipated." (Yutang, 1937, p.1*)*

Yutang (1937) discusses one way of seeing life and the world; what it is, and how you should position yourself to understand and manage it. He emphasizes the need to be emancipated, that is, detached from everyday activities, that is, the context you are acting within, and to see it for what it is in order to understand and explain the world. He also uses words with subjective judgments like love, sweet irony, cynicism and kindly tolerance, implying that he believes individuals' value-systems impact on how the world is understood. Yutang would be, from what has just been mentioned, positioned on the right side of the spectrum in Figure 3.2. Figure 3.2 illustrates different ways of seeing the world (ontology) and the nature of knowledge (epistemology) and this is what philosophies discuss (Biedenbach and Müller, 2011). Plato, for instance, described knowledge as justified true beliefs, implying that in order to accept something as knowledge we must justify truths and beliefs with different evidence. Trustworthy research processes and results entail using proper research design to adopted philosophy and the underlying research question (Biedenbach and Müller, 2011). Philosophies are, therefore, needed in research as they provide perspectives on how the world is disposed and what knowledge is, and thereby help us to justify our truths and beliefs. However, to be both emancipated from life and understand it when in its midst is often difficult; therefore it is vital to accept, as Kierkegaard stated; *"[it] is perfectly true, as philosophers say, that life must be understood backwards. But they forget the other proposition, that it must be lived forwards"* (quoted in Williams (2009, p.309)).

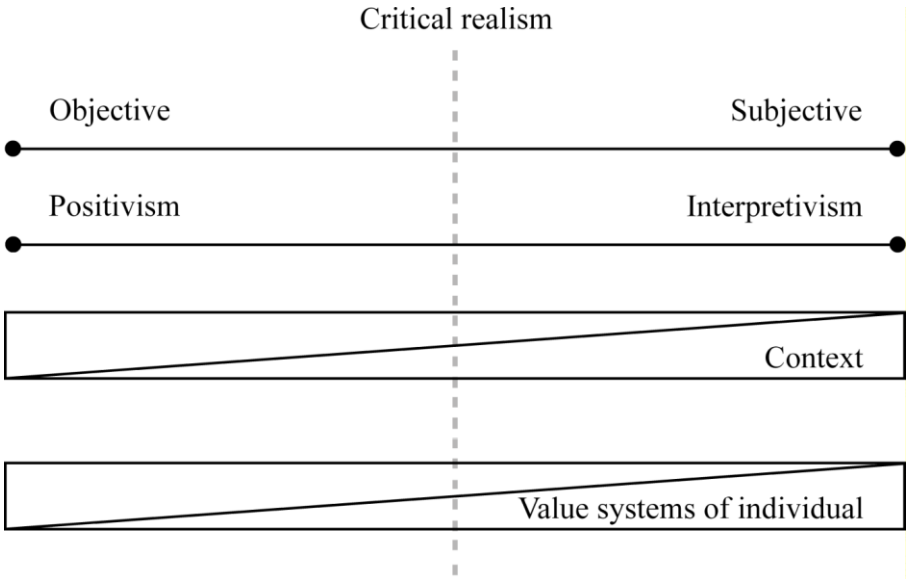

Figure 3.2 Three ways of seeing the world: positivism, realism and interpretivism.

Note: the top of Figure 2 shows the ontological perspective, followed by the epistemological perspective, the first box symbolizes the researcher's belief in the contextual impact and the lowest box symbolizes the axiological (role of values in inquiry) perspective. The impact increases from left to the right, that is, the interpretivist believes contextual influence on research results to be high, whereas the positivist tries to diminish it.

Previous research has adopted different ways of looking at organizations. They can be seen as objective, technically-measurable instruments for achieving desired outcomes. Organizations can also be regarded as subjective, social systems in need of interpretation, or as a combination of the two (Astley and Van de Ven, 1983; Daft and Lewin, 1993; Nayak and Chia, 2011). The first perspective sees the world through an objective lens, that is, the positivist perspective of the world (see Figure 3.2). Positivism is based on natural science; it has a functionalistic perspective and is concerned with material things that exist independent of human cognition. Impact from an individual's value systems and contextual factors should be diminished. The positivist attempts to find general claims to predict and control certain outcomes (Morgan, 1990;

Guba and Lincoln, 1994; Bechara and Van de Ven, 2011). The subjective way of seeing the world correlates to the interpretivism or postmodernism perspective (Bechara and Van de Ven, 2011). Proponents of this view claim the world to be socially constructed, where each phenomenon is unique (i.e. the impact of the context is high, as shown in Figure 3.2) and knowledge is created from the interaction among individuals (i.e. the value systems of the individuals impact). Prediction of certain outcomes is not relevant as the world constantly changes and develops (Morgan, 1990). A third way of seeing the world embraces both an objective and subjective reality, which is represented by, for example, the realism perspective. Critical realism is one version of realism that acknowledges contextual factors impacting upon a setting, but argues that there is no reason not to believe that the same phenomenon could occur in a similar setting. Objects are considered to exist independently of human beings but can never be fully understood, as they are subjectively interpreted by humans (Bhaskar, 2009). However, most researchers are not purists when it comes to the adoption of philosophies (Deetz, 1996). This research attempts to adopt the philosophy of critical realism in line with Roy Bhaskar's perspective as described below.

3.2.1 On critical realism's ontology and epistemology

Ontology describes the nature of reality; in other words, what the world must be like for science to be possible. Epistemology defines what knowledge is and how we can justify our claims about knowledge (Burrell and Morgan, 1985; Tsoukas and Chia, 2011).

The fundamental stance of critical realism is the existence of an objective world, but that our knowledge of it is subjective (Bechara and Van de Ven, 2011). This implies that we can never fully understand it, as the picture each person describes is only a shadow of that person's mind and its interpretation of reality (Bhaskar, 2008). The goal of research is not to predict or construct the world, but to highlight and demonstrate multiple possible explanations of a phenomenon (Outhwaite, 1983; Easton, 2010; Bechara and Van de Ven, 2011). The realist researcher therefore uses different perspectives when investigating a phenomenon, as no predefined methodology or criterion to judge the truthfulness of our knowledge exists. This does not imply that anything goes, rather that the researcher needs to be open to different explanations and perspectives in approaching the 'truth' (Bechara and Van de Ven, 2011).

The real world is regarded as an open complex system consisting of natural mechanisms and social structures and events (see Figure 3.3). The events are produced by the underlying structures and mechanisms. The researcher aims to understand the underlying structures and mechanisms through interacting with the world and gaining information on events and their patterns (Bhaskar, 2008).

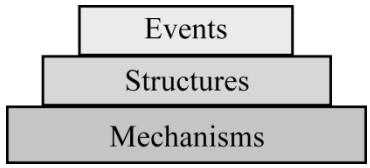

Figure 3.3 The critical realist view of the world, i.e. the events, structures and mechanisms, in accordance with Bhaskar (2008).

Due to these layers, critical realism is sometimes labelled depth realism, because it attempts to understand underlying mechanisms (Blaikie, 2007). The relationship between ontology and epistemology is intertwined in critical realism, as Bhaskar (2009) uses different kinds of knowledge to illustrate the world. The elements of critical realism are (Bhaskar, 2008):

- the empirical domain that is made up of experiences and is obtained by direct or indirect observations;
- the actual domain that is made up of events whether or not they are observed; and
- the real domain that is made up of the processes (i.e. structures and mechanisms) that produce those events.

These three domains represent different objects of knowledge: transitive and intransitive. Transitive knowledge is socially created knowledge, represented by the empirical domain. Intransitive knowledge is independent of human mind, represented by the actual and the real domains (Tsoukas, 1989; Bhaskar, 2008; Bechara and Van de Ven, 2011). The intransitive knowledge is the goal of research, but transitive knowledge is needed to produce it. Furthermore, the objects of science are the structures not the events. However, events are empirically achievable and necessary in order to understand non-empirical structures (Bhaskar, 2008). This implies that the realist researcher searches for intransitive knowledge of structures and mechanisms by investigating experiences and events. Critical realism emphasizes the need for a critical stance

with respect to empirical data, previous research and the researcher's own thoughts and reasoning. It is assumed every person is influenced by previous experiences and gives different significance or power to different events and things which influence the discovery of intransitive knowledge (Bhaskar, 2009).

This research is investigating knowledge processes in PBOs in the real estate sector. The aim is not to make general claims but to improve understanding of how underlying intrinsic conditions impact knowledge processes in PBOs. This implies that different perspectives are required to identify underlying patterns and relationships between mechanisms, structures and events. Moreover, I view organizations as both subjective and objective, and I am sceptical about stating that either everything is socially constructed or that we can understand the world only through objective observations. Critical realism is therefore an appropriate choice.

3.3 Approach, strategy and choices

All research aims to add to the existing body of theory and, depending on the nature of the phenomnon and adopted philosophy, different strategies are appropriate. In this section, strategies that have been chosen for this research are presented and the rationale of these strategies, from the perspective of critical realism, is explained.

Qualitative research should be viewed as an approach rather than a set of techniques (Morgan and Smircich, 1980). Research processes can take an *inductive, abductive* or *deductive* line of reasoning. In gerenal terms, inductive reasoning implies that the researcher, as openly as possible, explores different situations impacting, for example, knowledge sharing and integration in PBOs. Abductive reasoning starts from an empirical basis, such as induction, but also includes theoretical preconceptions and continuous reinterpretations between empirical and theortical data (Alvesson, 2009). Deductive reasoning starts with exisiting theory, formulates propositions/hypotheses, and tests them empirically (Blaikie, 2007). This research adopts a qualitative multi-method strategy combining abductive and deductive reasoning in order to add to the existing body of theory. In this thesis, abductive reasoning is used in four qualitative case studies, followed by a deductive qualitative cross-sectional study to triangulate findings from the case studies.

Investigating the world abductivly can, of course, also be questioned: is the topic so new and unique that it is necessary? Could the research not have used deduction from the start? This research aims to improve understanding of complex phenomena to which exisiting research findings, (i.e. the literature), could not provide a comprehensive answer. The literature reviews produced suppositions of the complexity; however, more empirical data and thoroughly developed theories were needed. These circumstances are suggested in order to validate the approach and are in line with Blaikie's (2007) suggestion.

From a critical theory perspective, Blaikie (2007) states that it is most common to use induction and abduction; but since triangulation is one of the most commonly proposed validation methods in critical realism research (Easterby-Smith et al., 2008), the last deductive study is an appropriate choice as it enables further reflection. This research adopts a step-by-step process and is visualized in Figure 3.4.

The study is cross-sectional since no longitudinal studies were used (Saunders et al., 2009). Nonetheless, interaction with three case companies continued for three years as different aspects of those organizations were explored. This successively improved emic (i.e. insider (Patton, 2002)) understanding of those organizations over time. Even though the research aims to take an emic view of the phenomena under investigation, it is acknowledged that, despite those efforts to understand the reality as thoroughly as possible, the reality will never be fully understood. Since reality is too complex and dynamic, and individuals are affected by their value systems and recent events (Bhaskar, 2008) (see Figure 3.2), a humble yet critical approach towards reality, the research process and findings was adopted. This has resulted in a methodological approach embracing multiple sources of evidence, investigation methods and techniques in order to understand 'reality' better.

3.4 Research process

Figure 3.4 illustrates the steps in the research process. The research question was initially broad and then narrowed down as gaps and themes emerged. Case studies were used in steps 1-4, to explore and investigate the research question. In step 5, a survey was used in order to validate previous findings but also to improve the understanding of new empirical data. Every phase includes a collection of empirical data, in this case they were interviews, workshops, meetings and documents (E), and theoretical data gained through literature

reviews (L). The outcome of every phase was a paper in a peer-reviewed research journal.

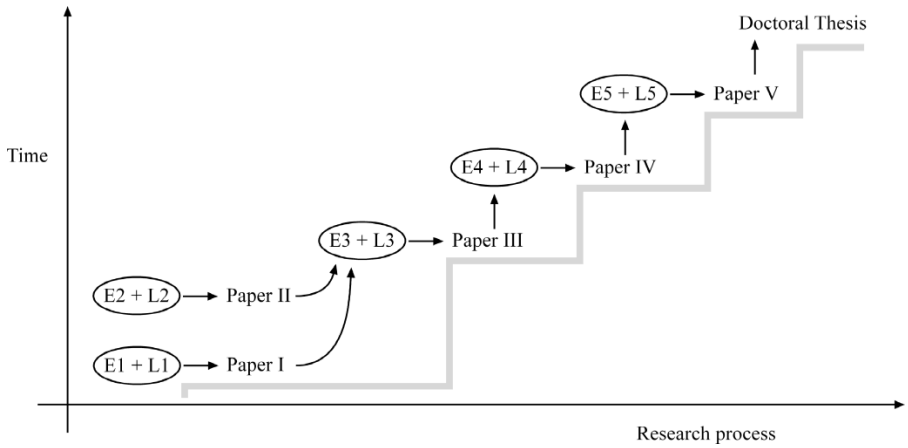

Figure 3.4 The research process.

Note: every phase comprises a collection of empirical data (E) and literature (L). Paper I was published in *Facilities*, Paper II in the *Project Management Journal*, Paper III in *Construction Management and Economics*, Paper IV and Paper V in the *International Journal of Project Management*.

This research was part of a Nordic research project, which predetermined the research design for the first two steps. The Nordic project investigated how well the construction sector succeeded in fulfilling the needs and requirements of end-users in the construction process. The final report of the project does not form any part of this thesis, although the project influenced the underlying research. The project improved the understanding of similarities and differences in purposively selected distinct contexts within the sector. Paper I and II is based upon the studies conducted in the research project. Paper I investigates existing methods for capturing needs and requirements of known end-users in two real estate organizations in Sweden. In Paper II, the management of unknown end-users' needs and requirements was investigated in two Swedish cases. The findings from these two papers generated further questions that were investigated in Paper III. In Paper III, brokering strategies with respect to external end-users are explored in real estate organizations in Sweden and Finland. This latter study validated another study concerning the boundaries between the project department and the rest of the PBO, and was investigated with cases drawn from Sweden and Australia (see Paper IV).

Propositions, from a knowledge governance perspective, were developed from the first four studies (presented in Papers I-IV), investigated in a cross-sectional sample survey in Australia, and presented in Paper V. The final stage of this research process is the writing-up of this thesis, which brings together and then analyses earlier findings. This has enabled variables and constructs to be identified and set into a tentative framework. The papers are found in Appendix I, II, III, IV and V respectively. The methods and techniques used will be further discussed in the following sections.

3.4.1 Case studies

What is a case? A case may be (a) theoretical and/or empirical, (b) bound to an object or a process, or (c) understood as general or specific. Often cases are defined by boundaries around places and time periods, and are either single or multiple. Even so, the definition of a case varies widely in social science depending on the traditions and philosophies adopted (Ragin, 1992b). Yin (2003) argues that case studies are useful when investigating complex and contemporary phenomena in real world contexts over which the investigator has no or little control. Additionally, Eisenhardt (1989) describes case studies as: *"a research strategy which focuses on understanding the dynamics present within a single setting"* (Eisenhardt, 1989, p.534).

Tsoukas (1989) argues that case studies are inappropriate from a realist perspective, since the main goal of realism research is explanations. This is not, however, an entirely valid statement since, from a realism perspective, Bhaskar (2009) stated that the main goal is not to be predictive, but exclusively explanatory: this does not denote that, for example, exploratory or evaluative studies should be rejected. Yin (2003) described case studies as having divergent purposes: they can explain, describe, explore or evaluate. Easton (2010), additionally, argues that critical realism is an ideal match for case studies since the events, entities, structures and mechanisms act as a guide for how one relates to and understands the world.

Case studies help to explain causal links in real-life interventions, in order to retain a holistic and meaningful characteristic of the reality under investigation (Yin, 2003). It therefore becomes crucial to find objects and processes that are representative of the phenomenon under investigation (Platt, 1992). A case can claim to demonstrate how and why the phenomenon occurs in this specific setting, otherwise the theory developed from the cases can be questionable (Walton, 1992). Case studies often combine theoretical and empirical realms as

a means of sharpening and refining emerging theory (Ragin, 1992a). The critical realist seeks to identify underlying mechanisms that generate a social phenomenon (Alvesson, 2009). Identifying underlying mechanisms often requires iterative processes of data collection and reflection (Easton, 2010), which were adopted in this research through abductive reasoning and which will be further explained.

The strength of using multiple case sampling is that it can add confidence to the findings from a single case, as it is about: *"specifying **how** and **where** and, if possible, **why** it carries on as it does"* (Miles and Huberman, 1994, p.29) (emphasis in original). Multiple case studies thereby provide an opportunity to deepen understanding and explanation of the phenomenon in question, and so develop a coherent theory (Miles and Huberman, 1994; Eisenhardt and Graebner, 2007). Easton (2010) argues that critical realism case studies are appropriate for bounded and complex phenomena such as organizations or inter-organizational relationships. This research is aligned with those thoughts, as it strategically uses cases to build constructs and find explanations, on a group and/or organizational level, in order to improve understanding of underlying patterns and relationships concerning knowledge processes in those settings.

The conclusions from each case study process generated questions to be further investigated in new studies, which led to a deeper investigation and understanding of the phenomena. The study procedure followed is illustrated in Figure 3.5. The procedure starts with designing a case study protocol, where the questionnaire is based on a literature review, in line with Yin's (2003) recommendations. The first data collection is analysed in an iterative process and compared with the literature, followed by a second round of empirical data collection with a narrower focus. In this research, each case has been analysed separately before cross-case analysis was performed in line with Eisenhardt (1989). The risk of this strategy is that findings from the earlier cases colour data collection in subsequent cases. This might mean that possible findings are not observed as they are outside the scope. Yet, at the same time, previous cases can contribute to the quality of the research as pre-knowledge increases. Consequently, more precise questions could be asked, which might instead have increased the quality of the studies and thereby the rigor of the constructs developed. If all data are to be collected in one step, research has to have a well-grounded scope and well-established research questions. That strategy was not possible here due to, for instance, the nature of existing theories. It is common in qualitative research that research questions and constructs are tentative in nature and refined during the process (Eisenhardt, 1989), which was the case in this research.

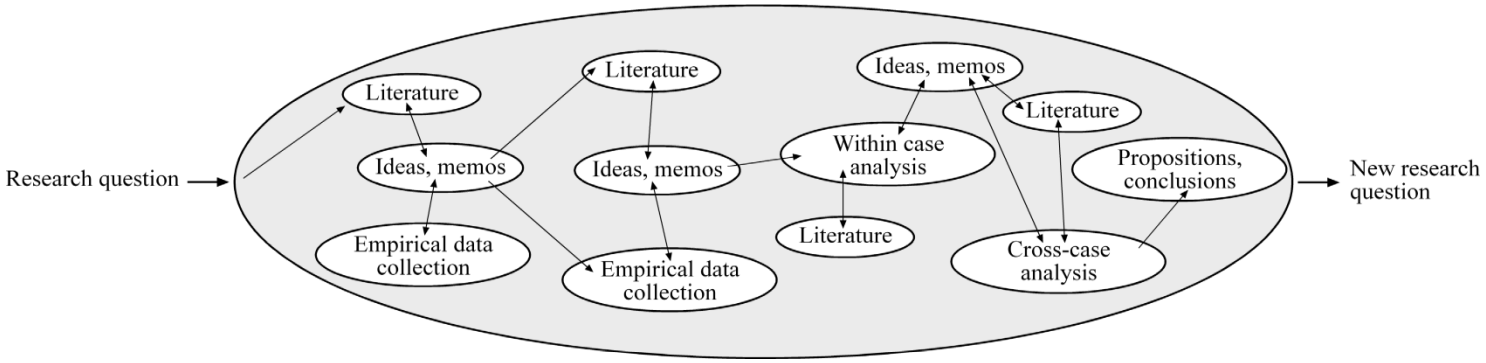

Figure 3.5 The case study process.

Note: the research question is the input and a new research question is the output, in addition to the conclusions and propositions. The illustration shows the abductive study process used in the four case studies.

Ideas/memos were continuously written by the researcher as themes and categories emerged (see Figure 3.5). The process is abductive since literature, empirical data and personal reflections led to new learning and ideas. That was followed by a new round of data collection or comparison with the literature and empirical data in accordance with Alvesson (2009). All cases were stored in a case study database as suggested by Yin (2003). Each study involved a number of case organizations. Table 3.1 describes the number of case organizations, and the roles and numbers of interviewees. A more detailed description of the interviewees is found in Appendix VI: Interviews and Workshops.

Table 3.1 The case studies in this research.

Case name	**Case organization**	**Roles of the interviewees****	**Numbers of interviews****
Study I	University (SE)	End-user Project manager* Property manager Architect	13****
	Hospital (SE)	End-user Project manager Property developer	4****
Study II	Housing (SE)	Marketing manager	2
	Franchises (SE)	Marketing manager	1
Study III	University (SE)	Project manager* Architect End user	9
	Hospital (SE)	Project manager* Facilities planner	4
	University (FI)	Architect Briefing consultant Project manager Workplace specialist Workplace consultant	6

Table 3.1 Continued.

Case name	Case organization	Roles of the interviewees**	Numbers of interviews**
Study IV	Education (SE)	Project manager PMO personnel/ Middle managers	15
	Health care (SE)	Project manager PMO personnel/ Middle managers	5
	Residential (SE)	Project manager PMO personnel/ Middle managers	5
	Engineering (AU)***	Project manager PMO personnel (2)	9
	Telecom (AU)***	Project manager	7
	Support service (AU)***	Project manager PMO personnel (2)	14
	Mining (AU)***	Project manager	9

Note: * i.e. end-user project manager, project manager for early phases and project manager client.
** a more detailed presentation of interviews and respondents is found in Appendix VI, Interviews and Workshops.
*** these interviews were a part of the study but conducted by the co-author in the paper (see Appendix IV, Paper IV).
**** a correction is needed concerning the interviews in Paper I as the abstract states that it is built upon 12 interviews – this should have been 17 – seven end-users and nine professionals.

Sampling approach

Eisenhardt (1989) claims that in *theoretical sampling*, it is important to select cases that are either likely to replicate existing theory or extend emergent theory. Non-probability sampling was mainly used when selecting the cases. In non-probability sampling the probability of each case being selected is unknown (Saunders et al., 2009). In this study, members in the case organizations elected to participate through the Nordic research project as they considered the topic interesting. After completion of the project four case organizations elected to participate in *studies III and IV* when asked. Saunders et al. (2009) argue that sample size is ambiguous for non-probability sampling. Rather, sample size depends upon the research question(s) and objectives, but

also upon the richness and validity of data, for example interviews (Saunders et al., 2009). Data were selected until saturation was reached following Saunders et al. (2009)'s aforementioned recommendations.

The case organizations in *study I,* were chosen because they (1) involved end-users throughout the construction process and (2) have long-term relations with the end-user organization. The sampling therefore followed *literal replication logic* (i.e. predict similar result) in line with Yin (2003). Literal replication was also chosen in study II as the two case organizations manage unknown end-users in their projects and (3) struggle to creating value from surveys and evaluations.

Study III used a *theoretical replication logic* (i.e. predicted contrasting results but for predictable reasons (Yin, 2003)) to contrast the Swedish cases (in study I) with one extreme case in Finland. It was regarded as extreme because of its stark contrast to practices in Sweden. This Finnish case was selected as it had the potential to reveal deeper and more nuanced information of brokering practices between end-users and the project organization. This strategy followed Yin's (2003) and Flyvberg's (2006) suggestions. The cases in the fourth study, *study IV*, also followed theoretical replication logic, including cases from different sectors and countries. The desire was to get a more nuanced picture of knowledge brokering between projects, and between projects and the PBO.

Some might regard this process as having a tendency to become broader and broader. From one perspective it has, since the researcher needed to study a still broader range of organizations and include more organizational levels to be able to dig deeper into the research question under investigation. It was necessary to improve understanding of the underlying mechanisms impacting knowledge processes and capabilities in PBOs. The sampling process therefore follows Eisenhardt's (1989) suggestion of case selection, that is, sometimes there is a need to extend theory to reach a better understanding of a complex situation. Consequently, it might require moving beyond the initial boundary to understand the phenomenon, find the underlying mechanisms and determine causality (Easton, 2010), that is, become broader to be able to identify the essentials.

3.4.2 Cross-sectional sample survey

Surveys are appropriate for collecting information and data in a standardized form from groups of people. An underlying and commonplace reason for

undertaking a survey is to understand something about a given population. Surveys can either have a complete (census) or partial (sample) coverage of a population. The nature of information and the purpose of the study determine which approach is appropriate. If information is straightforward and general statistical claims are intended then a census survey is appropriate. On the other hand, if rich (qualitative) information is needed and a non-statistical understanding is the goal then theoretical sampling will suffice (Moser and Kalton, 1971). The latter approach was chosen for this research, as the goal of the study is not to make generalizing claims; moreover, qualitative data were needed. In some situations, the researcher uses a survey to confirm findings derived from case studies. In this sense, surveys and case studies are complementary methods, although quite different in their purpose and construction (Moser and Kalton, 1971). Bryman (2006) mapped out and analysed 232 social science articles that combined qualitative and quantitative methods and found that, most commonly, semi-structured interviews were combined with a quantitative survey. Qualitative surveys are thus less common (Toerien and Wilkinson, 2004). When undertaken they often consist of questionnaires or structured interviews based on pre-tested questionnaires, which are positivistic in nature (Dick, 2006). Surveys in social investigations can however contain a range of data collection techniques, from closed questions to open questions, as part of in-depth interviews. The appropriateness of what to use depends on the purpose of the investigation (Moser and Kalton, 1971).

A sample survey was conducted in order to triangulate findings from the case studies so as to validate them in different contexts. Surveys often try to diminish contextual factors (Dick, 2006), while this survey embraced contextual factors. These contextual factors were necessary to gain a more comprehensive understanding of differences and similarities of the phenomena under investigation. This study consequently took a qualitative approach, and used theoretical sampling until theoretical saturation was reached (Moser and Kalton, 1971).

A non-probabilistic purposive sampling approach was chosen. The researcher scanned the real estate market in Australia, in order to purposively identify organizations from which it might be possible to gain heterogeneous responses to the research question. The organizations were sampled according to the following criteria. First, every organization had to be a PBO in the construction/real estate sector. Second, the organization had to: (a) demonstrate a desire for excellence or strive for improvements (i.e. be awarded, be at the leading edge of (for example) sustainability solutions, largest in the market, have good relations with its end-users and have a good reputation); (b)

match the case organizations (i.e. provide health care, housing or university facilities); or (c) provide initiatives that improved the sector as a whole through certification and training. As a result of this scan, emails were addressed to the organizations, and from the responses, a number of them were selected to participate in the study. Whether they elected to participate due to a genuine interest in the research question or just wanted to support research in general was unclear. The survey was based on 18 in-depth semi-structured interviews, with 19 individuals coming from 14 organizations (see Appendix VI, Interviews and Workshops, Table 1). The interview questionnaire was extracted from the questionnaires used for the case studies (see Paper V).

3.5 Techniques and procedures

3.5.1 Data collection

The empirical data in this research are qualitative. The strengths of qualitative data are, for example, (1) their *local groundedness*, that is, they are collected in a specific case embedded in its context, (2) *richness* and (3) a *focus on real experience* which provides an opportunity for locating the *meanings* people give to events, processes and structures in their social world. The downside of qualitative data is information overload resulting in a need for robust data analysis techniques (Maanen, 1979; Miles, 1979; Miles and Huberman, 1994). The data analysis techniques used in the research are described in the section on *Data analysis*.

Semi-structured interviews

Each interview had an interview guideline designed for each study. The interview guidelines were built upon a literature review to ensure competent questions were asked. The interviews were semi-structured and had a low degree of standardization. The questionnaire was not strictly followed but adapted to the specific situation, person and dynamics of the conversation in accordance with Schwalbe and Wolkomir (2002), Kvale and Brinkmann (2009) and Trost (2010). This choice was mainly based on the complexity of the research question, and a desire for a comprehensive picture of the interviewees' experience, without interfering too much with the interviewee. This approach opened up the possibility of capturing aspects about which the interviewer might not be aware. Leading questions were avoided and body

language and confirmations were used to make the interviewee feel comfortable, and understand that the interviewer was interested in the interviewee's point of view. This approach follows Adler and Adlers' (2002) thoughts about interviewing different personalities. Silence was more and more purposively used to make the interviewee talk during the interview process. Follow-up questions were used, for instance: why do you think this occurs? What is the value of this process? How would you like it to be? Why is that a problem/benefit? What do you think the consequences are of that situation? These questions were used to obtain a more comprehensive and deeper understanding of the interviewee's perception of the situation, as they had to reflect on their answers. In terms of critical realism, this means that the interviewer tried to make the respondent reflect on the events, and the structures that generated those events in line with Bhaskar (2008) (see Figure 3.3).

The interviews are presented in Appendix VI, Interviews and Workshops, Table 1. Notes were taken in interviews 1 to 26 inclusive, and interviews 27 to 61[3] inclusive were recorded. Each interview was documented. The notes were extended into comprehensive stories based upon the notes taken at each interview and the records were then transcribed. Every interview text was sent back to the interviewee for validation. Reflections on the interviews were drafted and impressions and ideas, which emerged during the interviews, were noted.

Selection of interviewees

Interviewees were selected based on criteria such as their knowledge of the organization, appreciation of its processes and activities under investigation, as well as experience of other organizations.

Study I

The purpose of study I was to obtain a better understanding of the management of end-users and their needs throughout the construction process. Therefore, interviewees were purposively selected to cover (1) project managers from the property organization, project managers from the client organization and project managers from the end-users' organization, including externally-hired project managers; (2) architects, since they were interacting with end-users; (3) participating end-users in the project; (4) non-participating end-users

[3] In addition to these 61 interviews, 39 interviews were conducted by the co-author of paper IV.

in the project; (5) real estate managers, since they take over the facility after the project's completion; and (6) a strategic planner in the real estate company.

Study II

The purpose of this study was to investigate how end-user needs were managed when they were not consulted. The study started with a literature review that was followed by a workshop with nine participants (five industrial members and four researchers). The workshop uncovered interesting aspects for further investigation. A case study protocol was developed from those initial studies. The study was built mainly on document analyses but also involved interviews with two marketing managers (where one was interviewed twice) from each case organization. These two respondents validated the findings of the document analysis.

Study III

The purpose of this study was to improve understanding of how the organizations bridge boundaries to the end-user organization in construction projects. The interviewees were selected to cover the intermediates: (1) project managers from the property organization, project managers from the client organization and project managers from the end-users' organization, including externally-hired project managers; (2) architects, since they were interacting with end-users; and (3) strategic workplace managers and experts.

Study IV

The purpose of this study was to improve understanding of the PMO as a knowledge broker between the project and the mother organization, (i.e. the PBO). Interviewees were therefore selected to cover: (1) top and middle managers involved in PMO activities; and (2) project managers.

Sample survey

The respondents in the survey were chosen in accordance with the following criteria, they had to: (1) work in the interface between projects and on-going activities so they had experience of knowledge exchanges between those units; (2) be middle managers, (i.e. manage project management departments); (3) be a top manager in the PBO; or (4) train members in the PBO.

Workshops and meetings

Beside the interviews, workshops and meetings were held to discuss the cases and subjects (see Appendix VI, Interviews and Workshops, Table 2). The purpose was to improve the understanding of the subject under investigation, the case organizations, to present the results of the studies, to receive feedback and to validate the results.

Document analysis

The purpose of document analysis was to confirm or question the interviewees' stories. The analysis mainly focused on content concentration and content discussion to improve the understanding of the phenomena under study (Kvale and Brinkmann, 2009). Study II was mainly built on document analysis. This document analysis involved detailed write-ups and structured analyses of surveys, measurements, evaluations and minutes written by the two case companies or in some instances undertaken by external consultants on behalf of the case companies.

Databases, archival records, minutes, and sketches were studied in all cases in order to confirm or deepen the understanding of the respondents' stories and situation. The aim was to better understand the respondents' frame of reference when it came to, for example, preparing post-occupancy evaluations (POEs), minutes and briefs.

Observing interviewees, when using their intranet or getting access to the intranet, was another method used to validate the interview data. In some cases the respondents did perceive that, for example, project managers wrote a lot of comments to be shared collectively when they recorded their project data electronically. Those comments were perceived useful by respondents for lessons learnt assignments. However, when the respondent and the researcher searched in the databases, no comments were found, that is, the respondents thought that they had a well-functioning database system for capturing and sharing lessons learnt, but this did not appear to be the case. Some of these shortcomings were tracked by letting the respondent demonstrate their work with databases and the intranet, making them think more critically about knowledge sharing endeavours in their organization. In two cases, the respondents did not have time to demonstrate their systems, and the researcher was granted temporary access to the intranet to investigate the database in more detail.

3.6 Data analysis

The data in this research is qualitative, with data analysis adopting abductive reasoning for the case studies and a deductive analysis method in the survey. Analysing qualitative data requires intuition, competence and includes some broad general steps of coding and categorizing data into higher levels of abstractions. It is important to *"trust your 'plausibility' intuitions, but don't fall*

in love with them" (Miles and Huberman, 1994, p.247), that is, remain flexible and critical.

3.6.1 Abductive data analysis

Every study consisted of at least two case organizations. A within-case analysis was conducted before a cross-case analysis was undertaken. The data analysis starts from a broad perspective at the same time as the data collections start, since it is a selective process. Every case used interim case summary write-ups in the analysis process in such a way as to get an overview and synthesis of the cases. In all cases, writing memoranda as a means of making sense of the newly conducted data collection was also involved. Memoranda were written for self-use to ensure that impressions, ideas, questions etc. emerging from the data collection were taken into account (Miles and Huberman, 1994).

The abductive data analysis was based on Miles and Hubermans' (1994) view of data analysis, including the four steps of data reduction, display and conclusion drawing/verification, and possible collection of further data. The analysis started with reduction, by selecting, focusing, simplifying and abstracting data into descriptive or interpretive codes. The analysis mainly adopted a case-oriented (opposite to variable-oriented) analysis due to the limited number of cases (Miles and Huberman, 1994). From those interpretive and descriptive codes, relationships and patterns were searched in order to understand where the gaps and emphases occurred in the data. The findings were then organized into more detailed codes. These codes where further analysed and clustered in order to find themes and trends. Categories were formed on a higher abstraction level. During this reduction process different data display techniques were used, such as context charts, event state networks and case dynamics matrices. These served to organize, visualize and make the data more accessible and thereby ease the creation of a conceptual framework. Conclusions were drawn by searching for patterns, themes, making contrasts and comparisons and verifying them against literature (Miles and Huberman, 1994). The steps of reduction, display and conclusion/verifying were conducted iteratively, leading to relabeling and restructuring of codes and categories until saturation was reached. Saturation is reached when the steps do not bring further information and the codes are organized into a coherent governing structure (Miles and Huberman, 1994).

3.6.2 Deductive data analysis

The transcribed interviews were summarized by organization to get a condensed and comprehensive understanding of each. Deductive pattern matching was used as the analysis technique to identify support for the theoretically-derived propositions. The interviews were coded and analysed in the search for patterns, relationships, characteristics that either were in line with, or contrary to, the patterns identified in the literature. The analysis used a dependent and independent variables model in order to validate the propositions (Saunders et al., 2009).

3.7 Quality of the research

The quality of the research is discussed in this section. Researchers have different opinions about what aspects are relevant to discussion in qualitative studies, for example, the use of reliability. Lindén (2003) argues that the process of validation includes, from a critical-realist perspective, a continuing process of enquiry into the meaning of scores, interpretations and involving questions on the appropriateness, usefulness, relevance and social consequences of tests. Stenbacka (2001) adopts interpretative reasoning and believes that it is inappropriate to use reliability, since it is impossible to differentiate between the researcher and the method, in qualitative research, as it is so dependent on the interpretative skills of the researcher. This research mainly includes case studies and will therefore follow Yin's (2003) criteria for testing research quality. The sampling approach in the case studies mainly followed Yin and Eisenhardt, who are both post-positivists, by considering construct validity, internal and external validity and reliability. Ethical considerations were observed, for example, confidentiality concerning respondents.

3.7.1 Construct validity

Validity in qualitative research is another word for truth, that is, are the results true? Do they properly reflect the real situation? Are the findings backed up with strong and rich evidence? Construct validity deals with establishing optimal measures for the concepts being studied (Yin, 2003), for example, through respondent validity (Silverman, 2001). Multiple sources of evidence were used in data collection, such as interviews, participant database reviews

and documents. Additionally, workshops were used strategically to review the findings in the case study reports.

3.7.2 Internal validity

Yin (2003) states that internal validity is highly important for explanatory case studies looking for causal relationships. The case studies here are mainly exploratory but have explanatory elements. Yin (2003) further argues that internal validity is relevant for all cases when it comes to inference, that is, are the results truthful? Have all explanations and possibilities been considered? Are stories convergent and is pattern matching used (Yin, 2003)? In order to improve the internal validity, several questions were posed: was a transparent description of the research process a goal; were well-established data analysis techniques (such as Miles and Huberman's data display and reduction analysis) and pattern-matching techniques used when analysing deductively; and were rival explanations addressed?

One aspect of internal validity is whether or not collected data truly reflects interviewees' perceptions. Every interview reached a point where the interviewee stated that: *"this is only my personal opinion..."* This point was almost always a breaking point when the interviews became more personal and more reflective, that is, after that point the interviews reached another level of abstraction. Before that point, people were a little suspicious, careful and mostly told a story that presented the organization from a formal and marketing perspective. The time it took before this break was reached was very individual. Some interviewees appeared to be more nervous and more concerned about their employer's opinions than others. This could also be a sign of validity concerning the interviews as such, since they actually succeeded in uncovering at least a part of the interviewees' perceptions of the world, even though it is recognized that they will never be fully understood.

The emic (insider) perspective was targeted as noted earlier, implying that in order to make theories valid they have to be qualitatively grounded (Guba and Lincoln, 1994). The Nordic research project facilitated a continuous interaction with the case organizations, and this interaction improved understanding of the case organizations' culture and climate (i.e. the emic view).

3.7.3 External validity

External validity concerns the ability to generalize beyond the immediate study. Case studies, though, produce context dependent research, implying that the only form of generalizations appropriate for use in case studies are analytical generalizations (Yin, 2003). Additionally, if identified properties and patterns exist in a number of cases in a different context, these should not be neglected or depreciated, but nor should they be assumed as truth for every situation (Bhaskar, 2008). There is a need to understand what is general and specific for each phenomenon (Easton, 2010), implying that the contextual and situational properties have to be investigated and taken into account. Patton and Appealbaum (2003) go as far as claiming that the generalizability of a case is determined by the strength of the description of the context.

Replications logic was used in every study to enable analytical generalizations between case organizations. Moreover, triangulation was used to increase validity by using multiple sources of evidence, in line with Bryman (2006) and Denzin (2010). Triangulation draws attention to the multifaceted nature of reality, but is not very well defined as a concept (Denzin, 2010). The meaning of triangulation has evolved over the years since it was introduced in the early 1960s. Denzin (2010) found that over the last four decades the concept has been redefined to meet emergent needs. There has been an on-going discussion on what is comparable and what is incommensurable, and the different opinions can be traced back to adopted philosophical perspectives. Triangulation can be made between different qualitative methods, or between qualitative and quantitative methods, by the use of different investigators, environments and theoretical perspectives (Jick, 1979; Denzin, 2010).

The survey increases the generalization of the findings, but still most of the knowledge produced in this research is context-dependent. Even so, pattern-matching techniques revealed similarities in patterns in different contexts. This increases the probability that these patterns are generalizable in other contexts. The research world has, unfortunately, had a predilection for context-independent knowledge. Flyvbjerg (2006) argues that even though knowledge cannot be formally generalized, that does not imply that it cannot enter into a collective process of knowledge accumulation in a given field. *"Formal generalization is overvalued as a source of scientific development, whereas 'the force of example' is underestimated."* (Flyvbjerg, 2006, p.228)

Environmental triangulation involves the strategic use of different locations, settings and other contextual factors as a means to improve the validity of the findings. This research was conducted in three countries, Sweden, Finland and

Australia. Different cultural contexts can bring different experiences, insights and understandings; in other words, they can enrich the research and help later consideration of generalizations that may be appropriate. Contextual factors, therefore, have to be understood, and their influence upon the result must be analysed and considered.

3.7.4 Reliability

Yin (2003) argues that reliability involves minimizing errors and biases in case studies, so that it is possible to determine whether or not the situation is the same the next time it is observed (Szybek, 2003). The underlying philosophy of this research is critical realism, which has implications for a view of reliability. From a critical realist perspective, the world is not viewed completely objectively and independently, but involves dynamics. The probability of getting the same results is therefore a question for inquiry. Some of the underlying mechanisms, when compared with (Bhaskar, 2008), would probably be more resistant to change, and the aim was to understand those underlying mechanisms. Not only has the entire world changed; my pre-knowledge and pre-understanding has also affected my interpretation of it. I also believe that I impact empirical data to some degree, since I influence the people involved in the research, for example during interviews or observations. Consequently, even though objectivity is the goal in all research, it is unwise to claim that one does not impact the collection of data and the interpretation of it in line with Bhaskar (2009). These factors impact the reliability of the study.

A study protocol, interview guideline that was based on a literature review and a case study database were used to increase the reliability in line with Yin's (2003) suggestions. Additionally, leading questions were avoided and I was acutely aware of my own prejudices and biases when interviewing people and analysing data, that is, objectivity was pursued. This was achieved, for example, through the literature review that initiated each study. The literature review improved objectivity by providing a framework for data collection instead of relying on personal values and assumptions.

Additionally, reliability was improved through tape-recording, careful transcription of the dialogue and presenting meaningful extracts of data in the research report (Silverman, 2001). Interviews 1-26 inclusive were not recorded, but from interview 27 onwards, they were. Even so, each interview was documented and sent back for validation as noted in the earlier section on *Semi-structured interviews*.

The authors of Paper IV independently coded the text and then compared the codes to ensure that interviews were interpreted in similar ways, which can be considered as an investigator triangulation (Jick, 1979) (see Appendix IV, Paper IV). This might have increased the reliability of study IV.

3.7.5 Ethical considerations and application

In this research all interviewees were assured confidentiality; furthermore, everybody was informed that participation was voluntarily and that they were free to bring their participation to an end at any time. They were also informed on how the material was to be used, that is, anonymity was promised. They all had the opportunity to read through their transcribed interview and the published paper: a pre-study report was also sent to them.

The findings and results were discussed with respondents and workshop members during the process to make them accessible and to validate the results. Additionally, the journal papers discussed the practical implications as a means of improving the usability and application of the findings.

3.8 Limitations of the research

All research methods have their strengths and weaknesses. *"Knowledge claims are languaged statements about how things are... they contain only simplified, selected, and extracted characteristics of the complex and situated phenomena they are about. Thus, there is a gap between a languaged knowledge statement about the way things are, and the way they actually are... A knowledge claim becomes valid when there is a strong and forceful reason to accept it."* (Polkinghome, 2003, p.12)

This raises questions that are of concern when considering limitations in research. This research focuses mainly on what people say they do, and not what they actually do. Some validation tests were carried out through document analysis and through asking similar questions of a broad range of people. This served to crosscheck the narratives provided by the interviewees. However, is it a sufficiently strong and forceful reason to accept them? Observation of how people actually interact and share knowledge might have strengthened the result and given new insights.

The research was mainly conducted in the real estate sector and the results might, or probably would, have been different in another industrial sector. As stated in the introductory chapter, most research conducted in this area has been in manufacturing, which tends to stress the importance of this choice. Additionally, the strength of the research is that it was conducted in three countries, and reveals both similarities and differences in order to gain an improved understanding of the underlying mechanisms.

3.9 Reflection of chosen methodology

This research chose to combine abductive and deductive reasoning to investigate the research question: it was a strategic decision. The research adopted a qualitative approach, as rich data were needed to understand the complexity of the phenomena. If another approach had been chosen, other results might have been achieved.

If a post-positivistic approach had been adopted, case studies would still have been possible, but the case studies would probably have appeared differently. They would most likely have been deductive and involved a more rigid collection of data for a number of well defined variables. If the research had a higher emphasis on generalization, the collection of quantitative data would probably have been beneficial. Overall, the empirical findings would have been broader at the expense of depth had a quantitative approach been conducted.

If an interpretative approach had been adopted, case studies would also have been possible; but the cases would probably have dug deeper into the individual's perceptions of the world and the contextual aspects would have been dominant at the expense of generalizability – only specific situations would have been interesting. Participant or nonparticipant observation studies would probably have replaced the survey.

3.10 Conclusion

This chapter has outlined the methodology of the study by presenting adopted philosophies, chosen approaches and strategies, and the techniques and procedures selected for use. This research rests on a critical realism perspective of the world and on knowledge. It uses abductive reasoning in a multiple case study strategy, and deductive reasoning in a sample survey. The empirical data are mainly qualitative and were obtained through 100 semi-structured interviews (of which 61 were conducted by the author of this thesis): the results from this study were presented.

An overview of the theoretical and epistemological perspectives used in the papers is found in Table 3.2.

Table 3.2 Adopted theoretical and epistemological perspectives in the papers.

Theoretical perspectives	**Knowledge types**	**Epistemological perspective**	**Study**
Inter-organizational relationships in projects, methods and tools for facilitating interactions	Knowledge is viewed tacit and explicit, individual and collective, and focus is upon knowledge processes and capabilities	Not explicitly stated, implicitly critical realism	Paper I, Appendix I
Autopoietic system Context and individual interpretation Cognitive, organizational and societal framework Knowledge can be both tacit and explicit, individual and collective	Value creation of explicit knowledge by questioning the knowledge access to information, view and take a process and capability perspective of knowledge	Not explicitly stated, implicitly critical realism	Paper II, Appendix II
Inter-organizational relationships in projects, organizational boundaries and strategies for bridging them	Knowledge is viewed tacit and explicit, individual and collective, and focus is upon knowledge processes and brokering capabilities	Not explicitly stated, implicitly critical realism	Paper III, Appendix III
Project management, brokering, learning and knowledge sharing behaviour	Knowledge is viewed tacit and explicit, individual and collective, and focus is upon knowledge processes, learning and brokering capabilities	Critical realism	Paper IV, Appendix IV
Knowledge-based view of an organization and governance theories	Knowledge is viewed tacit and explicit, individual and collective, and focus is upon knowledge processes and knowledge governance	Critical realism	Paper V, Appendix V

4. Research findings

This chapter provides a summary of the research findings presented in the five papers upon which this thesis is based. The results are presented as extended abstracts and give an initial response to the five objectives of this research.

4.1 Presentation of papers and objectives

The results in this chapter aim to provide an initial response to the objectives of this research, in accordance with Table 4.1. The results are presented as extended abstracts. For the full length papers and a more comprehensive reading of the results, see the appendices.

Table 4.1 The relation between the abstracts and the objectives of this research.

Extended abstract	**Objectives of this research**	
Paper I	1	Examine the management of end-users and their requirements when the end-users are known in construction projects
Paper II	2	Evaluate the management of end-users and their requirements when the end-users are unknown in construction projects
Paper III	3	Establish how boundaries are bridged in the interface between the end-users' organization and the project organization
Paper IV	4	Investigate the project management office capacity of acting as a knowledge broker in PBOs
Paper V	5	Determine if common patterns exist behind knowledge governance practices in PBOs

4.2 Extended abstract of Paper I

The present and future needs of end-users have to be understood if supportive environments are to be created for them. Yet, management of end-users and their needs is often found insufficient. The two-fold purpose of this paper is to identify areas of difficulty in managing the needs of end-users, in the course of the design and delivery of construction projects, whilst suggesting possible solutions. The focus of the paper is the interaction between three principal parties: end-users, the project leader (a selected end-user) and the facility planner (a facilities professional). The context is that of two projects in the public sector: a university and a hospital. The end-users of both are known from the start and participate in the whole process. The paper is based on a case study comprising 12 interviews: seven end-users and five professionals.

A number of methods and tools for managing end-users and their needs are mapped-out in the literature review. The majority of methods found focus on the end product, but some are more behavioural and interaction-oriented. Many focus on just one part of the construction process and are not considered good enough on their own to produce a result/outcome that can be readily acted upon. The extent to which these methods are used in practice is unknown, but they were not used in the case studies.

The case studies reveal that, during the project's design and delivery, communication and attitudinal problems have to be managed alongside the inherent difficulty of understanding end-users' real needs. The difficulties found in practice are principally in making end-users see their situation from a greater and longer-term perspective, and overcoming social and cultural barriers among participants as a means to understanding real needs. Signs of negative attitudes and frustration appeared in both cases when communication failed. To help in managing these issues, facility planners relied heavily on experience-based pedagogical and behavioural skills, rather than formalized methods as found in the literature. This calls for a need to re-evaluate and/or further develop existing methods, to embrace pedagogical and behavioural aspects in order to improve their usability in routine practice.

4.3 Extended abstract of Paper II

In order to stay competitive and meet the changing needs of the market, construction organizations must develop efficient means for gathering and using the knowledge of the end users' requirements. Unfortunately, feedback and learning loops are often broken in PBOs and existing tools for managing end-users are characterized by a lack of guidance and narrow focus, which complicates the ability to learn and improve practice.

The purpose of this study is to explore the characteristics of the sourcing and sharing processes in gaining information about end-users' requirements when end-users are unknown. The study uses two case studies to explore the knowledge creation of end users' requirements in project-driven organizations. The focus of the study is the interface between the PBO and the project. The interface is analysed from an autopoietic and a cognitive, organizational, societal view.

The findings demonstrate that the PBO and the projects are dominated by different kinds of knowledge and structures. This distinction is important in the knowledge-creating process to better understand: (1) what could be expected in the exchange of data; and (2) what action needs to be taken in order to create value from it. Certain types of data need to be contextualized to bring value, while others do not. The study implies that the use of standardized questionnaires might be a hindrance to managing the knowledge creation of end users' requirements properly, between the PBO and project. This study further discussed the fact that knowledge creation could probably be improved in the organization by either, decreasing the distance between the two organizational forms, by lessening the dominant knowledge type within them (encoded or embodied). Or by trying to foster a knowledge-sharing environment that supports creation of embedded knowledge and cumulative learning. The organization's ability to reproduce itself becomes critically important to meet the dynamic ever-changing environment. This implies that the creation of knowledge should be seen as an on-going and dynamic process, in order to be able to meet the changing requirements of the end-users.

4.4 Extended abstract of Paper III

Organizations have boundaries that serve various purposes; for example, differentiating internal operations from external activities and controlling flows of information. Boundaries can, however, hinder knowledge exchange in inter-organizational collaboration, leading to less effective outcomes. This study explores how the boundaries between organizations in a project, can be bridged efficiently to support knowledge exchanges. The purpose is to identify roles and activities that bridge boundaries in order to achieve productive project collaborations between parties possessing different knowledge and competences. This purpose is explored with case studies from real estate organizations in Sweden and Finland. End-user organizations and real estate companies constitute the subjects of enquiry.

The literature review analyses different boundary strategies and different boundary roles. Most of the boundaries identified in the case studies concerned the different parties' ability to comprehend the other parties' perspective and for inexperienced end-users to understand their role in the construction project. The main benefits of using boundary strategies were found to be in reducing conflicts, improving collaboration and achieving a mutual understanding that resulted in a smoother process. Commonly used strategies to bridge boundaries were to translate, educate, interpret, evaluate and learn, encourage change and provide support, also stereotyping and protecting. Real estate companies need, therefore, to be competent in finding bridging strategies and implementing appropriate boundary roles, such as the knowledge broker, spanner and gatekeeper. These capabilities appeared vital in the case studies for creating collaborations that foster learning, within and between projects, over the longer term.

Furthermore, the findings illustrate that Sweden and Finland use different approaches when managing end-users in their construction projects. For example, the depth of involvement of the end-user organization varies widely and, with it, the use of bridging roles and activities. The implication of this finding is that the approaches chosen for bridging boundaries have to be aligned with prevailing business system and cultural context. Adopting a standard approach irrespective of system and context would therefore be self-defeating.

4.5 Extended abstract of Paper IV

Knowledge sharing between projects in PBOs is often ineffective. Current research on PMOs found that PMOs have the potential to act as knowledge brokers between projects, and between projects and top-management. Nevertheless, the literature does not provide sufficient evidence of the brokering role of PMOs. The research reported here, aims to examine PMOs' functions from a knowledge sharing perspective, and to explore whether or not these functions reflect the knowledge sharing needs of project managers. These issues are investigated through a cross-case analysis of seven organizations with empirical data from 64 interviews. The contextual setting is that of PBOs in Australia and Sweden from the heavy engineering, real estate, telecommunication, communication services and mining sectors.

The research found that project managers are people who are oriented, free-thinkers, passionate, autocratic, conservative and pragmatic. They appeared to prefer prospective learning to retrospective learning, and share knowledge actively. However, the findings reveal that PMO functions are not fully aligned with the knowledge sharing behaviour of project managers. The PMOs tended overall to focus on explicit knowledge, retrospective learning and being reactive; but the most successful PMOs, from a knowledge perspective, appeared to be the ones taking an active knowledge-brokering role. Moreover, some PBOs allowed the project managers to act as autocratic free-thinkers to avoid conflicts, even though they were aware of the inefficiency from a knowledge resource perspective. Accordingly, this research extends earlier studies on the brokering role of the PMO and PMO functions, by focusing on the relationship between project managers and the PMO, taking into account project managers' nature and needs with regard to the PMO as a knowledge broker.

This research suggests that PMOs need capabilities in (a) facilitating and promoting the strategic development of project managers' relationships with diverse stakeholder groups, strategic use of boundary objects and endeavours when interacting with project managers. Moreover, the PMOs need capabilities in educating project managers to strategically use similar boundary objects and endeavours in their operations; (b) governing, controlling and supporting project managers in their operation to ensure efficient knowledge flows; (c) the adopting of coaching, negotiating and training roles, to ensure competence development, which requires an interplay of commanding and enabling strategies. The overall conclusion drawn from the case studies is that PBOs and PMOs do not truly understand project managers' needs and

expectations in terms of knowledge sharing, and that inefficient strategies concerning exploitation of knowledge were present. This might explain why knowledge endeavours are often ineffective in PBOs.

4.6 Extended abstract of Paper V

The rise of knowledge management as an important issue for the long-term survival of organizations has created the need to govern the knowledge management efforts within them. Even though some studies have been conducted, the concept of knowledge governance still needs further investigation both empirically and theoretically.

This research investigates patterns in knowledge governance practices in PBOs, achieved by examining the implications for PBOs concerning: (a) governance of knowledge creating processes; and (b) governance of intra- and inter-firm relationships. Five propositions about knowledge governance in PBOs were deductively derived from prior studies including 82 interviews, which were empirically tested and triangulated with 18 interviews in a qualitative sample survey in the real-estate sector in Australia.

Results indicate that the generation of knowledge creating processes requires subtle interplays between commanding and enabling knowledge governance practices, which is not always the case. It is indicated that knowledge governance practices in PBOs are impacted by structural and situational factors, such as being a subsidiary or standalone PBO, a PBO striving for excellence or not, as well as some preconditions such as the executives' competence in project governance. Moreover, the results show that informal governance mechanisms are more useful than formal, when it comes to knowledge creating processes. Governance of informal knowledge creating mechanisms, though, appears to be complex for executives, and their preconceptions were revealed as either enablers or barriers to productive knowledge governance practices. In subsidiary PBOs, knowledge governance provides practitioners with appropriate assistance to avoid the unbeneficial situation of having knowledge silos among loosely coupled islands of work. The analysis further revealed three mechanisms behind knowledge governance practices; these were structural, visionary and pragmatic mechanisms.

This research contributes to the existing body of knowledge, by suggesting a contingency theory perspective towards knowledge governance, where knowledge governance strategies are adjusted to organizational characteristics within PBOs in order to allow knowledge processes to prosper between subunits. The research suggests the use of multiple knowledge governance strategies for different subunits, due to the structural complexity of PBOs.

5. Analysis and discussion

This chapter analyses and discusses the findings of the thesis by connecting the five papers to provide an overarching analysis and discussion. All papers are interrelated and contribute through a deeper understanding of knowledge processes and capabilities in PBOs in the real estate sector from a knowledge-based view of the organization. After concluding the analysis and discussion of the results, the research question can be answered. Before closing this chapter, a broader discussion of the research is presented.

5.1 Synthesis of the research

The five papers together provide a multi-dimensional view of knowledge processes and the capabilities of PBOs in the real estate sector (see Table 5.1).

Table 5.1 Dimensions of knowledge processes and capabilities in this research.

Level	Adopted strategies	Impacted by
External contingencies	Exploitation/exploration	Market conditions Patterns of growth and development Business/project networks
Knowledge governance	Formal/informal/relational Commanding/enabling Trust/professional ethos/ reputation Exploitation/exploration	Situational/structural factors Learning landscapes Subsidiary/standalone Time Problem character Nature of tasks Goals Knowledge types Politics Personal beliefs and attitudes
PMO	Prospective/retrospective learning Boundary strategies Passive/active	Knowledge types Dimension of knowledge specialization Tradition and routines Authority
Project	Boundary strategies Formal/experienced-based User involvement	Skills and capabilities Knowledge types Output type

Table 5.1 summarizes and highlights the strategies that were discovered and their impact factors in Papers I-V, Appendices I-V. This section further analyses the relationship between the strategies and impact factors at different organizational levels in the search for patterns and structures shaping knowledge processes in PBOs in the real estate sector. This analysis starts with revisiting the propositions in Paper V and their support in further elaboration of the findings from an overall knowledge-based perspective of the organization. Paper V is a deductive paper, deriving and testing propositions from the other four papers in conjunction with an extended literature review.

The propositions suggest that capabilities in organizations are both individual and collective abilities to interact, absorb and adapt to a surrounding internal and external dynamic environment. Capabilities, in this sense, can be seen as

an organizational antecedent to perform, and develop an existing body of knowledge, and embed new knowledge in its operation, for instance, into its routines. Moreover, capabilities are mainly regarded here as the capacity to interact with, and manage, interfaces. Development of technological skills, for example, is not considered any narrower here than in the sense that common knowledge may facilitate interactions, since the use of boundary objects is likely to become more efficient due to a higher chance of similar interpretations of them.

Organizational capabilities and processes are impacted by a number of interplays in organizations (see Figure 5.1), which to some degree, can be regarded as the organization's 'DNA', shaping outcomes, patterns and structures. The findings from this research indicate that some organizations emphasize exploration higher than exploitation processes, while some are using more enabling than commanding strategies to make individuals share their best practices and lessons learnt. Others tend to put projects over business goals, or stress the importance of collective knowledge sharing and integration endeavours much higher than those who do not have the energy or motivation to make these efforts. It is suggested that the balancing act of interplays between these opposite or complementing pairs, depending on how they are regarded, impacts highly upon knowledge processes and capability building in PBOs. Consequently, these interplays have to be investigated in order to understand the mechanisms, structures and patterns of knowledge creation in PBOs.

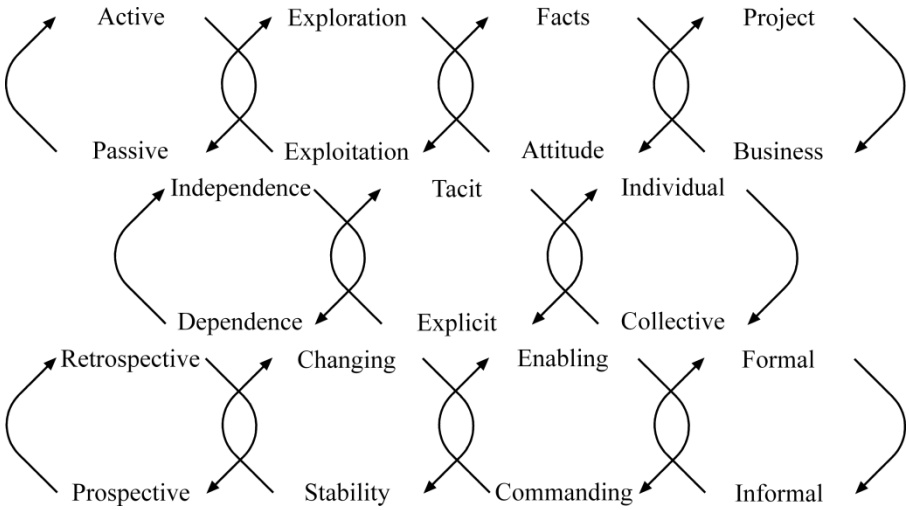

Figure 5.1 Example of interplays that shape the interplay between the development of capabilities and processes on each level of the PBO.

5.1.1 Development of a knowledge governance strategy typology

The empirical data from the PBOs included in this research, displays tendencies toward the dominance of different interplays. The companies are set in different countries and are from the public and private sector, which also impacts their strategies and goals. This needs to be borne in mind in the search for underlying mechanisms that characterize PBOs knowledge processes in the real estate sector.

The analysis revealed that the members of the PBOs adopt distinct knowledge governance strategies. The strategies displayed in Table 5.1 divide the PBOs in this study into six distinct groups (see Table 5.2), that is, the Survivor, Deliverer, Superior, Explorer, Supporter and Collector.

The Survivors are subsidiary PBOs, undertaking projects, maintenance and facilities management. For various reasons governance strategies in the PBOs do not strive for excellence. One of the respondents explained that they were, at the moment, learning to crawl and that they, in the future, will hopefully be able to walk, that is, they are improving their processes and procedures,

however, the focus is, at the moment, more on survival than excellence. Others have no intentions to expand and survive due to long term relationships with customers in the market. Employees are independent and generally do not appreciate interference from executives: organizational cultures and norms tend to protect this behaviour.

The Deliverers are subsidiary PBOs undertaking projects, maintenance and facilities management. The Deliverers have developed routines and procedures for project and business processes and tend to focus on documentation and control. Employees are independent and most often do not appreciate interference from executives, although not to the same extent as the Survivors. The Deliverers regard themselves as well managed and strive for improvements; thus, they do not completely invest in these improvements, which results in strong routines restraining innovative changes. Command strategies are though used in emergencies only.

The Superiors are subsidiary PBOs undertaking both projects, maintenance and facilities management. They have well-developed processes, procedures, control systems and a stronger knowledge sharing and integrating focus than the previous two, and try to implement knowledge thinking into their culture; they have, for example, internal research departments. The Superiors do not accept protective or superior attitudes among employees: *"that kind of behaviour will not get you anywhere other than out of the door."* These organizations thus have some inherent barriers towards change, due to their significant size, with many areas of expertise requiring significant coordination efforts. However, since employees show a strong passion for what they do, and exhibit a willingness for individual development, changes tend to be rather well received.

The Explorers were all found in Australia. They are standalone PBOs, specialists in conducting project management services for all kinds of construction projects in this study, but potentially also for other kinds of projects in other sectors. They cannot rely on building relationships with customers in maintenance and operation, and therefore strive for professional excellence in every aspect of their work in order to attract customers. There is a strong and cohesive knowledge focus throughout the organization and they have close relationships with research centres and universities. Employees are passionate about what they do, are often head-hunted, and know they are there because they are considered among the best around, which creates a strong organizational desire to strive for excellence.

The Supporter is a subsidiary PBO undertaking both projects and maintenance; it owns, sells and acts as a franchise organization for brokers in

the market. It has a training department and invests in award winning activities and internal research projects. Moreover, it has a strong customer focus and arranges a number of customer relationship building activities. However, their external focus appears stronger than internal exploitation activities and, for instance, knowledge codification activities are scarce.

The Collector is a franchise company, which is rare in the real estate market. It develops concepts of residential buildings, such as apartments and villas, and has a strong control focus and knowledge codification process. Even so, it has difficulty in internalizing information into embodied and embrained knowledge, that is, it has neither the ability to act upon the collected information, nor the shared understanding of the conceptual meaning of the respondents in their surveys.

The last two PBOs' knowledge governance strategies, are represented by one or two cases only in this study (see Table 5.2), and the tendencies cannot be regarded, therefore, as being as strong as in the cases of the other four PBOs' knowledge governance strategies. However, all strategies probably need more empirical underpinning in other sectors to improve their robustness. Thus, the results here provide an interesting area for analysis and the strategies will therefore be further analysed and connected to the impact factors (see Table 5.1). The focus will be on inter and intra-organizational relationships and interactions, since they indicate a shaping of the coordination and knowledge processes.

In terms of output types, that is, whether it is a residential or non-residential facility, there appeared to be no significant difference. Survivor, Deliverer, Superior and Explorer include PBOs that deliver residential, non-residential facilities or both. The Supporter produces both types but the Collector produces solely residential facilities. This may imply that the output type is not a significant contingency factor when it comes to internal knowledge processes in PBOs. Certainly distinct knowledge areas are necessary for managing distinct companies and space layouts for example. Even so, the construction project processes are, in overall terms, well established and the nature of the task is similar for both residential and non-residential facilities. What appears to distinguish between PBOs is how deeply they, through the projects, involve themselves in end-users' change processes, which often occur in conjunction with construction projects, their internal ambitions concerning product development and external contextual aspects represented as dynamics in the market. From a coordination perspective, these tendencies suggest that if an organization has the proper capabilities to solve numerous problems, and can use them competently, the type of product is of lesser importance.

A comment is needed concerning the Finnish case study presented in Paper III, Appendix III, as it is not included in Table 5.2. This case study was built upon interviews from distinct organizations with the goal of deepening the understanding of boundary bridging to end-users in construction projects. Consequently, the case does not cover a multilevel strategy investigation of one PBO and is therefore excluded from the table. The results from Paper III are however incorporated in the last strategy concerning user involvement and the results of the study are further elaborated in this chapter.

Table 5.2 Illustrates six tendencies of knowledge governance strategies in PBOs. Companies within parentheses are not from the real estate sector.

	Survivor	**Deliverer**	**Superior**	**Explorer**	**Supporter**	**Collector**
Organizations	Health care, A, B, C, L, (Mining)	Education, D, (Engineering), (Telecom), Residential	I, F, K	E, H, J	G, (Support services)	Private housing organization
Knowledge Governance Level						
Formal/Informal/Relational	Weak in formal, informal and relational	Formal, relational and weak in informal	Formal, informal and relational	Formal, informal and relational	Mainly informal and relational weak in formal	Mainly using formal
Commanding/ Enabling	Enabling, using command only in emergencies	Enabling, using command only in emergencies	Commanding and enabling	Commanding and enabling	Commanding and enabling	Commanding
Trust/ Professional ethos/Reputation	Trust, reputation, professional ethos	Trust, reputation, professional ethos	Trust, reputation, professional ethos	Trust, reputation, professional ethos	Trust, reputation, professional ethos	Trust, reputation, professional ethos
Exploitation/ Exploration	Uninformed strategy for exploitation and exploration	Uninformed strategy for exploitation and exploration	Strong in exploration rather strong in exploitation	Strong in exploration rather strong in exploitation	Strong in exploration, ad hoc in exploitation	Rather balanced strategies between both

Project Management Office Level						
Prospective/ Retrospective Learning	Retrospective	Retrospective	Prospective	Prospective	Retrospective	Retrospective
Boundary strategies	Developed but can be improved	Developed but can be improved	Rather well developed	Rather well developed	Rather well developed	Mainly using boundary objects
Passive/active	Passive	Rather active	Rather active	Active	Rather active	Passive
Project Level						
Boundary strategies	Individually experienced based: lack of subtleness and collective continuous improvement	Individually experienced based: lack of subtleness and collective continuous improvement	Individually experienced based: lack of subtleness and collective continuous improvement	Collaboration and individually developed, continuously improved	Individually and collectively experience based: continuously developed through formalized training	Only evaluating projects not managing
Formal/ experienced based	Experience based with uninformed formal learning	Experience based with some formal learning	Experience based and strategic formal learning	Experience based and strategic formal learning	Experience based and strategic formal learning	Only evaluating projects not managing
User involvement	Building and space	Building and space, sometimes workflows	Workflows, sometimes goals and strategies	Workflows	Building and space	Make multiple choices

5.1.2 Formal, informal and relational knowledge governance strategies

What knowledge characteristic can be regarded as antecedents for the choice of mechanisms for shaping governance strategies in PBOs? How do knowledge governance strategies impact upon internal knowledge processes and capabilities?

Most executives combined formal, informal and relational knowledge governance mechanisms, but few did it in an informed or strategic way. For instance, how does a company create a knowledge sharing culture in practice? The executives in the Superior, Supporter and Explorer PBOs tried to combine enabling and commanding strategies on an ad-hoc needs basis. The belief in culture as an informal knowledge governance strategy was thus strong among the executives in these PBOs. Executives in the Survivor, Collector and Deliverer however did not emphasize this knowledge governance mechanism in their strategies. The latter were more directed towards formal strategies and preferred enabling, ahead of commanding approaches. There are however some commonalities among the executives, of which the advocacy of relational governance mechanisms was the most prominent.

Additionally, the executives in the Deliverer, as well as the Superior, Supporter and Explorer PBOs, all advocate the informal governance mechanism of networks. Thus, the executives in the Deliverer treated networks more like a relational mechanism than an informal mechanism, that is, they formalized and scheduled network meetings to make them happen with varied results. Trust, reputation and professional ethos were considered vital in knowledge process endeavours among members in networks. The formal network meetings did not always succeed in achieving this state. Instead, the networks were more often than not found to be intertwined, and involve some degree of trust in every relationship; in other words, good experience was combined with either know-how and/or know-whom knowledge. The PMO members from one of the Delivery companies, who were experts in a certain knowledge area for instance, explained that it took a number of interactions through formal project control meetings and reviews, before the project managers contacted them voluntarily for technical advice or to seek the names of those whom they could contact on other matters. It was therefore vital for the PMO members to gain trust, professional ethos and a good reputation in the PBO, to be accepted as a member in the project managers' networks.

The executives in the PBOs thereby have distinct knowledge governance emphasis, even though they appear to face similar problems in their projects, have to deal with similar knowledge types and have similar work tasks. When it comes to knowledge processes and capabilities, the executives in the PBOs have distinct goals (i.e. striving for excellence and innovation or being good enough) and, moreover, they are impacted by distinct politics. However, the executives' own beliefs and attitudes also appeared to impact the knowledge processes in PBOs.

Another impact factor is the learning landscapes of the PBOs, that is, the accent on knowledge accumulation, articulation or codification on different organizational levels. However, it was not evident from this study whether it is the existing learning landscapes that shape the strategies or the strategies that have shaped the learning landscapes. A correlation between them appears to exist but needs further research. Implications supporting this correlation are, for instance, that in Delivery, Survivor and Collector, where the formal mechanisms are stronger than the informal, collective knowledge codification is stressed over collective knowledge accumulation and articulation. The Superior and Explorer show a tendency for a more balanced view of informal and formal mechanisms and stress the importance of all three learning processes. The executives in the Supporter emphasize informal and relational mechanisms, and the activities are dominated by knowledge accumulation and articulation endeavour, but are weak in knowledge codification. This finding is in line with proposition 3 in Paper V which asserts that: if knowledge governance was adapted to a learning landscape, the knowledge creating processes could be efficient but not necessarily effective, indicating the interplay between strategies and their result (the learning landscape), that is, what comes first, and which is a result of what? Strategies are supposed to bring organizations to a future desired level and it appears occasionally as though the desired state is where the PBO is at the moment. It could also be that the organization is unwilling, does not have the capability or is stuck in prevailing routines, culture or norms impacting the ability to relearn or try new methods of interaction. This could also explain the findings in Paper I, in that none of the many methods and tools for managing end-users in construction projects was used. The post-occupancy evaluation (POE) method, that is, evaluating facilities in use through a combination of technical, functional and behavioural aspects, was used in Finland (see Paper III), but none of the other methods was found.

5.1.3 Coordination of exploration and exploitation

Exploration refers to searching for new knowledge, for example, development of new products or ways of working; while exploitation, for instance, refers to refinement of existing procedures (March, 1991). PBOs require an appropriate balance between the two processes to survive, but what is appropriate among organizations differs due to the strategies and goals of the PBO. Indeed, how does a PBO gain competitive advantage through its knowledge efforts and strategies concerning exploration and exploitation? This is a qualitative study and therefore statistical measurement of balances between exploitation and exploration is not investigated. Instead, exploration and exploitation issues are discussed from a coordination perspective in PBOs, that is, how identified factors (see Table 5.1) impact the organization's knowledge processes and capabilities when it comes to exploitation and exploration.

Results from this study indicate the following.

- Internal knowledge processes are often insufficient in PBOs, but knowledge processes and capabilities in PBOs benefit from a combination of formal, informal and relational strategies in conjunction with a combination of enabling and commanding strategies.
- External knowledge processes require multiple boundary strategies when, for instance, attempting to understand end-users' needs and requirements necessitating a broad range of capabilities; however, the boundary strategies were mainly held individually and were experience based.

Both findings relate to exploitation and exploration, that is, coordination of knowledge processes.

The implementation of a PMO, as an internal knowledge broker, has been found appropriate in order to increase internal knowledge processes among project managers and for top-management, if the PMO takes an active role in multiple expertise areas. The effectiveness of PMOs appears, from a coordination perspective, to be impacted more by traditions, politics and routines in the PBO than over the kind of knowledge processes it aims to increase/support.

The acceptance of independence and individuality appeared higher in the Survivor and Deliverer than in the Superior, Collector and Explorer, which hampers internal knowledge processes. The latter organizations had developed strategies and practices for collaboration and discussion of distinct brokering strategies with external parties, such as the end-users, while the former

organizations did not often discuss these issues collectively. That is not to say members in these organizations never discussed issues, since they most likely did with individuals with whom they either had strong, trusting relationships or with whom they were closely associated (indicated in Paper III and IV Appendix III and IV respectively). Their organizations did not formally and/or explicitly have this on the agenda and relied upon employees possessing sufficient competence to do their job.

The strategies concerning user involvement and the competence of managing end-users and their needs varied among the PBOs. In the Finnish case, the organization had a department dedicated to workplace management, where external specialists were employed, when the interaction involved more sophisticated analyses of workflows and where changes covering business development were involved. In other words, it included changes of goals and strategies in the end-users' organization, concerning facilities and collaboration activities. The Superior, Explorer and Supporter coordinated themselves similarly, while the Deliverer, Survivor and Collector lacked this internal dedication of developing and maintaining this competence.

Exploring new trends, procedures, methods and technologies appears in every PBO, but the collective drive to implement them varies. Again, the Superior, Explorer and Supporter have an organizational drive to be at the forefront of the market and often won awards for excellent performances. This makes them implement relational governance practices more strategically than the others. These companies operate in the private sector while the Deliverer and Survivor include a mix of public and private companies. Claiming that private companies are always more competitive than those in the public sector is therefore inappropriate. The public sector has to manage a political game concerning money and decision making which put it in a different position. Nonetheless, these PBOs adopted a bureaucratic and formal governance approach, which they might not have needed to adopt. The private PBOs in these groups also lacked the drive to compete and be at the forefront of the market. Many of these PBOs relied on their reputation of being a well-kept family business, steeped in tradition, with a reputation for reliable maintenance and operation in use, which the customers appreciated or which competitors lacked.

The organizational compositions of the PBOs also impacted on knowledge processes. One significant factor that was confirmed in Paper V is whether the organization is a subsidiary or standalone PBO. The standalone PBOs are the Explorers in Table 5.2. Overall, they had the most varied and interactional approaches to knowledge processes and development of capabilities and

competences. This finding might be the result of a deficient ability to build or draw benefits from long-term relationships with the customer/end-users, thereby creating a mentality of 'it is now or never'. The Explorer needs to be at the forefront, and has to appeal instantly to the customer through its portfolio of accomplishments and competences to a greater extent than subsidiary PBOs.

The subsidiary PBOs have the opportunity to gain experience from both projects and business networks. For instance, subsidiary PBOs have the opportunity to gain knowledge of end-users through business and project networks, which, in turn, have the potential to improve the efficiency of interaction for them both, in projects, maintenance and operations through combination and recombination of knowledge. This is not however often the case. Frequently, interactions between real estate managers, asset managers, facilities managers and development managers were found to be insufficient for different reasons, such as poor attitudes, bad experiences, stereotyping and inhibiting professional ethos. The organizations seldom have sufficient knowledge brokering strategies to improve their internal knowledge processes. Even though the PMO provided some support in order to improve the relationship between project managers and between project managers and top managers, for example project control meetings, more horizontal brokering strategies are needed. The interface between the PBO and the rest of the corporation in this study is thus valid for the Survivor, Superior, Supporter, Collector and Deliverer.

This synthesis aims at analysing the findings of this research in the search for patterns and structures that shape knowledge processes. This synthesis can be summarized by concluding as follows.

- The analysis has brought together the five papers into a table of the dimensions of knowledge processes and capabilities (see Table 5.1) and has emphasized the multiple interplays that shape the interactions between the development of capabilities and processes on each level of the PBO (Figure 5.1).
- This analysis has provided a tentative knowledge governance strategy structure, presenting six main tendencies among PBOs.
- An analysis of organizational structures that shape knowledge governance strategies and coordination of exploration and exploitation has been provided.

The above will be further elaborated in the following discussion section, in the search for underlying mechanisms.

5.2 Discussion

This section compares findings from the analysis, with the literature, in the search for underlying mechanisms through an investigation of commonalities and differences. The aim is to bring everything together in order to grasp the underlying mechanisms, as well as identify vital contingency factors, for a knowledge-based view of PBOs in the real estate sector. Returning to the, yet to be discussed, contingency factors presented by Söderlund and Tell (2011), that is, dimensions of knowledge specialization, problem character and nature of task, it is not possible to give one straight answer to these matters due to the multilevel and dimensional aspects of knowledge processes and strategies; they will therefore be elaborated upon further.

Tensions exist in every organization due to political games, distinct goals and norms (see for example Hosking and Morley, 1991). These factors, such as, knowledge differentiation, conflict of interests and complexity, have been found to impact cognitive failures of knowledge governance strategies (Grandori, 2001). One tension and possible failure for knowledge governance strategies in PBOs is the requirement of autonomy in projects and the need for interdependence within the PBO to integrate knowledge bases and improve the business (Grant, 1996b; Sydow et al., 2004). From a knowledge perspective it can be argued that the PBO has a higher potential to embed knowledge, through combination and recombination, into its business networks rather than projects due to the time perspective (Grabher, 2004). Findings from the last section, therefore, shed light upon distinct strategies concerning independence and dependence in PBOs, where the Deliverer and Survivor often let project managers act independently to avoid conflicts and disturbance to routines and norms. This understanding is in line with Swart and Harvey's (2011) finding that tends to concede carefulness when managing lower levels. This research, in addition however, highlighted the opposite situation at these lower organizational levels. The Explorer and Supporter tried to diminish independency concerning knowledge creation, through continuous and obligatory interactions and discussions, that is, they tried to embed embodied knowledge and were less careful in their management and, instead, were commanding. Also, the Superior PBOs tried to change and challenge previous norms of independency and protection rather than sharing knowledge behaviour through commanding strategies. This indicates that the tension, or interplay, between independency and dependency is a multidimensional, socially-embedded problem in PBOs.

Conservative norms, attitudes and political games in the construction and real estate sectors have also been found previously, as well as in this research. A number of interviewees stated it was a problematic issue both when recruiting project managers and interacting with external experts in projects, that is, it was occasionally hard to find individuals who were skilful communicators, relationship builders and technically competent. This contextual situation may impact PBOs' strategic choices concerning choice of battles with respect to, for example, independence and dependence, encoded, embedded and encultured knowledge. The independent project members were probably rather efficient in their operations due to their intertwined private and public networks (in the sense of Grabher, 2004). This raises questions such as 'how do inherent relationships in networks, that is, degree of private, public, short and long-term attributes in the relationship, impact the coordination between a project and business networks?'

Business processes connect different parts of a PBO (Gann and Salter, 2000) through customer, administrative or management processes (Van Der Merwe, 2002). The implication is that the relationships in business networks in PBOs are maintained with external partners, such as end-users and clients; and vertical partners, for instance, the chain between executives, PMO personnel and project managers; and horizontal partners, such as between project managers as well as, for subsidiary PBOs, development managers, real estate managers and asset managers. Conversely, the project networks, due to their independence, mainly include external partners like consultants, end-users contractors and sponsors. The character of the problem to be solved has been found to be impacting knowledge processes (Nickerson and Zenger, 2004) and, consequently, the interactions between project and business networks. Decomposable problems require low levels of interaction between individuals with different knowledge sets, whereas non-decomposable problems require high levels of interaction (Nickerson and Zenger, 2004; Foss, 2007). For routine aspects, this study indicates that the business network manages decomposable problems, or problems in need of a directional search for the projects, and occasionally the two networks interact in non-decomposable problem solving through project-control meetings, reviews, reporting and value management sessions. End-users are involved in both networks, but the relationship to them is mainly professional; occasionally, it turned into professional and private relationships for key end-users. The Supporter and Superior built strong relationships with end-users as a knowledge creating strategy and overall business strategy, to ensure satisfaction and trust and as in indicator of whether the PBO had an appropriate balance between exploitation and exploration or not. This further indicates that, in line with the

propositions in Paper V, boundary bridging strategies have to be adjusted to business and project networks and to the nature of tasks and problems in order to diminish potential cognitive failures. Moreover, executives were found with the potential to bridge social and cultural barriers through strategic use of relational knowledge governance practices. Thus, the executives' preconceptions towards actors were found to be either enablers or barriers. The implication is that coordination problems involve, aside from the capabilities of solving the actual problem, capabilities of managing the embedded social and political structures wherein the actors operate (Grabher, 2004; Sydow et al., 2004). This is why PBOs require capabilities to use multiple boundary strategies and why knowledge processes are difficult to steer or govern.

Knowledge governance, like project governance, appears in this study to range from consultative to law-making (cf. Müller, 2011). More often than not it is consultative rather than law-making, as enabling and commanding strategies were mainly used on a needs basis. The respondents' overall view of people is that they are lazy unless they are extremely passionate about their jobs. Therefore, a combination of commanding and enabling knowledge governance strategies was often found appropriate in PBOs. Consequently, in the Explorer and Superior PBOs, it was almost law to share and integrate knowledge; in the Explorer PBOs, it was obligatory to participate actively in relational governance practices. Using PMO services in projects was mandatory for Superior, Explorer and Delivery. The reasoning, as stated earlier, was to create relationships of trust, as these tended to increase informal interactions among members of the PBOs. This finding supports the notion of PMOs as interacting with forces, mediating diverse organizational tensions and contributing to organizational performance through the internal processes of control and information sharing (Aubry et al., 2010b). In connection with the opening of this discussion, the PMO provides one prominent mechanism to manage tensions in PBOs, concerning conflicts of interests, knowledge differentiations, dependence and independence. But for this a number of capabilities are required, such as adapting, integrating and reconfiguring skills, for example to facilitate, promote, coach, educate, govern and control project managers in current situations and over time. This study however, further demonstrates that the PMOs, in practice, possess the potential for improvement in order to manage this multidimensional role.

Antonelli (2006) suggests adopting knowledge governance mechanisms to knowledge type (see Table 2.4, Chapter 2). Tacit and sticky knowledge in Explorer PBOs were governed through job-rotation and working in pairs, which can be roughly viewed as a quasi-hierarchical command strategy; the other PBOs did not strategically govern tacit and sticky knowledge. Articulable

knowledge was mainly governed through relational and informal governance strategies, which can be viewed as constructed interactions, in line with Antonelli. Finally, codified knowledge was mainly governed through formal governance strategies, such as information systems, guidelines or courses, which can be viewed, more or less, as coordinated 'transactions' (according to Antonelli).

In order to further elaborate upon Antonelli's knowledge governance mechanisms, the notions discussed here derive from the five knowledge types discussed by Collins (1993) and Blacker (1995), that is, embrained, embodied, encultured, embedded and encoded knowledge. Embrained knowledge corresponds with articulable knowledge, embedded with sticky and tacit knowledge, encoded with explicit knowledge and these knowledge types therefore correspond with Antonlli. Nonetheless, encultured and embodied knowledge is only partly covered in his study. This study suggests that the process of achieving shared understanding (encultured) in PBO is most often governed through boundary strategies. Bridging the boundaries is partly managed through relational governance mechanisms and partly through the use of either a third party mediating and brokering, such as the PMO or external consultants, but also through informal governance strategies like network interactions. The individual and tacit action-oriented, embodied knowledge was mainly governed by letting people work to gain experience. The Supporter provided a lot of training to improve the ability to act properly in distinct situations, while most PBOs did not provide training.

Returning to the contingency factors presented by Söderlund and Tell (2011), which were partly discussed in section 2.2 and partly in this section, it can be concluded that they appear valid in the real estate sector (see Table 5.3). However, three additional factors are presented in Table 5.2, namely structure, network and product lifecycle commitment. Structure relates to whether the PBO is a subsidiary or a standalone organization, since this research suggests it to be an important factor impacting knowledge governance strategies. Networks accentuate whether the PBO's focus is on the project, business networks, or both. A product lifecycle commitment determines whether the PBO owns and rents or sells the output (facility) after project completion.

In reviewing Table 5.3, it becomes evident that the Collector is the PBO that has the most elements of M-form corporations of the six PBOs. In regard to the nature of the task, PBOs in the real estate sector are most often characterized by a rather high degree of project process routinization, that is, the market condition allows development of rather stable dynamic capabilities (in line with Eisenhardt and Martin, 2000). The main difficulty appears to be

management of people and interactions, that is, coordination problems which include the customer relationship part of project capabilities in accordance with Brady and Davies (2004), who suggested how it was possible to build project capabilities. Every project is to a large extent unique, although most actors have produced similar facilities beforehand, and most PBOs have developed routines, guidelines and procedures for managing typical projects. There are difficulties and unique elements in each and every project, for instance managing end-users, coordination of different expertise, implementation of new energy saving technologies or ensuring the quality of extremely sensitive requirements, such as would be found in laboratories in universities or in hospitals. These conditions make the problems almost non-decomposable, but the tasks often maintain significant degrees of routine concerning the phases of the project, matters of reporting, needs analysis, briefing, design, production and delivery/occupation. For these reasons, it is valid to label the nature of tasks in PBOs in the real estate sector as heterogeneous, albeit with elements of both project and PBO routines.

With regard to Table 5.2, it is suggested that user involvement concerns building and space, workflows and/or goals and strategies. In contrast, Söderlund and Tell (2011) suggest that user involvement involves high or low degrees of involvement in the innovation and delivery process. These two suggestions are not fully compatible. End-users are involved in almost every delivery process of projects but whether they are involved in the innovation process or not are questions of how the innovation process is defined and what is regarded as high and low involvement. The real estate market, as discussed in section 2.2, can be regarded as differentiated and rather dynamic, but not as dynamic and rapid as many other product development markets such as, for example, telecommunication. Nevertheless, the market requires recombination of knowledge to meet the current and the new demands of customers and thus user involvement in projects is rather intense (high degree of involvement) in line with Söderlund and Tell (2011). This implies that even though user involvement covers buildings and spaces alone, it can be considered to be a matter of high involvement. Still, this research has found there is no guarantee that their needs and requirements will be met, despite being involved, as sometimes: (1) what they say they need is not always what they need; (2) interactions are insufficient; (3) their opinions are ignored; (4) there are too few end-users with the time, financial possibilities, interest or competence to be involved in, or contribute to, the innovation process; and (5) professionals have insufficient capabilities to involve them in a productive manner. This may

question the validity of the innovation aspect of this contingency factor as, even though end-users are highly involved, that does not guarantee they will have any significant impact upon the innovation process.

Table 5.3 The contingency factors based upon Söderlund and Tell (2011), with the additional dimensions of structure, network and product lifecycle commitment, contributed from the perspective of the real estate sector.

	Real estate PBOs					
Contingency factor	**Survivor**	**Deliverer**	**Superior**	**Explorer**	**Supporter**	**Collector**
Market conditions	Differentiated and (dynamic)	Differentiated and (dynamic)	Differentiated and (dynamic)	Differentiated and (dynamic)	Differentiated and (dynamic)	Differentiated and (dynamic)
Output type	Customized products, systems and services	Customized products, systems and services	Customized products, systems and services	Customized products, systems and services	Customized products, systems and services	Standardized products sold in diverse markets
User involvement	High degree of user involvement in the innovation process	High degree of user involvement in the innovation process	High degree of user involvement in the innovation process	High degree of user involvement in the innovation process	High degree of user involvement in the innovation process	Low degree of user involvement in the innovation process
Time orientation	Deadline focus	Deadline focus	Deadline focus	Deadline focus	Deadline focus	Deadline focus
System of production	Unit production and small batch	Unit production and small batch	Unit production and small batch	Unit production and small batch	Unit production and small batch	Unit production and quite small batch
Economic rationale	Economies of systems	Economies of systems	Economies of systems	Economies of systems	Economies of systems	Economies of systems
Technology type	Engineering	Engineering	Engineering	Engineering	Engineering	Engineering
Primary type of interdependencies	Reciprocal	Reciprocal	Reciprocal	Reciprocal	Reciprocal	Reciprocal

Table 5.3 Continued.

	Real estate PBOs					
Contingency factor	**Survivor**	**Deliverer**	**Superior**	**Explorer**	**Supporter**	**Collector**
Nature of task	Heterogeneous but project and PBO routines	Heterogeneous but project and PBO routines	Heterogeneous but project and PBO routines	Heterogeneous but project and PBO routines	Heterogeneous but project and PBO routines	Heterogeneous but PBO routines
Dimensions of knowledge	Breadth and depth	Breadth and depth	Breadth and depth	Breadth and depth	Breadth and depth	Breadth and depth
Problem character	Nearly and non-decomposable	Nearly and non-decomposable	Nearly and non-decomposable	Nearly and non-decomposable	Nearly and non-decomposable	Nearly, non-decomposable and decomposable
Structure	Subsidiary	Subsidiary	Subsidiary	Standalone	Subsidiary	Subsidiary
Networks	Project and Business	Project and business	Project and business	Mainly project	Project and business	Mainly business
Product lifecycle commitment	Lifecycle commitment	Lifecycle commitment	Lifecycle commitment	Project commitment	Lifecycle commitment	Product development commitment

Table 5.3 sheds light on the fact that the PBOs investigated in this study are rather similar when it comes to contingency factors, but vital distinctions occur that have implications for the knowledge governance and internal knowledge processes in the PBO.

So far in this discussion section a number of patterns and structures have been discussed concerning, for example, relationships between knowledge types and governance mechanisms, the nature of problem, and their relation to business and project networks. In the following section the underlying mechanisms are identified.

5.2.1 Underlying mechanisms' impact upon knowledge processes

This section brings earlier chapters and sections of this thesis together in order to provide the first, full discussion on the answer to the research question.

The research question was formulated in Chapter 1 as follows: *how do project-based organizations' underlying mechanisms impact on internal knowledge processes?*

Underlying mechanisms and structures produce events and experiences, where the former two can be understood through investigation of the latter two, according to Bhaskar (2008). In this case, mechanisms are referred to as conditions and contingencies, shaping social structures and events and, thereby, the knowledge processes in PBOs. This implies that in order to understand how underlying mechanisms impact upon knowledge processes in PBOs, a multilayer and multidimensional approach is needed to penetrate the real domain.

Table 5.4 and Figure 5.2 together, provide an overview of the main factors and dimensions grouped into six areas of contingencies and conditions that have emerged to interplay and impact upon each other in this research. Reading Figure 5.2, from the bottom to the top, indicates that contextual contingencies set the learning and knowledge goals in the organization. From these goals, the organization has to reflect upon knowledge governance mechanisms, in order to set appropriate strategies which impact the knowledge governance practices that the organization has to implement. These practices impact the knowledge types and knowledge processes that are generated in the organization. Moreover, if the knowledge types and processes in the organization are

insufficient, that is, scarce reproduction as suggested by (Varela et al., 1974), the organization has to refine its processes, relearn or restructure itself like an autopoietic system and, in order to do so, the underlying structures and mechanisms have to be understood.

Table 5.4 A knowledge governance structure for knowledge processes and capabilities of PBOs in the real estate sector.

Contextual contingency	**Learning and knowledge goals**	**Knowledge governance mechanism**	**Knowledge governance strategy**	**Knowledge governance practices**	**Knowledge type**	**Knowledge process**
Market conditions User involvement Structure Output type Time orientation System of production Technology type Economic rationale Primary type of interdependencies Nature of task Dimensions of knowledge Problem character Networks Product lifecycle Commitment	Prospective learning Retrospective learning Cumulative learning Disruptive learning Exploitation Exploration Experience accumulation Repetition Recombination Reflection Relating	Formal Informal Relational Trust Professional ethos Reputation Coordinate transactions Construct interactions Quasi-hierarchal Communities or networks of practices Capabilities Culture Independence Dependence	Commanding/ Law making Enabling/ Consultative Boundary strategies Horizontal integration Vertical integration	Controlling Managing Passive Active Boundary roles Boundary objects Education Training Information systems etc	Embrained Encoded Embodied Embedded Encultured	Transferring Sharing Integration Creation

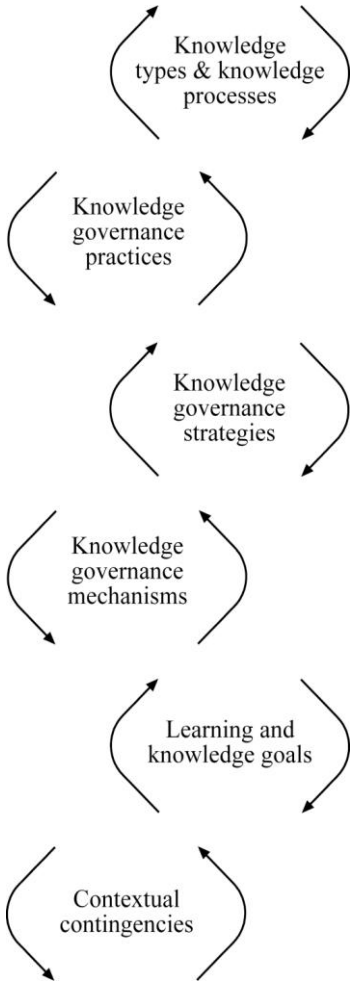

Figure 5.2 A knowledge governance structure for the knowledge processes and capabilities of PBOs in the real estate sector.

The underlying mechanisms, thus vary from organization to organization, and are shaped by interplays such as those illustrated in Table 5.1 and Figure 5.1, and by interplays within and between the six areas in Figure 5.2. For instance, Paper V, Appendix V, identified three main mechanisms impacting knowledge governance practices in PBOs in the real estate sector. These were structural, visionary and pragmatic mechanisms. In relating the mechanisms to Table 5.4 and Figure 5.2, structural can be seen as connected to contextual contingencies

and knowledge governance mechanisms; with visionary connected to contextual and to learning and knowledge goals; and pragmatic to knowledge governance mechanisms and knowledge governance practices. However, as Table 5.2 has highlighted, even though this research is set in the real estate sector, PBOs may come in many forms, with distinct aspirations, shaping an organizational assortment of knowledge processes and knowledge type outcomes.

Table 5.1 and Figure 5.1 draw attention to the number of interplays shaping the PBO and its learning processes. Table 5.4 and Figure 5.2 further elaborate on this through a tentative illustration of dimensions that may impact the knowledge processes in PBOs discovered in this research. Figure 5.2 should be regarded as a proposition in need of further testing and no statistical correlation or impact factors between the six areas can be presented here. A further study is recommended with the emphasis on exploring correlations and statistically-confirmed causal relationships among impact factors. Nevertheless, the analysis has drawn attention to a number of patterns and confirmed relationships between, for instance, knowledge governance mechanisms and knowledge types.

Davies and Brady (2000), in their study of complex product systems, emphasize the importance of investigating capability development through a focus on the interactions, that is, strategic interventions, optimizations and learning processes, between the top, middle and operational levels and their development over time. This bottom-up (project-led) vs. top-down (business-led) approach provides insights into how exploration and lessons learnt are achieved in projects, and how organizations learn to improve strategic decisions concerning their project business, that is, embedding the lessons learnt from project-led learning in the organization (Brady and Davies, 2004). Their view corresponds with this research process, which is concerned with investigating the PBO through its organizational layers: from the lower levels up to the top and then investigates knowledge governance strategies (top-down) (see Paper V). Development over time was not investigated in this study. Instead, the contribution is rather a multi-knowledge perspective and analysis approach, embracing both theories and derived from economic, management, system and behavioural theories. This approach proved to be productive since a knowledge-based view of an organization is still a view and not yet a theory, resulting in the need for rich and various investigations in the area, before a stable theory can be established. The findings concerning knowledge interplays in a PBO also have the potential to contribute to general organizational theory. This is suggested as the notion of internal interplays among factors shaping the organizational 'DNA' and exists for other organizational forms as well. The

main difference is probably the balance between the interplays, where the knowledge outcome of either is, for instance, a knowledge silo or a loosely coupled system. Even so, the notion of interplays leading to distinct knowledge process outcomes also has the potential to be valid in other contexts and organizational forms.

From this discussion, we can conclude that this research has contributed to existing bodies of knowledge through a knowledge-based view of PBOs in the real estate sector, with a particular interest in end-users. The main contributions are as follows.

- Investigation of a P-form corporation in the real estate sector, with three additional factors (Table 5.3) and some adjustments of their characteristics.
- A multi-perspective view of knowledge is emphasized in order to comprehend internal knowledge processes in PBOs.
- The development of a tentative knowledge governance framework (Table 5.4 and Figure 5.2).

5.3 Reflection upon chosen strategies

Some limitations in this research have already been noted in Chapters 1 and 3. In summary, this research is mainly set in the real estate sector and has investigated PBOs from a bottom-up perspective. The overall scope of the research is rather broad as it takes knowledge processes in the PBO as the unit for analysis, in which a number of layers and interfaces exist. This choice was considered valid in order to grasp structures behind knowledge processes in PBOs from different perspectives and dimensions. Limitations and selection have thus been applied to the focus on the project, PMO and top-management. This action has resulted in, for instance, programme and portfolio management being excluded. The focus on the stakeholder group of end-users also impacts the results. Had a shareholder and top down approach to the research process been investigated, it is possible that other conclusions and impact factors would have been discovered.

In Chapter 2 it was stated that previous research occasionally mixes knowledge perspectives and cooperation and coordination activities. This may be a sign that there is no single appropriate perspective available and/or that a mix might be needed to grasp what happens in the 'real world', where things are seldom

clear-cut. The appropriateness of mixing may be questioned, but if the researchers are explicit about their perspectives, both in terms of knowledge and coordination vs. cooperation, the reader can judge. However, if the fundamental view of the nature of knowledge, that is the epistemological position, is not stated, it is harder for the reader to judge the work, which carries the risk of misinterpretation. One reason for not stating an epistemological stance might be as simple as saying that they do not know where they belong.

This research takes a critical realism view of the world and adopts a qualitative investigative approach. The critical realism view implies that distinct sources of data can be combined in the search for underlying mechanisms that shape events and patterns in the real world. This is why, for example, combining cognitive and constructivist theories in Paper II and a combination of abductive and deductive studies can be regarded appropriate: multiple sources and perspectives are encouraged. This research, however, is purely qualitative and from a critical realist perspective, the results and findings would have been considered stronger with at least one quantitative study. However, as stated in the methodology chapter, a number of methods were used to improve both the internal and external validity of the results. As stated in section 5.3.1, would it have been possible for a quantitative study to have ultimately found any statistical correlation between the dimensions and contingencies? Thus, in this research I made a choice, as stated in Chapter 1, not to aim for general applicability but to deepen the understanding of the phenomena under investigation. The final propositions presented (illustrated in the figures and tables in this chapter), therefore open the door to further studies.

Paper IV includes PBOs from four industrial sectors, other than real estate. These PBOs are included in Table 5.2 in accordance with their adopted knowledge governance strategy, thereby strengthening this research and offering the possibility that it might be valid in other sectors. Even so, if other sectors had been included they might have shown totally different knowledge governance patterns. Moreover, this is qualitative research with a limited number of countries, sectors and organizations included, making it unwise to suggest that the findings would be valid anywhere else.

Another limitation, as stated and discussed in Chapter 3, is that the research captures what people say they do against the background of a limited number of controls in databases. If observations were made, or other forms of qualitative methods such as cognitive mapping or laddering were used, the result might have been different. For example, cognitive mapping could have been useful as it investigates interrelationships and interconnections between

key events and processes (Goodier et al., 2010) and thereby provides an opportunity to understand what knowledge base, beliefs and assumptions exist in accordance with Edkins et al. (2007). Moreover, the laddering technique (Saunders et al., 2009) could possibly have been valuable in this study as a means to making sense of, for example, project managers' patterns and values in a specific context (Baker, 2002), such as in regard to knowledge seeking and searching. The mapping of attributes, patterns and values would possibly have led to a deeper understanding of why project managers act the way they do, when it comes to knowledge sharing and searching. This would be interesting to do in a future study but was outside the scope of this study.

5.4 Conclusion

This chapter has analysed and discussed the findings of the thesis by connecting the five papers, to provide an overarching analysis and discussion.

The synthesis examines the findings of this research in the search for patterns and structures that shape knowledge processes. The five papers were brought together into a table of the dimensions of knowledge processes and capabilities (see Table 5.1), and emphasize the multiple interplays that shape interaction between the development of capabilities and processes on each level of the PBO (Figure 5.1). Moreover, it provides a tentative knowledge governance strategy structure (Table 5.4 and Figure 5.2) representing six key tendencies, or profiles, among PBOs and investigates organizational structures shaping knowledge governance strategies and the coordination of exploration and exploitation.

The P- and M-form contingencies have been revisited and three additional contingency factors are suggested and discussed (Table 5.2). By connecting the findings to previous literature, a tentative framework of knowledge governance in PBOs has been developed. It is suggested that the internal knowledge processes are an outcome of numerous interplays among:

- contextual contingencies;
- learning and knowledge goals;
- knowledge governance mechanisms;
- knowledge governance strategies;
- knowledge governance practices; and

– knowledge types.

The research mainly contributes to the existing body of knowledge through an end-user focus in the knowledge-based view of a PBO, by uncovering numerous interplay factors shaping the 'DNA' of the organization, and its internal knowledge processes. A further study of relationships is thus recommended as this, as with all research, has limitations.

6. Conclusions

This chapter concludes and closes this thesis with promising areas for future research. A short summary of the research, and answers to the objectives of the research are provided, followed by answers to the research question. The theoretical and practical contributions of the research are highlighted.

6.1 Knowledge-based view of PBOs in the real estate sector

This research aims to investigate the impact of PBO's underlying mechanisms on internal knowledge processes, with the aim of fulfilling end-users' needs and requirements. This was investigated through a knowledge-based view of PBOs, with knowledge processes as the unit of analysis. The research adopts a critical realism perspective and combines literature reviews with 14 qualitative case studies and a final qualitative sample survey. The empirical findings are based upon 100 semi-structured interviews[4]. The research process investigated the phenomena from distinct theoretical and empirical perspectives and contexts, resulting in an incrementally increasing comprehension of the phenomena. This summary part of the thesis has provided a synthesis of the findings presented in the paper part of this thesis and, consequently, has improved insights into how the PBO's underlying mechanisms impact internal knowledge processes in PBOs (see section 6.2). But before that, answers to the five objectives are presented. As the objectives were partly answered and discussed in Chapter 4, summarized accounts are provided here.

[4] Of which 61 interviews were conducted by the author of this thesis and 39 interviews were conducted by the co-author of paper IV.

6.1.1 Management of known end-users and their requirements

The first objective was to examine the management of end-users and their requirements, when the end-users are known in construction projects.

The study revealed that there exist a number of methods and tools for managing end-users in theory, but few were used in practice. Every PBO in this study found it necessary and vital to manage end-users and their needs, to stay competitive in the market, that is, for explorative reasons. Thus there are indications that both explorative and exploitative strategies concerning these issues were often scarce or absent in the PBOs. It appears as if capabilities of managing end-users and their requirements were not often considered as core capabilities in the PBO. Lessons learnt (knowledge transfers) documents and discussions of strategies for managing end-users and their requirements, that is, knowledge sharing and integration, are often deficient.

Nonetheless, the project managers often succeed in managing end-users by drawing on their experienced-based, individually and tacitly held knowledge. Yet, the research found a lack of exploration concerning, for example, searching for new forms of interaction in the market. This was also found concerning exploitation strategies and initiatives for refining existing procedures on projects. This might indicate that routines and capabilities for managing end-users sometimes appear to resist change, and thereby self-repeating patterns become insulated. This consequence would not necessarily be a disadvantage, if well-established and efficient routines and capabilities existed in the organization. However, when patterns appear to be the effects of strategic and resource scarcity, it can be reasonably regarded as an organizational risk from both an effective and efficient perspective.

6.1.2 Management of unknown end-users and their requirements

The second objective was to evaluate the management of end-users and their requirements when end-users are unknown in construction projects.

When end-users are unknown to the PBO, the most successful approach appears to be the use of a combined strategy of surveys, focus groups and evaluations. Solely relying on decontextualized information appears insufficient, as it was found that the organization benefits from using relational

governance mechanisms to combine different knowledge areas. A vital attribute to possess for managing this situation is the capability to internalize, embed and enculture knowledge into processes so that the organization can reproduce itself, that is, relearn or recombine its knowledge efficiently. Such a capability or capabilities are often found to be scarce.

Reasons for this appear to be two-fold. First, there is the contradictory situation of having both information overload and scarcity, since the PBOs occasionally appear not to have well-developed capabilities for collecting appropriate information. Second, there is the lack of awareness of antecedents for knowledge processes, that is, they rely on antecedents of knowledge transfers in situations where knowledge integration is required, due to the non-decomposable problem to be solved. This study suggests that PBOs have to use methods with a high level of interaction among departments to combine and recombine knowledge areas. Often, the internal interactions between departments are insufficient, that is, isolated islands of work with scare communications between them.

6.1.3 Bridging boundaries in the interface between end-users and project participants

The third objective was to establish how boundaries are bridged in the interface between the end-users' organization and the project organization.

Boundary bridging between end-users' and project organizations needs to be adjusted to the current situation and the purpose of the project for it not to be self-defeating. The study identified strategies concerning brokering roles and objects, and found that the strategies were more or less used, but the strategies were mainly individually held and used. In some cases, organizations use formal and informal knowledge governance strategies for improving this capability, but most often the knowledge of these strategies is tacit and individually held. The organizational learning and knowledge goals concerning capabilities and knowledge processes of bridging boundaries to end-user organizations, therefore appear deficient.

This is quite remarkable as many PBOs have a lifecycle commitment to their buildings and state that end-user satisfaction is vital. Thus, many of the PBOs in this study appear not to acknowledge, investigate or prioritize the connection between end-user capabilities, which can be regarded both as a project and a business capability, and overall organizational efficiency. More remarkable is that organizations without a lifecycle commitment, that is the

Explorers, appear to have the most developed end-user capabilities. This indicates that interacting with end-users is a non-decomposable problem in need of well-developed dynamic capabilities. Most often, it is the expert organization, as in the Finnish study, that has the capacity or will to prioritize these issues.

6.1.4 The capacity of PMOs to act as a knowledge broker in PBOs

The fourth objective was to investigate the project management office capacity to act as a knowledge broker in PBOs.

PMOs have potential to act as an internal knowledge broker through management of tensions in PBOs, concerning conflicts of interests, knowledge differentiation, dependence and independence etc. A number of prerequisites are essential in order to become efficient. For instance, the PMO needs to take an active role in multiple areas of expertise, to win the project manager's respect and trust and to become a part of their networks. The effectiveness of PMOs appears therefore to be impacted by traditions, politics and routines in the PBO, but also by the kind of knowledge processes it aims to increase/support.

Few, if any, PMOs in this study were thus operating efficiently as a knowledge broker; most often, parts were efficient but not the entire spectrum of functions and services that they offered. Furthermore, they did not fully meet the project manager's expectations of functions and services. It is further concluded that the PBO strategies concerning the development of PMO functions and services, as well as learning and knowledge goals for PMO personnel, are scarce. PMO personnel rely mainly on experiences and improve their competence on an ad hoc needs basis.

From this it can be argued that the entire PMO might appear to be permeated by temporary project thinking that fosters individual and tacitly held knowledge and explicitly written process documents. Emphasis on routinization, repetition and retrospective learning mechanisms appears higher than reflection, relating and prospective mechanisms, especially on a collective level. This is why the PMO benefits from taking an active brokering role to break routines and repetition, and make the project managers recombine their knowledge and relearn when needed. Stressing knowledge processes results in encultured and embedded knowledge, which is often low, with the exception of the Explorer and, to some extent, the Supporter and Superior PBOs.

6.1.5 Common patterns behind knowledge governance practices in PBOs

The fifth objective was to determine if common patterns exist behind knowledge governance practices in PBOs.

This study suggests a contingency theory perspective to comprehension emergence and patterns of knowledge governance strategies and practices in PBOs. It is found that strategies are adjusted to organizational characteristics within PBOs in order to allow knowledge processes to prosper between subunits. Additionally, common patterns impacting knowledge processes in PBOs were launched to emerge from structural, pragmatic and visionary mechanisms.

The six knowledge governance strategies indicate that both similarities and distinctiveness exit behind knowledge governance practices. Competence of knowledge governance thus often appears insufficient in PBOs and knowledge processes rarely prosper sufficiently between subunits. It is suggested that knowledge governance practices are impacted by a number of contingency factors (see Table 5.3) as well as cultures and attitudes towards a distinct professional ethos and its capabilities. Good examples, or best practices, were found among the organizations. For example, the generation of knowledge creating processes benefits from: (1) subtle interplays between commanding and enabling knowledge governance practices; and (2) relational governance mechanisms. Furthermore, informal and formal governance mechanisms appeared most efficient if combined with relational governance mechanisms. An active and collaborative knowledge governance approach is suggested, due to the rather repetitive nature of project procedures in the real estate sector and the need to better integrate and share knowledge concerning management of end-users and their needs, between project and business networks, as well as within each network.

Sections 6.1.1 to 6.1.5 inclusive have provided responses to the five objectives of this research. The following section answers the research question.

6.2 Impact upon internal knowledge processes

Returning to the research question, which was formulated as follows: how do project-based organizations' underlying mechanisms, impact on internal knowledge processes?

In order to understand the answer to the research question, which will be given in this section, it is vital to remember that this research is mainly set in the real estate sector. Projects in the real estate sector maintain elements of a repetitive nature such as the underlying project process, even though unique elements, for instance, finding unique solutions for end-users, are a part of the project outcome. End-users and their needs are often seen as complicating the project process. The capabilities intended to manage them in the process are often found to be scarce, even though they are vital for the emergence and prerogative of the project's existence and, in the longer run, the PBO. In this research, end-users have been found to either directly or indirectly impact the internal knowledge processes in PBOs.

It has been shown that the internal knowledge processes in PBOs have been influenced by PBOs' contingency factors, which set the preconditions and arena for development of knowledge processes and capabilities in PBOs. From the contingency factors, organizational goals are set concerning knowledge and learning, which both impact on, and are impacted by, the knowledge governance mechanisms. This feature was found to further affect the strategies and practices that are appropriate to adopt, in order to foster and create required knowledge processes and knowledge types. That is required in the sense of reaching the organization's knowledge and learning goals (see Figure 5.2). Figure 5.2 was derived from previous literature (Chapter 2), and confirmed by this research (Appended Papers) through an abductive analysis process.

The organization's internal knowledge processes can therefore be viewed in terms of a number of interplays (see Figure 5.1) shaping the organization's 'DNA' and impacting the development of the organization. This study identified six distinct PBOs classified according to their knowledge governance strategies (see Table 5.2), that is, the Survivor, Deliverer, Superior, Explorer, Supporter and Collector. Moreover, these PBOs adopt distinct strategies for distinct organizational levels and interfaces shaped by a number of impact factors (see Table 5.1).

Finding one solution to how the PBO's underlying mechanisms impact internal knowledge processes, and how efficiency can be achieved, appears

unrealistic. Rather, this research contributes by highlighting the need to comprehend the multiple layers and interplays within and between contingency factors, mechanisms, strategies and practices that shape internal knowledge processes. Moreover, this research has shed light upon organizational outcomes and capabilities, often reflecting the organizations themselves, that is, a reflection of the culture, attitudes, ambitions and playground. If knowledge processes are insufficient, the organization most likely benefits from investigating itself, layer-by-layer, in the search for patterns and structures shaping knowledge processes and initiatives. This notion is in line with the critical realism perspective of research, that is, to highlight and demonstrate multiple possible explanations of a phenomenon (Outhwaite, 1983; Easton, 2010; Bechara and Van de Ven, 2011).

This section has answered the research question. The remaining sections discuss theoretical and practical implications of the research, and suggest future research.

6.3 Research contributions

This research takes a critical realism perspective. Critical realism attempts to highlight and demonstrate multiple possible explanations of a phenomenon, not to predict or construct the world (Outhwaite, 1983; Easton, 2010; Bechara and Van de Ven, 2011) in the search for truth and knowledge. This needs to be borne in mind when discussing the contributions of the research.

What lessons can we learn from this research, that is, what are the contributions? In order to answer this question, the five identified areas in need of further investigation stated in Chapter 1 are revisited. The first identified area concerns the need to differentiate knowledge governance theory for distinct organizational structures. This research contributes with an investigation of PBOs, both subsidiary and standalone, and suggests the need to: (1) adjust strategies to distinct sub-units within the PBOs; (2) use a combination of enabling and commanding strategies; and (3) investigate underlying mechanisms, as these foster distinct knowledge process cultures and outcomes. The research contributes through the identification of six knowledge governance strategy profiles, and discusses and extends the existing contingency framework for PBOs in a real estate sector context. This contributes to existing knowledge governance theory and suggests the need for further appropriate research.

The second area concerns the need to further investigate knowledge processes in PBOs, as many studies exist on knowledge in project or functional organizations but only few on PBOs. This study contributes a literature review and an empirical investigation of multiple impact and contingency factors, and the interplays that shape internal knowledge processes and capability development in PBOs in the real estate sector. The research contributes by a multilayer approach, both concerning organizational layers and the conditions that shape the outcomes of knowledge governance mechanisms, strategies and practices.

The third and fifth areas concern the integration of project and business networks which, in this research, are investigated through the relationship to end-users of the PBOs products. The research contributes through the investigation of capability development concerning bridging knowledge boundaries in PBOs, with special attention to the case of the management of end-users and their needs. This aspect is investigated both at the external boundary to end-users in projects, and the internal boundary bridging through the PMO. The findings contribute to the existing body of knowledge, through investigations of dynamic and project capabilities required for efficient interactions in PBOs.

The fourth area concerns the importance of incorporating lower parts of the organization to improve initiatives from the top, over a short and long-term perspective. The research also contributes through the identification of enablers and barriers for efficiency of knowledge utilization from the project up through the organization. The research discovered that strategies for bridging knowledge boundaries need to reflect and be adjusted to the project managers and the experiences of the PMO's personnel, but they need to be resolute about development and improved knowledge integration and sharing to improve capabilities on every level of the PBO.

Closely connected to the fourth gap is a contribution to research methodology. The main methodological contribution is the adoption of the bottom-up investigation through a critical realism perspective in conjunction with a qualitative approach. This is a contribution on the grounds that: (1) the critical realism perspective allowed for the use of multiple perspectives in the search for underlying mechanisms; and (2) the qualitative bottom-up approach increased comprehension of distinct actors' preconditions, preferences and arenas of operations through rich empirical data. These contributions are valuable as both the knowledge-based view of an organization and knowledge governance theories are rather immature research fields, especially in the context of the real estate sector. Additionally, conducting studies in three countries, in various

organizations and on various organizational levels was beneficial. It increased the understanding of which findings were more generally valid structures and mechanisms concerning internal learning processes in PBOs, as opposed to those that were individual, case or country-specific events and structures.

Practical and managerial implications of this research are as follows.

- The usability of tools and methods for managing end-users needs to be improved.
- In order to implement new tools and methods and thereby change routines, law-making governance strategies might be required.
- PMO personnel as well as project managers need to be competent across a range of brokering strategies.
- Organizations probably benefit from collective knowledge sharing and integration processes concerning experienced based brokering strategies.
- PMO personnel need support both concerning development of expertise knowledge, and winning the trust of the project managers in PBO, to become efficient knowledge brokers.
- Knowledge processes in PBOs benefit from a subtle interplay between enabling and commanding knowledge governance strategies.
- The PBO needs to actively and continuously manage preconditions held, with respect to professional ethos, to improve internal collaborations.
- The PBO needs to adjust knowledge governance strategies for distinct subunits, as their learning and knowledge goal, as well as underlying mechanisms, appears insufficient.

6.4 Further research

This research implies that there is a need to further investigate and refine the notion of knowledge governance, its strategies and the implications for knowledge governance practices in different organizational forms. Moreover, there is a need to further develop the understanding of the role of managers and executives when it comes to their competences and leadership style concerning knowledge governance practices, as well as their impact upon the implementation of knowledge governance strategies on an operational level. Additionally, the knowledge-based view of a PBO has potential for improvement. The six PBO knowledge governance strategies suggested here would benefit from further empirical investigations to refine the knowledge governance strategy profiles.

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Managing the needs of end-users in the design and delivery of construction projects

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Abstract

Purpose – The two-fold purpose of this paper is identifying areas of difficulty in managing the needs of end-users in the course of the design and delivery of construction projects and suggesting possible solutions.

Design/methodology/approach – The focus of the paper is the interaction between three principal parties: end-users, project leader (a selected end-user) and facility planner (a facilities professional). The context is two projects in the public sector: a university and a hospital. The end-users of both are known from the start and participate in the whole process. The paper is based on a case study comprising 12 interviews – seven end-users and five professionals.

Findings – The research shows that during the project's design and delivery, communication and attitudinal problems have to be managed alongside the inherent difficulty of understanding end-users' real needs. To help in managing these issues, facility planners relied heavily on pedagogical and behavioural skills, rather than formalised methods as found in the literature.

Practical implications – The findings highlight areas of difficulty for managers and planners and how these areas were handled in practice. Suggestions on how to resolve some of the areas are presented and discussed.

Originality/value – Much of the research related to managing end-users focuses on how to extract value from the construction process, for instance providing greater flexibility and improved air quality. This paper concentrates on relations between parties who are central to the briefing, design and delivery process

Keywords Communication, Behaviour, Skills

Paper type Research paper

Introduction

Present and future needs of end-users have to be understood if supportive environments are to be created for them. Understanding such needs leads to more satisfied and less critical end-users (Kaya, 2004). Each construction project should therefore have the needs of its end-users in mind throughout the whole construction process[1] (Dewulf and Van Meel, 2002). This means that attention to end-users must span all phases in the project lifecycle and not just briefing as is generally the custom.

End-users are defined as those who use/occupy the building; they are not experts in managing it, but have knowledge and opinions, nonetheless, about its performance in relation to their own objectives (Kaya, 2004; Lai and Yik, 2007). In some cases, end-users are known in person and in other cases they are not. This situation demands different approaches in order to understand end-users and their requirements adequately. These approaches can take the form of direct involvement, such as focus groups and workshops, or indirect involvement utilising, for example, experience and

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surveys. (Dewulf and Van Meel, 2002). Either of these broad approaches has its advantages and as well as limitations.

End-user satisfaction is contingent not only on the outcome, but the way it is achieved (Campbell and Finch, 2004). This highlights the importance of successfully managing end-users. Even so, managing them is a complex affair; it demands a lot of time and energy and involves planning, workshops, interviews, presentations and feedback. Furthermore, there is always scope for problems to arise during the construction process (Kaya, 2004).

This paper reports the findings of research that has the aim of identifying areas of difficulty in managing the participation of end-users during the various life stages of a construction project. The rationale for studying the whole process is that end-users can be involved throughout, but most methods for managing them and their needs cover just part of the process. The particular focus of the research is the interaction between three parties: end users, end user project manager (EPM) (a selected end-user) and facility planner (FP) (a facilities' professional). The work is based primarily on a literature review discussing the expectations of the various methods uncovered and two case studies, whose findings will be summarised. The following aspects receive particular attention: difficulties arising from managing the participation of end-users, available methods for managing their needs and those methods actually used.

Managing end-users and their needs

Difficulties can arise when managing end-users, because they and the project group are drawn from different organisations each having their own goals, values and expectations (Kernohan *et al.*, 1992). Conceptual, institutional and social barriers have to be crossed to achieve an effective level of interaction (Lawrence, 1996) and, often, this is not the case. End-users can become a hostage, where their opinions do not really matter, because the things that are discussed do not fall within their area of knowledge (Mumford and Sackman, 1975). Negative stereotypes and images can exist among professionals and, if insensitive managerial practices are adopted, a confrontational relationship can easily arise (Loosemore and Tan Chin, 2000). An interaction problem in occupancy is:

> Users who discover problems with their use of facilities are apt to keep their frustration to themselves rather than blame the providers of facilities. In turn, providers tend to suggest that users need to be "educated" into ways of "correctly using" facilities, so that the facilities can perform as anticipated when they were designed (Kernohan *et al.*, 1992, 16).

The relationship described previously is not especially effective or productive and raises questions such as: how can barriers be overcome? How is effective interaction created? What methods exist to manage end-users throughout the whole process?

To succeed in improving the quality of the outcome of the process, the real needs of end-users have to be understood (Peña and Parshall, 2001; Mello, 2002). A need is often unconscious and hard to express, while requirements are statements related to existing products (Ericsson, 2007). A number of methods and tools exist for understanding end-users, their requirements and needs across the different phases of a construction project, not just briefing (Figure 1). A majority of the methods operates in either the early or later phases, but there are a few that attempt to cover the whole process. Many of the methods are not used regularly in practice and some have not been sufficiently

		Phases	Briefing	Design	Construction	Occupancy
Methods and indicators						
Dynamic briefing development	(Barrett *et al.*, 1996; Othman *et al.*, 2004; London *et al.*, 2005)					
Needfinding	(Patnaik and Becker, 1999)					
Concurrent engineering	(Kamara *et al.*, 2001; Yang and Peng, 2001)					
Project functional briefing	(Gray and Hughes, 2001)					
Strategic needs analysis	(Smith *et al.*, 2003; Smith *et al.*, 2005; Smith *et al.*, 2008)					
Soft system methodology	(Green and Simister, 1999; Wilson, 2001)					
Problem seeking	(Peña and Parshall, 2001; Hansen and Vanegas, 2003)					
Market driven product definition	(Mello, 2002)					
Housing quality indicators	(Hall and Meng, 2006)					
System dynamics	(Lee and Pena-Mora, 2007)					
Value management	(Kelly and Male, 1994; Gray and Hughes, 2001; Setijono and Dahlgaard Jens, 2007)					
Post-project evaluation	(Kelly *et al.*, 2005)					
Information management for design	(Fristedt and Ryd, 2004)					
Creative techniques for design professions	(Fristedt and Ryd, 2004)					
The built environment	(Fristedt and Ryd, 2004)					
Right decision	(Fristedt and Ryd, 2004)					
Quality function deployment	(Gustafsson, 1995; Cristiano *et al.*, 2001; Han *et al.*, 2001; Yang *et al.*, 2003; Delgado-Hernandez *et al.*, 2007)					
BriefMaker	(Hansen and Vanegas, 2003)					
BriefBuilder	(Van Ree *et al.*, 2006)					
EcoProP	(Huovila and Porkka, 2008)					
Expert choice	(Smith *et al.*, 1998)					
ICOP[a]						

(*Continued*)

Figure 1.

Integral client brief	(Malmqvist and Ryd, 2006)
Technical standard	(Malmqvist and Ryd, 2006)
Design performance measurement	(Torbett *et al.*, 2001; Hansen and Vanegas, 2003)
Design management	(Ahire and Dreyfus, 2000; Sebastian, 2005; Sebastian, 2007)
Participatory design	(Luck, 2003; Luck, 2007)
Design quality indicator	(Cole-Colander, 2003; Gann *et al.*, 2003; Gann and Whyte, 2003; Markus, 2003; Dewulf and Van Meel, 2004)
Intension practices aspiration model	(Lawson *et al.*, 2003)
Contractor quality performance	(Yasamis *et al.*, 2002)
Achieving excellence design evaluation toolkit	(Gann and Whyte, 2003)
Design excellence evaluation process	(Gann and Whyte, 2003)
Post-occupancy evaluation	(Preiser et al., 1988; Bechtel, 1996; Cooper, 2001; Preiser and Schramm, 2002; Vischer, 2002; Preiser and Schramm, 2005; Hadjri and Crozier, 2009)
Post-occupancy review of buildings and their engineering	(Bordass *et al.*, 2001; Cohen *et al.*, 2001; Preiser, 2001)
A generic approach to building evaluation	(Kernohan *et al.*, 1992)
Satisfied customer index	(Cessel and Strand, 1999-12-21; Swaddling and Miller, 2002; The American Satisfied Customer Index, 2008)
Customer perceived value	(Swaddling and Miller, 2002)
Construction products industry	(Construction Products Association, 2005)
Building performance indicator	(Shohet, 2003)
Building performance evaluation	(Preiser and Schramm, 2005; Preiser and Vischer, 2005)
Building research establishment environmental assessment	(Holmes and Hudson, 2002)
Behaviour-performance-outcome paradigm	(Liu and Walker, 1998; Liu, 2003)

Notes: The methods and indicators for managing end-user and/or their requirements and needs, the grey areas shows in what phase they are operating in. The methods are grouped after their similar phase activity

Source: [a]ICOP, www.icop.nl, (2008-08-19)

Figure 1.

validated. Other methods are criticised for not making clear how the results/outcomes should be acted on (Vischer, 2002; Markus, 2003). The usability of these methods should be improved, because of the potential benefits that would accrue from their use. Many of these methods highlight the interaction of participants in various ways; for example, design management focuses on the product, process and organisation/actors (Ahire and Dreyfus, 2000; Sebastian, 2005); concurrent engineering focuses on the organisation, supporting tools and information systems in the process (Kamara *et al.*, 2001); and post-occupancy evaluation considers the technical, functional and behavioural aspects of the outcome (Preiser *et al.*, 1988). As an example, the design quality indicator could be used for improving communication in the early phases, although it attempts to enhance understanding of end-users needs in a specific cultural, social and political context (Gann *et al.*, 2003). Building performance evaluation advocates improvement in the communication, collaboration and quality of every decision taken during the whole lifecycle of the building by evaluating the outcome of every phase (Preiser and Schramm, 2005; Vischer, 2008).

Managing the participation of end-users – two cases

It is important to see the case studies in their true context. They are not meant to provide a definitive account of how end-users are engaged, or should be engaged, and managed in a project. Their purpose is to illustrate some of the issues that arise and which are a cause for concern. The case studies were a refurbishment scheme and a new construction for a hospital and a university building – both are in the public sector. The end-users in these cases were known from the outset and involved in the whole process – from initiation to occupancy. The case studies do not cover occupancy, although the projects were ongoing or recently completed. Both projects were triggered by end-users' needs. The durations of the two projects were in the range ten to 15 years and the costs were in the range of SEK 250 to 300 million. An EPM, a steering/project group and working groups were constituted. The FP in both cases was a professional who acted as the link between other professional disciplines and end-users. The main role of the FP was to support end-users, having their interests in mind throughout the construction process.

In the hospital project, the end-users had a FP in the initial briefing stages only. After that the EPM had to handle all questions.

In the university project, the end-users were supported throughout the whole project, but both the EPM and the FP were replaced; in one case, this happened four times.

Understanding end-users' attitudes

In both projects, the FP and EPM explained that it was difficult to get end-users to see the bigger picture relating to their situation and to do so over a long time horizon. In the university project, the EPM found that end-users were focusing on the colour of the curtains in their rooms and not what opportunities the new centre would give them in their work. In the hospital project, both the EPM and the FP felt that a lot of work had to be put into making end-users pause to take stock of the situation, by lifting their heads to see their situation from another perspective.

A vision was formulated to help end-users see this wider perspective and to draw in project participants. The vision had to withstand robust questioning and act as a

guiding light when choosing between different decisions. According to one of the FPs: "vision and organisational questions have to be processed by end-users before building-related questions are discussed. They have to own the vision and the organisational questions". On the hospital project, the end-users were allowed to pursue their reorganizational questions before any space-related issues were discussed; in the event, some organisational questions were discussed in parallel. On the university project, end-users were allowed to manage organisational questions in parallel, but mostly once they were occupying the space. Commonplace among several opinions was that "organisational changes have to take long time". The FP explained that it was essential to run the project at a pace that end-users can keep up with: "you have to be half a step before them not 20". When driving the project forward, it is a balance between "a long time for ensuring that everyone can get used to the changes" and "you cannot just sit there and say that it is a process and that things will be put in order – then nothing happens".

Since both projects were in the public sector, decision-making and financial processes were subject to particular controls. The end-users had to learn about the construction process, lobby for their projects and adapt to changing preconditions. Two examples serve to illustrate these points.

(1) In the hospital project, the FP managed the politicians; but the end-users had to understand and adapt to changing directives from the head of the hospital and politicians.

(2) The university project had no money when the project started. The end-users had to learn to become entrepreneurs, with the process of applying for money lasting for several years. The decision making structure was considered rather exacting among both end-users, EPM and FP.

In the beginning there existed "a frustration and a resignation among end-users" towards the projects. The end-users did not believe that the projects would happen because of earlier experience of disappointments. One of the FP stated that "my commission is to make people believe in the project so that they become engaged [. . .] so that negative opinions transform to positive".

The methods used to understand end-users and their needs were found to be quite similar. FPs based their working approach on pedagogical skills and human behaviour to build effective relationships – "to confirm, praise and have a sensitive ear is a matter of listening, protecting initiatives and people, and being honest". Since end-users come from different organisations and have dissimilar skills, they need different kinds of support. The FP has to ensure that the right person is in the right place so that the process moves forward. In the university environment, the FP undertook an analysis of end-users' attitudes and behaviour. According to the FP:

> [. . .] representatives from different fields of knowledge are dissimilar in the university world: some are better in submitting requirements on physical issues while others put themselves above worldly matters. In this project the end-users were in the latter category.

It was also considered important to understand end-users reaction to changes. There was a certain amount of conservatism among end-users in the university project, while end-users in hospitals were considered to be essentially positive towards physical change.

End-users were actively involved in work groups that were responsible for various topics. These groups were supported by EPM, FP and an architect. People with requisite knowledge were invited to explain their needs. Study tours were arranged to the extent of nine per project to create a common frame of reference of good and bad examples and to meld together the participants. The process of becoming conscious of requirements takes time and one of the EPMs stated that "you see things with different eyes on other occasions".

It was seen to be important to ensure that everyone was aware of when it was possible to affect the outcome. To ensure that non-participating end-users were informed and that their needs were considered, meetings were held regularly during the project. Those for who the end-users were creating values were managed differently. A small survey of students' preferences with respect to a library was undertaken and students were represented in the project organisation. In the hospital project, no patients or visitors were involved. A full-size mock-up was, however, created for gathering opinions about functionality: a questionnaire was also used. The EPM felt it was important to have opinions on paper when end-users came along with complaints: "I could always refer to the questionnaire". The EPM in the hospital project wrote weekly letters to end-users, but stated that: "sometimes it became chaotic when people did not absorb the information. People are skilled differently when it comes to reading and understanding the consequences".

Barriers to effective interaction

Even though many activities were performed to clarify the building process and the role of end-users, uncertainty remained. This uncertainty was present both among FPS and end-users. In the hospital case, the EPM had to enter a new "male world" when joining site and construction meetings. Social and cultural barriers had to be learnt and crossed. The EPM had to understand the consequences of decisions and be able to meet the end-user organisation, but was sometimes met with a negative attitude and found some of the questions annoying.

For the university project, the EPM's commission ended when construction started, resulting in a stressful situation for those participating end-users. Their obligations and opportunities to influence the project were unclear. A new FP, who was a novice in her profession, was at the same time entering the arena. The FP found it difficult to understand the informal communication paths. Participants experienced the communication paths to be very slack and people broke set formal communication paths. One of the EPMs explained that he "did not have the mandate to manage the situation when the project management did not work: it was frustrating". All those interviewed in the projects agreed that end-users should have one contact person who follows them throughout the whole project.

One of the FPs for the university project explained that she "noticed that people in general have a resistance towards change if they do not have someone to blame." Is that a sign of an attitude of not wanting to own the process before it has even started?

The FP in the hospital explained that "the end-users have to 'own' the project, because when they do they accept small inadequacies, otherwise they tend to blame others". If you do not "own" the process it can impact negatively on the work motivation among other participants (Herzberg *et al.*, 1959). Signs of a slack communication and decision-making process appeared, making it hard for end-users to

"own" the process. Uninvolved end-users tended to be more critical towards the functionality aspects of the result than those who were involved. End-users were not allowed to bring their old furniture into the new offices; even so, people did when they found that their needs were not satisfied. "It was anarchy" explained two uninvolved end-users in the university project. Even so, participating end-users were not aware of this state of affairs. Those involved were proud of their new offices, with the imperfections blamed on others; for example: "that happened before I was involved or after I ceased to be involved".

Discussion

In short, the methods found in the literature were not used in the case studies. Many of the various activities on which the methods were built were however used, for example meetings, workshops and questionnaires, but not in the same methodological order. How well the methods have been used in reality is uncertain. Most methods are enacted in just one or a very few phase while the cases studied involved end-users throughout the whole project. Some of the methods have been criticised for not offering guidance on how to act on the results/outcomes, which also limits their usefulness. Are the methods fulfilling the needs of the real world? This section discusses the main areas of difficulty found in the empirical study in relation to existing theory as embodied in the various methods found in the literature.

Difficulties in understanding real needs

What value does effort in managing end-users bring to a project? The answer when asking users for opinions on design often becomes a traditional building solution, although to be fair most users have little or no reference material for considering different (spatial) solutions (Dewulf and Van Meel, 2002). In the cases studied, a lot of effort was put into broadening the end-user's perspective, but was it worth it? One of the FPs had experience of a project in which politicians did not allow end-users to participate, because they were considered to be conservative. Although this event took place the early 1970s, the FP still remembered the occasion and with some discomfort. The end-users were very disappointed with the result; there was a huge gap between the range of options for the end product and the way the end-users actually worked. Nobody wanted to take responsibility for the result and the building was subsequently rebuilt. In this case, the building was 20 steps ahead of the organisation's working procedures.

Another reason for involving end-users can be to overcome the impact of different values, interests and organisational changes, as well as a changed business environment, in order to reach commitment to the project (Pennanen *et al.*, 2005). In fact, the FPs had developed their own methods for managing end-users. The cases showed that pedagogical and behavioural skills were of critical importance for success in understanding end-users and the interdependent context of the projects. Drawing-in project participants were a strongly formulated idea for the project and study tours were used to help engage them.

End-users had the chance to express their opinions, but did not have decision-making power. They were acting in an interdependent situation, which complicated the decision-making process (Hansen and Vanegas, 2003), which highlights the importance of having a cross-disciplinary approach to understanding

the contexts they are working within (Love, 2002). The people for who the end-user organisations are creating value had little or no chance to express their opinions. The effort put into involving and understanding different end-users and their needs is, among other things, a matter of prioritising resources. People often try to categorise "things" to understand them better. The FPs base their work mostly on experience; for example, the unstructured analysis of users. They assign attributes to the end-users in order to understand them and their context better. This understanding of human behaviour and pedagogical skills was not shared within the project or applied to future projects in a structured way. In the hospital project, interviewees thought it was strange that knowledge and experience from different projects were not better-managed and fed back and used in new projects. "The knowledge exists in the head of the people, but is not systematically transferred" complained the FP. Signs that a full understanding of end-users needs in the project were lacking and apparent, although communication and attitude problems existed between all three parties.

Communication and attitude difficulties

The study showed evidence of the existence of social and cultural barriers: these were revealed by ineffective communication and negative attitudes. The importance of good communication was recognised among participants. The FPs attempted to listen and confirm with the end-users continuously throughout the process, but it was not always enough. When communication worked, end-users thought the projects were fun and when not, frustration set in.

The strict project management organisation advocated for the university project was not followed exactly. End-users experienced communication process slack, which resulted in stronger informal relationships occurring among the participants thus complicating the introduction of new participants. The personal chemistry between end-users and FP varied and affected the satisfaction of end-users. The EPM, for the hospital project, was not supported by a FP during the design and construction phase. Cultural differences existed and there was complicated communication between participants. The EPM seemed, however, to be more mature and have more skill in dealing with human behaviour than some of the other professionals attending construction site meetings. The projects show signs of a need for a better understanding of "softer" issues like cultural and social habits and highlight the importance of putting effort into ensuring a productive and trustful relationship and communication among all participants. To succeed in implementing changes and long-term strategies, it is important to provide customers with timely feedback and adequate explanations and to take on-board suggestions (Campbell and Finch, 2004).

In both projects, the FPs did succeed in turning initial negative attitudes into positive attitudes. Both the EPMs and FP stressed the importance of maintaining continual enthusiasm on the part of participants. A vision was used to engage participants on both projects. While members changed during the project so did attitudes and communication. Frustration sometimes occurred and end-users uninvolved in the university project showed signs of not being appreciated sufficiently. If their needs were not fulfilled, they took the matter into their own hands and broke the rules.

The methods found in the literature point to the importance of increasing the communication and evaluation of different aspects to achieve a better product and

process. Lundvall (1992) states that increasing communication alone is not enough to solve the problem between user and producer. It is a matter of improving communication and forgetting any communication patterns that do not bring benefit for interaction within the project, both in terms of formal and informal procedures (Lundvall, 1992). If a more structured evaluation of the management of end-users were undertaken, during the process and after, unproductive communication could be replaced by other initiatives. It would be interesting to follow-up the cases, in (say) five or more years, to see what actions have been taken to ascertain end-user satisfaction.

In the briefing phase, Barrett *et al.* (1999) found that there was a need for making the brief takers interested in the methods and overcoming their reliance on experience. Even though many methods have been published, little improvement has been seen in practice (Barrett *et al.*, 1999). Does this imply an unwillingness to forget old ways and learn new ways or are the methods too complicated and theoretical to be of practical use?

Conclusions

Managing the participation of end-users throughout a project requires that a number of difficulties have to be overcome. The difficulties found in practice are principally in making end-users see a greater and longer-term perspective of their situation and overcoming social and cultural barriers among participants as a means to understanding real needs. Signs of negative attitudes and frustration appeared in both cases when communication failed. To overcome these particular difficulties, the facility planner in question attempted to provide end-users with sufficient support, basing the approach more on pedagogical and behavioural skills than methods recommended in the literature. Indeed, no methods for managing end-users and their needs found in the literature were used in the cases; of course, that is not to say they are not used elsewhere. Nonetheless, most methods for managing end-users and their needs focus on the end product, but some are more behavioural and interaction-oriented. Many focus on just one part of the construction process. How many of these methods are actually used in practice is unknown. Many are not considered good enough on their own to produce a result/outcome that can be readily acted on. If these prescriptive approaches are to be used in routine practice, they might be more effective as tools to support a more broadly based pedagogical and behavioural approach.

Note

1. In this paper, "whole construction process" covers the briefing, design and delivery phases.

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PAPERS

Creating Knowledge of End Users' Requirements: The Interface Between Firm and Project

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ABSTRACT

In order to stay competitive and meet the changing needs of the market, construction firms must develop efficient means of gathering and using knowledge of end users' requirements. This article uses two case studies to explore the knowledge creation of end users' requirements in project-driven firms. The focus of the study is the interface between the firm and the project. The interface is analyzed from both an autopoietic and cognitive, organizational, and societal view. The findings implicate the importance of understanding (a) what kinds of knowledge dominated in the different organizations, (b) what could be expected in the exchange of data, and (c) what action needs to be taken in order to create value of it. The study suggests that considering the organization as an autopoietic system could be useful to understand the organization's responses to a dynamic environment.

KEYWORDS: knowledge creation; end user requirements; project-driven firms

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INTRODUCTION

Knowledge is an important asset in a firm, and the ability to learn is essential for staying competitive in the market (Andersen & Vaagaasar, 2009; Blessing, Goerk, & Bach, 2001; Hong, Kianto, & Kylaheiko, 2008). Companies must have knowledge about their customers (Blessing et al., 2001) and know how to manage that knowledge efficiently (Connell, Klein, Loebbecke, & Powell, 2001), both by sourcing and sharing knowledge (Velasquez, Durcikova, & Sabherwal, 2009). The capability to learn within a firm is affected by a number of factors—for example, the organizational structure (Hobday, 2000; Lam, 2000) and the ability to combine the development of knowledge with knowledge application and measurement (von Krogh & Roos, 1996).

A project-based firm is one that focuses strongly on the project dimension and carries out most of its activities in projects (Lindkvist, 2004). Hobday (2000) discussed the concept of project-based organizations by describing six different kinds of organizations arranged according to the influence projects have on the body of knowledge within the firm: functional, functional matrix, balanced matrix, project matrix, project-led, and project-based organizations. The ability to learn is higher in a traditional functional matrix organization than in a project-based organization (Hobday, 2000). The project-based organization is decentralized (Lindkvist, 2004) and loosely coupled (Orton & Weick, 1990). Loose coupling occurs because the knowledge the individuals possess is not effectively shared (Orton & Weick, 1990), as every part of the project-based organization is a separate, isolated unit. One way to improve the learning capacity in a project-based organization is to encourage cross-project communication. Because of the cross-project communication, the purely project-based firm becomes a project-led firm. A strength of project-based organizations is, for example, their capacity to meet clients' needs through a close engagement with the end users (Hobday, 2000).

To stay competitive in a dynamic environment, it is essential for project-based firms, such as construction firms, to be able to respond to rapid changes and new demands (Gann & Salter, 2000). The needs, requirements, and expectations of the client and the end users have to be understood in order for the firm to be able to create value for them (Achterkamp & Vos, 2008; Project Management Institute [PMI], 2008). In construction projects, the client is sometimes also an end user of the project result, but not necessarily. The client can be both representing a firm and be a private person. The end users are sometimes known by person, but not always. Each of these preconditions requires different approaches in order to create value for the client as well as for the end user.

Feedback and learning loops are essential for improving the quality of the work provided, creating knowledge, and finding innovative solutions, but these loops are often broken in project-based firms (Gann & Salter, 2000). A number of tools exist for managing end users and their requirements in construction projects, but these seldom provide any guidance about how to act upon the outcome and most commonly focus only on one part of the process. This lack of guidance and narrow focus complicates the ability to use such tools to learn and improve (Pemsel, Widén, & Hansson, 2010). The purpose of this research is to explore the characteristics of the sourcing and sharing process in gaining information about the end users' requirements when the end users are unknown. To gain a deeper understanding of the nature of the learning process in the firms, we conducted a comparative analysis of two perspectives of learning: (1) cognitive, organizational, and societal and (2) autopoietic.

Knowledge and Learning in Organizations

Knowledge is a multidimensional concept with various definitions and meanings (Nonaka, 1994; Starbuck, 1992). Knowledge has both a tacit and explicit dimension, and new organizational knowledge is created from a constant dialogue between the tacit and the explicit. Information turns into knowledge when it is interpreted and related to a context by its holder; it requires human action. Knowledge can be held by individuals, organizations, and societies (Nonaka, 1994). The organization can be considered as a distribution system of knowledge (Tsoukas, 1996) or an integrator of knowledge (Grant, 1996), in which the knowledge consists of physical and social capital, routines, organizational cultures, and the individuals (Starbuck, 1992). Learning in organizations can be viewed as single- or double-looped. Single-loop learning occurs within accepted routines, while double-loop learning requires that the underlying values and features be changed. Single-loop learning is appropriate for everyday work procedures, but improving long-term efficiency in the organization requires double-loop learning (Argyris, 1999). Argyris (1999) said, "Learning occurs when the invented solution is actually produced" (p. 68). The creation of knowledge can be viewed as a process influenced by, for example, normative expectations in the context, and the past and the present experiences of individuals and the collective group (Karni & Kaner, 2008; Tsoukas, 1996).

Knowledge creation and learning can be regarded as a social (Lundvall, 1992; Mariotti, 2007) and dynamic process; it is not solely the transfer of information and data (functional view) (Mariotti, 2007). The "input-process-output" view of information processing in organizations has been the dominant view in strategic management studies (Mariotti, 2007; Nonaka, 1994). This input-process-output view is regarded as unprolific by many researchers, as it considers the organization to be passive and static (Nonaka, 1994) and humans to be passive receivers like computers (Sveiby, 1996). Sveiby argued that knowledge is an active process of knowing that requires human action, interpretation, and understanding.

Cognitive, Organizational, and Societal Perspective

Lam (2000) presented a three-level framework (Figure 1) "to explain how knowledge, organizational forms, and societal institutions interact to shape learning and innovation" (p. 489).

The first level describes knowledge from a cognitive perspective. Knowledge is experience-based, contextually dependent, and transmitted through social networks. Four types of knowledge are presented based on if they are tacit-explicit or individual-collective.

1. Embrained knowledge (individual-explicit)
   - formal, abstract, and theoretical
2. Encoded knowledge (collective-explicit)
   - information, signs, and symbols
3. Embodied knowledge (individual-tacit)
   - practical and individual

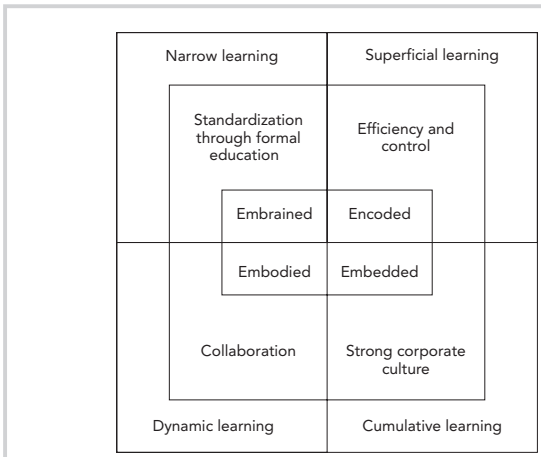

Figure 1: The relation between the knowledge type, characteristics of the organization, and learning (adapted from Lam, 2000).

4. Embedded knowledge (collective-tacit)
   - organizational routines and shared norms

Organizations possess all types of knowledge, but one is often dominant (Lam, 2000).

The second level describes four types of organizations divided after what kind of knowledge is dominated in the organization—for example, the ability for coordination and learning (Lam, 2000).

1. Professional bureaucracy is dominated by embrained knowledge.
   - high level of standardization through the individual's formal education and training
2. Machine bureaucracy is dominated by encoded knowledge.
   - standardization, specialization, and control to achieve efficiency and control
3. Operating adhocracy is dominated by embodied knowledge.
   - dominated by collaboration of individual experts (often project-based); low standardization and low degree of knowledge accumulation
4. The J-form organization is dominated by embedded knowledge.
   - combines stability with flexibility by a strong corporate culture and a knowledge base of the firm

The knowledge and organizations in the third level are related to the education and training system (degree of formalization and academic bias) and to labor markets (degree of mobility for the employee [firm-market]), which results in four types of models (Lam, 2000):

1. Professional (including professional bureaucracy and embrained knowledge)
   - narrow learning and inhibited innovation
2. Bureaucratic (including machine bureaucracy and encoded knowledge)
   - superficial learning and limited innovation
3. Occupational community (operating adhocracy and embodied knowledge)
   - dynamic learning and radical innovation
4. Organizational community (J-form organization and embedded knowledge)
   - cumulative learning and incremental innovation

Autopoietic Perspective

Lam (2000) described the importance of getting a broader perspective of the organization by involving the environment it performs in to understand how the organization learns and shapes innovation. Another way to understand how organizations learn is by looking at them as being part of an autopoietic system (Koskinen, 2009). Autopoiesis means self-production of the system through the system (Brandhoff, 2009). Luhmann (2006) viewed organizations as social systems held together by a closed network of communication, but the system is not independent of the environment: "a system is the difference between system and environment" (Luhmann, 2006, p. 38). The system continuously responds to the environment, if it is meaningful to the system, by creating a chain of operations with the purpose to adapt to changed demands and learn (Luhmann, 2006). For example, new information in a system is only information if it initiates a change of state in the system. In other words, the information differs from the existing information and creates a difference in the system: reproduction (Luhmann, 2006). Input to the system is not regarded as knowledge but as data. The data is contextualized and interpreted by the individuals, which transforms the data into knowledge. Information is not seen as knowledge; it enables communication and knowledge processes to start (Koskinen, 2009).

Koskinen (2009) applied the thoughts of autopoietic systems when analyzing project-based organizations. The system's capability to regenerate and respond to a dynamic environment is vital for projects. As projects have to be able to manage customers' changed requirements, that requires the ability to develop new knowledge and new skills—for example, structural coupling (Koskinen, 2009). Knowledge from an autopoietic epistemology perspective is created and not directly transferable, as it is dependent on history and context. To create knowledge and communicate it both vertically and horizontally (between projects) in project-based companies is vital to avoid system disintegration (Koskinen, 2009).

Method

In this article, we explore the characteristics of the sourcing and sharing process of information of end users' requirements, when the end users are unknown in two housing firms. The end users are those who will use/occupy the building. The end users have knowledge and opinions about the outcome of the project in relation to their own objectives (Kaya, 2004; Lai & Yik, 2007). The end users, in this study, are unknown during the execution of the construction project; nonetheless, potential end user requirements need to be understood to enable value creation for them.

The present study involved the investigation of the information and knowledge sharing in two housing firms: one public and one private. The public firm is a property manager whose responsibilities include maintenance, refurbishment, and new construction. The housing firm is a public real estate concern, wholly owned by the county of the city it is performing in. They supply 20,000 inhabitants with 8,500 dwellings and 100,000-square-meter habitats (shop premises, office premises, cinema premises, and geriatric care). The business includes building new houses, refurbishment, and operation and maintenance.

The private firm has this as the main goal: "build quality homes at prices that allow as many people as possible to buy their own properties." The company is selling building concepts to licentiate

takers in Sweden, Denmark, Norway, Finland, and Great Britain. The building consists of new-build villas, apartments, and terrace houses. Forty percent of their products are delivered to several public real estate owners as rental houses. The firm develops the concepts, both process and product, and then sells them to a contractor. The contractors build and then sell them to the end users, who become the final owners of the property.

The similarities between the companies are:

- The client (the housing firm) is the "main" project manager and the link between the executive project manager and the end users.
- When designing new houses or apartments, the end users are unknown. As a result, the clients have to keep in mind the interests of both the housing firms and the end users.

Both struggle with the difficulty in an effective knowledge "interaction" between projects and the firms.

The focus of this study is on the firms' ability to create knowledge from different sources of information (project-specific, surveys, experience-based, etc.) and consists of a literature study, a workshop, and two case studies. The literature review was performed first, in preparation of the case studies, in order to explore characteristics of the knowledge creation in different kinds of organizations. Next, a workshop was carried out involving clients from the two housing firms studied. During the workshop, a discussion about similarities and differences that have caused struggles was generated.

The case studies involved interviews and studies of documents. The interviews were semistructured and performed with client representatives from the housing firms. The purpose of the case studies was to determine some of the issues in the management of unknown end users' requirements and to gain insight into which are causes for concern. The study is not meant to provide a definitive account of the relations or to present conclusive analysis of how a project should be managed.

Result

No matter how a project is organized, the information about end users' requirements has to be not only gathered but also processed into some kind of value. In this case study of two firms, we found that value creation was consistently considered difficult. For example, during discussions in the workshops, it was said, "It is not hard to ask questions; the difficulty is using the information gathered in the value-creation process."

This study was conducted to gain insight into how two firms responded to this difficulty. The findings reveal two very different ways of managing information about unknown end users in the firms studied.

Systems for Collecting Information From/About End Users in the Private Firm

The information flow to determine end user requirements/values within the private firm is illustrated in Figure 2. There, the end users are represented as outside the circle of the client organization, to indicate that the end users are not in contact with the organization at the start of the projects.

The study found that though the customers (e.g., end users) of the private firm were not known from the start, the firm put a great deal of effort into trying to understand their future customer and to evaluate the fulfillment of the customers' expectations in occupancy. To do this, the marketing department used a system of surveying and evaluating methods to get the information needed in order to improve and develop the product and project process to meet the needs of the customers. The entire process is illustrated in Figure 3. When the project starts, a survey is conducted by the marketing department to determine how potential customers want to live in that specific market. This survey is followed by parallel work to develop the product and the project performance using a customer perspective. The development of the product begins and ends with different kinds of surveys: The project is initiated with a market survey and followed by a positive-customer-index survey. The surveys include questions about the customers' experience of the external project executers' performance. In addition to these parallel

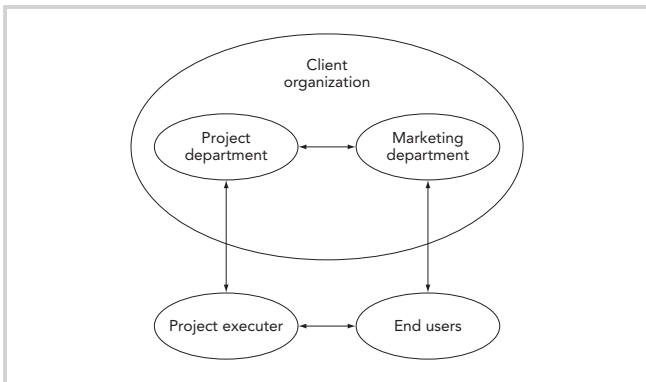

Figure 2: The information flow in the private firm between the four parties: project department, marketing department, project executer, and end users.

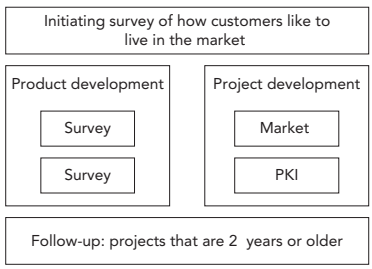

Figure 3: The different surveys performed by the private firm to collect information about potential and in-use, existing end users.

surveys, customer surveys are performed by the marketing department on projects that are 2 years or older of both product and living area.

The firm works systematically with the different surveys, but the surveys are not linked together into an efficient system. In the words of the marketing manager, "The information is not efficiently fed forward in the process."

Systems for Collecting Information From/About End Users in the Public Firm

The information flow of end user requirements/values within the public firm is illustrated in Figure 4. There too, the end users are outside the circle of the client organization, to indicate that the end users are not in contact with the organization at the start of projects.

As with the private firm, the public firm was found to be working with a number of procedures to gain an understanding of the needs of their existing tenants and future ones. The marketing department surveys the existing tenants using customer-satisfaction indicators and input from meetings with the tenants' associations. Sometimes members from the marketing department are present as well during those meetings. The project department obtains information about the renovation projects (from working groups and questionnaires).

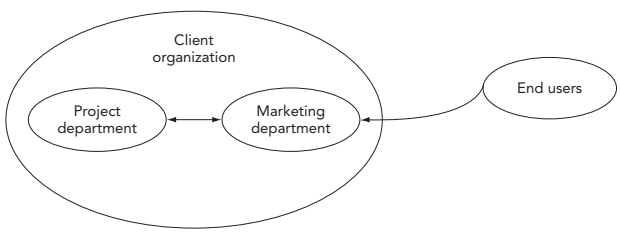

Figure 4: The information flow in the public firm between the three parties: project department, marketing department, and end users.

When the company plans to build new housing, the marketing department sometimes performs marketing surveys to obtain information about the interest in the planned housing area. The firm, furthermore, collects information in a data bank about what the tenants wish their future living to be like and where they would like to live. However, the firm does not use the information in a systematic manner. Much of the knowledge the employees rely on is experience-based, but this knowledge is not systematically shared. This circumstance can be seen as a risk factor for the firm: when someone quits a job, a lot of knowledge disappears. A more systematic knowledge sharing and building up of information would serve its purposes better.

Discussion

The cases studied show two project-driven construction firms that want to be competitive by building knowledge. Common characteristics of their information systems were found in their policy regarding two information processes:

1. Knowledge gathering: They stated that knowledge gained from the project should contribute to "the body of knowledge" within the firm.
2. Knowledge sharing: They felt that sharing knowledge from the common body of knowledge within the firm contributes to the improvement of projects.

In both companies, the goal in creating and sharing knowledge of the end users' requirement was to bring value to the end users and to stay competitive in the market. As value is a multidimensional concept with various definitions (Thomas & Mullaly, 2007), the focus of value here is on end user satisfaction and learning about the end users in the organizations.

The study showed that these two knowledge-based processes were not easily managed. It was considered difficult to build up a system for knowledge

gathering and sharing that contributed to the body of knowledge and thereby to ensure that value was created for the end users. One reason for this can be that the relevant types of knowledge are of a different kind and hard to combine. Another aspect is whether it is possible to transfer knowledge in a system at all.

Cognitive, Organizational, and Societal Perspective of the Case Studies

We now analyze the organizations according to the framework presented by Lam (2000), and then compare this view to the autopoietic view. According to Lam (2000), a project organization corresponds with the so-called operating adhocracy organization. The environment, in this organizational type, is characterized by a dynamic and complex environment, in which the knowledge is diverse, varied, and organic. The knowledge is mainly of a tacit nature and hard to accumulate, as it cannot be standardized, disembodied, or predetermined (Lam, 2000).

According to our analysis, the private company appeared to show characteristics that correspond with the type of organization commonly referred to as a machine bureaucratic organization, as it is dominated by standardization, control, and attempts to learn by corrections (performance monitoring). The knowledge obtained through surveys is explicitly coded (e.g., information). Tacit knowledge is lost in the translation and aggregation process, and, as a consequence, the learning becomes superficial (Lam, 2000). Although the firm attempts to learn by doing (compare with Gann & Salter, 2000) by getting feedback and then improving work from both internal and external sources, the firm has difficulties in creating knowledge of what brings value to the end users. The characteristic of superficial learning in the machine bureaucratic organization could possibly explain why the private firm had problems in creating value of the gathered data from the different surveys. The information of the end users' requirements still just becomes information in the firm. The body of knowledge is only a database of information until the information is related and processed.

The public firm, on the other hand, is decentralized and has the project management function in-house. The public firm is not standardized to the same extent as the private. It attempts to control the project's performance with surveys and uses market surveys to understand the users' requirements in the initial phase of new builds. The organization can thus be viewed as a weak machine bureaucratic organization (Lam, 2000). A problem arises, however, because much of the knowledge within the firm is carried individually and is of a tacit nature, which complicates the learning process. To complete the tasks in the public firm, both formal knowledge and practical skills are required. The public firm faces the same challenge as the private one: to create knowledge of the collected information.

As stated previously, both project-based companies want to gain knowledge from the end users and share it within the firm in order to improve their relations with the end users. The knowledge in the project is of a tacit nature, and the control of the work and the collection process attempts to make it explicit. In other words, the firms want to turn tacit knowledge into explicit knowledge, and then they want to transfer it to the firm. This knowledge should build up its body of knowledge and then correct the behaviors, processes, and products in the project and the firm. Is this possible with the existing structures within these companies? Are the project managers applying policy that allows others to become aware of the knowledge they possess or of how they act?

Grant (1996) found that the firm's capability in integrating specialized knowledge is fundamental to their ability to create and sustain competitive advantages. This requires a flexibility in management actions (Grant, 1996). Does the machine bureaucratic organization allow this flexibility or would another form, like the J-form organization, be more efficient? The J-form organization is both stable and flexible, and learning is cumulative and knowledge-based on shared norms and routines. The J-form could be helpful to strengthen the body of knowledge within the firm and deepen it. As the project organization is dynamic, collaborative, and often experimental in its way of working, what value does superficial knowledge from surveys bring to the project manager to improve relation to the end users? A strong culture of shared norms and values in a J-form organization could possibly be more easily transferred to the project. This may be achieved through cooperation between the project management functions and other important functions (i.e., the market division within the firm).

The private firm studied has outsourced the project execution; their way to impact the project management is probably more formal. Internally, would the firm probably be more efficient from a knowledge-creating perspective of a J-form organization? As the public firm bases its work on more diverse sources of knowledge (surveys, collaboration with end users, and experience-based tacit knowledge), it is probably easier for it to understand the context of its end users and, as a consequence, easier to create value for it than the private firm.

Our findings indicate that one way to enrich the contextual understanding of the end users and thereby more easily understand what they value is a focus group. Focus groups have an unstructured nature that allows uncontrolled information to arise, in contrast to standardized questionnaires. This often uncovers specific beliefs and values of the target group (Lengua et al., 1992), which gets a broader understanding of the contexts of possible future end

users. By understanding the context of the end users, it is easier to create value for them and knowledge of their requirements. Thus, not all information needs to be contextualized. It is important to adapt to the specific situation. Information is enough for situations that are more obvious, while knowledge of more complex aspects needs to be contextualized. The need to adapt to the situation is in line with Argyris (1999), who said that some learning does not require changes or govern assumptions, while other learning does. Explicit data collected and stored by the firm may be enriched for the project manager by using focus groups (possibly future end users or equals) to make sense of the data for a specific context.

To conclude, knowledge is, from this point of view, regarded as transferrable and has a different nature in the projects and the firms that makes it a challenge to combine them into something valuable. Both companies have difficulties transforming the collected information into knowledge; the surveys bring information that is not necessarily knowledge or learning. As a paradox, it has been found that in time, information is widely used and the need for tacit knowledge in firms has become a crucial factor for the performance of the firm (Lundvall & Nielsen, 2007).

The Autopoietic View

The autopoietic view considers the organization as a self-producing social system held together by communication. One of the difficulties with the collected information seems to be that it is not being communicated to the people who are using it in the firms. The process of reproducing does not seem to be triggered, as the firms do not know what to do with or how to act upon the gathered information. Possible reasons could be that the information does not make a difference to the individuals within the system, resulting in the knowledge creation not being initiated.

Creating new knowledge requires learning, creative forgetting, or just forgetting (Lundvall, 1992). This corresponds with the reproduction of the system where there exists a flexibility to change its actions after meaning information is received. The knowledge is dependent on history and context but not stuck in it, which is essential for the organization. If the organization does not possess this capability, the risk increases for disintegration of the system. The concept of reproduction, to a certain degree, corresponds with the idea of double-loop learning, as it also requires that the system is willing to change govern values and norms.

From an autopoietic perspective, creating knowledge of the databases in the firms requires that the message of the collected data is understood, which requires human action, so that the data turns into information. The information could then be used as a base for a focus-group discussion with possible end users. By getting a contextual understanding of the information, it becomes easier to interpret it and thereby receive an awareness/knowledge of how to create value to the end users. As the environment is dynamic and changes, more data is needed to ensure that the knowledge is current. If a difference exists, this will trigger actions in the system (organization) to adapt to the changes (reproduction). It implies that if the project manager should make use of the data obtained through surveys and other means and stored in databases, it may be necessary to make use of those collecting and putting the data in the database to ensure a full understanding of the data.

Koskinen (2009) concluded that to create knowledge and communicate it both vertically and horizontally (between projects) in project-based companies is vital to avoid having the system disintegrate. A challenge is to know how to communicate it to ensure that knowledge is created. Increasing communication is not enough; creating information flows and good communication inside firms is important for learning and innovation (Lundvall, 1992). Is good communication communicating the right things with the right media, and how is that ensured? This study does not answer that question, but it would be of interest for a further study.

Conclusion

Creating knowledge of end users' requirements is an important but challenging task to manage in project-driven organizations. Knowledge creation in the interface between the firm and project involves the contribution to the body of knowledge within the firm from the projects and vice versa.

The cases showed that the firm and the projects are different kinds of organizations dominated by different kinds of knowledge. This distinction is important in the knowledge-creating process to better understand (1) what could be expected in the exchange of data and (2) what action needs to be taken in order to create value of it. Certain types of data need to be contextualized to bring value, while others do not. The study implies that the use of standardized questionnaires might be a hindrance to managing the knowledge creation of end users' requirements between firm and project better. The richer the data (tacit and explicit) is, the greater the opportunity to create knowledge and in return create value for the end users.

This study further discussed that knowledge creation could probably be improved in the organization by either decreasing the distance between the two organizational forms (machine bureaucracy or operating adhocracy) by lightening the dominated knowledge type within them (encoded or embodied) or by adapting the embedded knowledge in the J-form organization to create cumulative learning.

The organization's ability to reproduce itself becomes of critical importance to meet the dynamic ever-changing environment. The study highlights the value of analyzing the organization as

an autopoietic system to deepen the understanding of knowledge-creating processes. The creation of knowledge should be seen as an ongoing and dynamic process to be able to meet the changing requirements from the end users.

Future research into the actions and support that the project manager needs is important. It is vital to create the knowledge and the tools needed for the project manager in different situations to ensure that the data is correctly contextualized. A few different main issues are important to address:

- To what extent is internal communication and cooperation utilized, and how may it be improved?
- How can external resources (i.e., focus groups or market evaluators) be exploited with the best result? ■

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Bridging boundaries between organizations in construction

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Organizations have boundaries that serve various purposes; for example, differentiating internal operations from external activities and controlling flows of information. Boundaries can however hinder knowledge exchange in inter-organizational collaboration, leading to less effective outcomes. Empirical results from comparative case studies on how boundaries between organizations in a project can be bridged effectively to support knowledge exchange are presented. End-user organizations and real estate companies form the subjects of the enquiry. The results show that the depth of involvement of the end-user organization varies widely and, with it, the use of bridging roles and activities. To identify bridging strategies that can foster productive knowledge exchange in inter-organizational collaboration, it is necessary to understand contextual aspects of end-users' needs to ensure the availability of sufficient competence within, and time for, the project team to perform its duties.

Keywords: Organizational boundaries, communication, bridging strategies, end-users, projects.

Introduction

Organizations have boundaries that serve various purposes: for example, differentiating membership from non-membership and internal operations from external activities (Pawlowski and Robey, 2004; Wenger, 2008). Boundaries can restrict knowledge exchange in inter-organizational collaboration, because they represent interfaces that must be crossed (Boland and Tenkasi, 1995). Previous research on organizational boundaries has tended to focus on strategies to increase organizational effectiveness from multiple perspectives (see for example Brown and Duguid, 1998; Carlile, 2002). One aspect is the coordination of knowledge differences as a means to, for example, decreasing transactional costs and/or increasing value adding activities (Santos and Eisenhardt, 2005; Hakansson and Snehota, 2006). Most of the activities carried out in the construction sector are inter-organizational as well as project-specific, where organizations possess certain kinds of knowledge. Depending on the emphasis of activities and structure of the organization, different kinds of knowledge are dominant. Knowledge can be 'embrained' (individual-explicit), encoded (collective-explicit), embodied (individual-tacit) or embedded (collective-tacit) (Lam, 2000) and when it comes to knowledge exchanges the latter two are the more difficult to manage. Embedded knowledge constantly undergoes negotiation and development in practice that requires long-term collaboration (Cook and Brown, 1999) and has different degrees of *embeddedness*, i.e. the degree of contextual understanding necessary in order to comprehend it (Chai *et al.*, 2003). Project and project-based organizations—for example, real estate companies—have low knowledge accumulation as they are dominated by embodied knowledge (Lam, 2000; Senaratne and Sexton, 2008) and have loosely coupled teams that result in inefficiently shared knowledge (Orton and Weick, 1990; Nonaka, 1994; Nooteboom, 2001) as feedback and learning loops are often broken (Gann and Salter, 2000; Dubois and Gadde, 2002). This situation frustrates attempts to create innovative solutions to problems (Gann and Salter, 2000). In the end, it affects the end-users of facilities and the services provided to them.

In construction projects, end-users have knowledge and opinions about the outcome of the project in relation to their own objectives (Kaya, 2004; Lai and Yik, 2007). The importance of understanding end-users' requirements and needs, as a prerequisite to achieving project success, and the difficulty in succeeding with it in construction projects, has been confirmed by many

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researchers (see, for example, Preiser, 1983; Bottom *et al.*, 1997; Campbell and Finch, 2004). Previous research has also found that complications occur in distinguishing end-users from actors in the construction process, which can affect the success of the interaction (Lawrence, 1996). The objective of the research reported here is to explore how the boundary between any two organizations in a project can be bridged efficiently to support knowledge exchange. End-user organizations and real estate companies form the subject of the enquiry (see Figure 1). The purpose is to identify roles and activities that bridge boundaries in order to achieve more productive project collaboration between parties possessing different knowledge and competences. The reason for the focus on boundaries is that it is often through the real estate company that the needs and requirements of end-users are introduced into the project organization.

Prior research has attempted to develop methods, tools and techniques for collaboration, control and evaluation of the understanding, fulfilment and satisfaction of end-users' needs and requirements in construction settings, for example, post-occupancy evaluation (Preiser *et al.*, 1988), design quality indicators (Gann *et al.*, 2003), quality function deployment (Delgado-Hernandez *et al.*, 2007), participatory design (Luck, 2003) and building performance evaluation (Preiser and Schramm, 2005). Many of these methods have been criticized for being neither easy to use nor easy to act upon the outcomes they offer to practice. It is necessary, therefore, to question the traditional management of end-users in construction projects by investigating the competences that are appropriate for correctly interpreting the flows of information across the boundaries between end-users, real estate companies and the project organization, as a precursor to effective knowledge exchange between the respective organizations (see Figure 1).

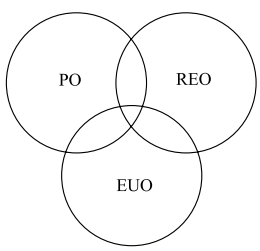

Figure 1 The relation between the three organizations of concern in the study: the end-user organization (EUO), the project organization (PO) and the real estate company (REC)

Findings from case studies in Sweden and Finland of how boundaries between end-users, real estate companies and project organizations can be bridged are presented.

Boundaries, knowledge and context in projects

In a project context, organizations bring together people from different professional backgrounds (Koskinen *et al.*, 2003), implying different contextual interpretations that have to be understood and managed to create productive interactions. End-users and professional participants in the construction project organization possess different experiences, perspectives and knowledge, concerning project activities, end-users' business and space (accommodation) solutions, all of which give rise to boundaries that inhibit a developed understanding of other parties' needs and meaning. In a study of tacit knowledge sharing, moving away from looking at traditional functional organizations and instead studying it in a project context, it was found that tacit knowledge is context and situation dependent (Koskinen *et al.*, 2003). Another study on complex products and systems, typically carried out in projects, concluded that there is limited use of static objects such as de-contextualized portrayals of knowledge, for example written instructions or design drawings when the giver and receiver have different contextual understandings (Marshall and Brady, 2001). This implies that it is important to have an understanding of the different parties' contexts to succeed in any knowledge-sharing endeavour. Similar conclusions were drawn where knowledge on a more general level was shared between business sectors (Fernie *et al.*, 2003) as well as for a boundary bridging activity. Boundaries, from a network perspective, can be explained by a large cognitive distance between parties, resulting in a lack of mutual absorptive and communicative capacity, i.e. the two groups are not sufficiently embedded in a common network as exemplified by weak ties concerning knowledge, activities and relations (Nooteboom, 2004).

Boundary activities

In order to understand both the knowledge and contextual situation that different groups possesses in a network, a number of boundary activities and roles have been identified and suggested in previous research. From a study of product development teams (a situation analogous to construction), Carlile (2002) confirmed that functional boundaries are bridged by one of three main approaches—syntactic, semantic or pragmatic. A syntactic approach advocates more information

processing to bridge boundaries, whereas a semantic approach acknowledges that information is often differently interpreted and thereby suggests translations for successful interpretations. On the other hand, a pragmatic approach recognizes knowledge and knowing as localized, embedded and invested in practice and that boundaries are bridged through transformations of knowledge and knowing (Carlile, 2002, 2004). All three approaches rely, to varying extents, on boundary bridging activities and their usefulness most likely depends on the purpose of the act of bridging.

In continuing with the analogy to product development teams, Ancona and Caldwell (1990), in a large study of boundary roles taken on by team members, described and differentiated four kinds of boundary activities in need of management in the context of inter-organizational collaboration. An *ambassador* is lobbying for support and resources, managing the relationship with top management and buffering (i.e. protecting) the group from outside pressure. A *task coordinator* aligns groups in order to perform tasks. *Scout activities* inspect the market to ensure that demands are met and competitiveness is achieved. *Guard activities* control information flows to external organizations (Ancona and Caldwell, 1990, 1992). From those activities, a number of bridging roles have been defined and are discussed below. Correct understanding of the roles and relationships between them is essential for analysing practices critically.

From a theoretical perspective, Aldrich and Herker (1977) argued that *boundary spanning* is a useful term to describe the activities occurring at organizational boundaries and so this term has been adopted and further developed by later researchers. A *boundary spanner* provides communication linkages between the organization and its environment by facilitating and filtering information and representing the organization externally. The spanner mediates, i.e. negotiates, between the organization and its environment (Aldrich and Herker, 1977). In two cases of location-dispersed product development teams, it was found that spanning activities are necessary in order to decrease the distance in space between organizations and to make tacit knowledge explicit (Bengtsson and Soderholm, 2002). In work on communities of practice, it was found that commonly used boundary encounters between different 'communities' are visits, meetings and conversations (Wenger, 2008). Pawlowski and Robey (2004) developed the concept further by looking at organizations specifically aimed at 'brokering' knowledge and argued that a *boundary spanner* is often part of the organization, whereas a *broker* is more likely to exist outside the organization. In the case of construction, it implies that, for example, an internal project manager from a real estate company acts as a spanner, while an architect might attempt to act as a broker between the company and end-users. *Brokers*, i.e. knowledge brokers, contribute by providing a different perspective. A *broker* needs to be capable of translating, coordinating and aligning perspectives (Pawlowski and Robey, 2004; Wenger, 2008) in order to create a flow of knowledge between organizations. Brown and Duguid (1998) argued from their studies on inter-organization interrelations that brokering activities are social processes with the broker participating in the interactions. As a consequence of their own study, Pawlowski and Robey (2004) were able to concur on the importance of being skilled in translating and interpreting in order to succeed at brokering. Information can be easily misinterpreted when translated due to ambiguity at the source, interference from earlier knowledge/experience or from the absence of corresponding words or concepts (see, for example, work on how knowledge transfer is a translation process (Holden and Von Kortzfleisch, 2004)). This phenomenon led to the development of another bridging strategy—the *translator.* A translator helps parties to understand each other's use of language, by acting as a mediator, but does not participate in the process like the broker (Brown and Duguid, 1998). Translating activities include evaluating and explaining the relevance of the translations (Pawlowski and Robey, 2004). This combination of translation and interpretation has been shown to be critical for inter-organizational knowledge transfer as it can enable the creation of common cognitive ground, and is supported by the findings of a large study on the transfer of a new model for strategic management in New Zealand's state sector (Cranefield and Yoong, 2007).

Researchers have argued that *boundary objects* facilitate interconnections, i.e. translating, between organizations by bridging boundaries temporarily. In this connection, Star and Griesemer (1989) investigated the management of divergent viewpoints; Brown and Duguid (1998) studied the structuring of knowledge between organizations; Pawlowski and Robey (2004) identified knowledge brokering as an objective for professional consultants; O'Mahony and Bechky (2008) showed how parties challenging established social systems collaborate with defenders of those systems; and Hovin Kjolle and Gustafsson (2010) examined how understanding was managed in architectural design.

Star and Griesemer (1989) categorized boundary objects in four ways: repositories, ideal types, coincident boundaries and standardized forms. Hovin Kjolle and Gustafsson (2010) adapted these findings to the construction context and in doing so argued that in the design process the objects can be architectural

knowledge, project documents distributed among stakeholders, i.e. *repositories*; results from surveys in the form of graphs and illustrations, i.e. *standardized forms*; general illustrations and maps for initiating discussions, i.e. *ideal types*; sketches, drawings, workshops and analytical tools, etc., i.e. *coincident boundaries* (Hovin Kjolle and Gustafsson, 2010). Pawlowski and Robey (2004) stressed the importance of combining the objects with human activities to gain efficient translations. A *boundary organization* creates a triadic role structure between project and firm. The boundary organization's main practices are to manage governance, membership, ownership and control over production. The purpose is not to merge organizations, but to bridge between them: they do not resolve conflicts but support collaboration (O'Mahony and Bechky, 2008), as, for example, in the case of an external workplace management consultant. A *relationship promoter*, on the other hand, should solve inter-organizational conflicts and support interactive learning processes. Relationship promoters act as boundary spanners and have to demonstrate social competence and knowledge about the network and portfolio relationships, since their functions include the need to foster cooperative norms, mutual norms and a good climate of communication (Walter and Gemunden, 2000).

A commonly used term in organizational studies is *gatekeepers*; they bridge information or communication barriers by building relationships when interfacing with other organizations. Hauschildt and Schewe (2000) studied organizations involved in product development and innovation, and argued that the expertise of the gatekeeper is to communicate, both externally and internally. The gatekeeper must be skilled in understanding and translating different coding schemes, which can take years to master. It has been argued that the gatekeeper must also master knowledge transformations in order to truly help in problem solving activities. A gatekeeper is often independent of a specific project while the *process promoter* is usually connected to a certain project, but their roles are similar (Hauschildt and Schewe, 2000). A theoretical study showed that *key account managers* have a similar purpose, as they promote relationship building and shared learning in collaborations with customers (Ryals and Bruce, 2006). In a study on mergers and acquisitions among engineering consulting firms, it was found that *facilitators* have a similar role in promoting relationship building, because they possess knowledge of peer departments (Bröchner *et al.*, 2004). In knowledge intensive organizations such as those that heavily engage in research and development, it has been found that the role of a *knowledge transformer* is to facilitate the adaptation of information to organizations' routines, as a means of limiting the risk of misinterpretation (Harada, 2003).

This literature review has discussed a number of roles and activities for bridging boundaries in inter-organizational collaborations from different theoretical perspectives, which can bring about a more developed understanding of the management of bridging boundaries in inter-organizational collaboration (Santos and Eisenhardt, 2005). Many of the roles and activities are rather similar, which implies (a) a lack of common acceptance, both within and across different disciplines; or (b) a lack of cumulative research which indicates immaturity in the research field. Few of the roles and activities have been reported in previous research (see for example Hovin Kjolle and Gustafsson, 2010) when analysing boundary bridging between end-user organizations and project organizations. Many of the concepts have, however, been used to improve collaboration between suppliers and their customers.

Case study

The research findings reported in this paper are based on an investigation of approaches for bridging boundaries between end-user organizations and real estate companies. A multiple case study approach (Merriam, 1994; Stake, 2006) was adopted so that an in-depth investigation of the phenomenon could be achieved. A number of other studies have looked at how to manage end-users in the construction process. These studies are more concerned with inventing new collaborative methods, tools and techniques rather than understanding the competences and knowledge needed to mediate in different contextual situations, which is the interest of this research. This shift in focus necessitates a more thorough, deeper investigation that is best suited to a case study rather than, for example, a survey. The context of the cases is construction projects initiated by real estate companies in the public sector with end-users involved in the process from initiation to occupancy. All cases used a triadic role structure as a means of bridging boundaries. Two cases were investigated in Sweden to obtain a broad understanding of the phenomenon followed by one case in Finland to gain a deeper understanding of a structured approach to bridging between organizations. These cases were chosen because they are held to be 'best in class' by their respective governments. They are seen as important precedents for setting the norm in the country. This is not to say that they have nothing to improve or learn; indeed they have, but that justifies the selection. The cases were influenced by the countries' business norms, values and rules. The choice of Sweden and Finland is interesting as the latter has a tradition of controlling and structuring while the former emphasizes more collaboration and consensus building. These

contextual differences were taken into consideration in the analyses of the results.

The focus of the research is the ability to reach a mutual understanding between end-users and the real estate companies, as they have to consider the needs and requirements of each other in construction projects. Furthermore, the research attempts to explore how strategies for bridging boundaries facilitate communication and competence building with the aim of decreasing the impact of incommensurability in inter-organizational collaboration. Other aspects, for example procurement strategies, contractual approaches and project organization are not included as this research concentrates mainly on different bridging roles that an intermediary can take between organizations of concern and the consequences of exercising those roles.

The Swedish cases

Both cases covered partly new construction and partly new configurations of existing healthcare and university facilities. The durations of the projects were in the range of 10–15 years. The projects were triggered by end-users' needs and an end-user organization was established with functions such as an end-user project manager (EPM), a steering/project group and working groups. The case studies are built upon documentary studies and interviews with experienced and well-respected professional managers and planners. End-users were randomly selected to reduce bias. The EPMs had long-term experience of their mother organizations, but were inexperienced in their role as project manager. Interviews were held with two end-users, four EPMs, two facility planners (FP) (architects), four project managers (PM) (engineers) and one architect. The choice of semi-structured interviews with a low degree of standardization was to adapt to the situation and open up new aspects as a means of achieving a broader and more comprehensive understanding of the phenomenon (Yin, 2003). In the university project, end-users were supported throughout the whole project by a FP, acting as a mediator. In the hospital project, the EPM had to act as the mediator.

In the university case, two impediments to boundary bridging were evident: (1) an ineffective information and communication process, which generated informal communication and decision paths, i.e. lack of transparency resulting in lack of control; and (2) territorial thinking concerning power and interests between the PM and FP. Even though those territorial attitudes existed, the FP had to rely on the PM, as he in general possessed more experience and knowledge. No systematic knowledge sharing between those parties existed. Decision-making and communication processes, between the PM and the EPM, worked well in the healthcare project. The PM had to put more effort into educating and supporting the EPM in the construction process than the PM found necessary in the university project. When the PM did not understand the importance of supporting the EPM, misunderstandings and confrontations surfaced because of differences in culture, use of language and possession of knowledge.

The Finnish case

This case includes six semi-structured interviews. The interviews were not connected to a specific project; instead, the focus was on the ability to bridge boundaries on different levels of end-user interaction. Each interviewee had prior involvement in projects in the public sector (e.g. university, office, research and cultural buildings) and was well regarded in the sector. The interviewees were between 40 and 65 years old and had worked their entire career in the construction sector and most of the time in the professional role they represented in the interview. No end-users were interviewed in Finland. The interviews were held with:

- one internal workplace strategist (WPS) (architect), with responsibility for managing the process of marketing and procurement, a steering group and communication both internally and between the workplace management and project process, as well as supporting communication in the client organization;
- one internal project manager (IPM) (architect), with responsibility for managing the internal work in the real estate organization and communicating with the external project manager of the construction project;
- two external workplace consultants (WPC) (interviewed separately) (architects), who were involved in developing the end-user organization's workflows and who were responsible for supporting end-users in the definition of needs and requirements;
- one external briefing consultant (BC), who defined the whole project (time, budget and quality), not just workplace management issues. The BC is an architect and a workplace manager and is skilled in acting as a project manager for the early stages, but is not involved in internal changes in the end-users' organization;
- two external architects (A) (interviewed together), with responsibility for combining each analysis and design into a whole when a WPC is involved. When a WPC is not involved, they interact directly with end-users during the early stages.

The real estate organization adopted a workplace management approach to bridging boundaries with the end-user organization. The construction process and the workplace management process ran in parallel. The workplace manager is responsible for connecting those two processes, but is mainly involved in the early and later phases. During design and construction, the workplace manager is not involved and may not support or represent end-users: much depends on end-users' requirements. Workplace management is about questioning and developing the current use of space and communicating with end-users. If conducted successfully, the approach was regarded by the interviewees as a driver for development, thereby increasing customer satisfaction, customer commitment and respect among parties, and resulting in better functional facilities.

Boundaries and bridging strategies

The case studies uncovered a number of boundaries and bridging strategies. The main boundaries, when interacting with end-users, were found to be (see Table 1):

(1) end-users' ability to understand the construction process;
(2) end-users' ability to express their needs and development plans in relation to workflows and spaces;
(3) knowledge brokers' (i.e. actors' links between the end-users and the real estate organization) ability to understand the end-user organization and its development plans;
(4) construction professional managers' ability to understand end-users' needs;
(5) each party's ability to understand other parties' perspectives; and
(6) ability to learn and improve between projects.

The respondents in Finland gave a more nuanced description of experienced boundaries than the Swedish respondents, which can be a result of the more explicitly stated structure for managing end-users in Finland. However, in order to bridge recognized boundaries, approaches such as translate, educate, interpret, evaluate and learn, encourage change and support, stereotyping and protecting were used by the respondents from both countries (see Table 2). It appeared that current end-users' needs and the skilfulness of the manager influenced the choice of strategies deemed appropriate for a specific boundary. Even though the case studies were set in two different countries, which adopted different approaches to bridging boundaries, the cases showed that the projects had to deal with the same type of boundaries.

Many of the strategies were almost always useful, but some were dependent on a required level of involvement. On a general level, it was found important to possess skills in pedagogy and human behaviour with enough tact and diplomacy to adapt to the current situation. But the greater the proximity to the organization's core business, the more the professional manager was involved and the more important it was to have a professional cross-disciplinary team as a means of crossing boundaries. The WPCs were working in cross-disciplinary teams, with specialists in human resources, change management, organizational development, economics, industrial psychology, process development and corporate identity-branding alongside architects, designers and project managers. This broad area of expertise was considered essential, in order to manage communication and knowledge transfers between end-users and the project team, as they can speak and understand both sides' language and business. The BC has a similar approach when interacting with end-users and believed that the role benefited from being regarded as an outsider: BCs are not emotionally, culturally or commercially connected or involved and can, therefore, see things in a more objective manner.

The end-user organization's willingness, or need, to develop its facilities and operations, e.g. defining an optimal workplace concept that supports operations, determined the required depth of involvement in the organization (see Figure 2). In the outer circle (1), the focus is on space and building design and the concern is mostly about the physical building, its image and the urban landscape. In the inner circle (2), the end-users' workflows are considered. The core (3) includes strategy-based workplace management for considering end-users' goals and objectives. Circles 1 and 2 are most commonly used, but from a long-term perspective it is beneficial to include the core as well (according to the WPC).

The main difference between the Swedish and Finnish cases was the size of the resources invested in the management of end-users in the projects and, thus, potential activities. The WPC had a range of expertise working closely in a team with end-users, while the FPs in Sweden and architects and BC in Finland had to rely more on their professional background. This probably explains the various attitudes concerning interference in end-user organizations. The WPC wanted to be a part of the change management process since, to some degree, he had the competence for it; while the others believed that it was the end-user organization's business to manage. The parties had different opinions about end-users' need to understand the project context. The WPC, PM and FP strove to ensure that end-users receive a

Table 1 The boundaries uncovered when interacting with end-users

Boundaries	Finland	Sweden
Boundary 1: the end-users' ability to understand the construction process		
Understand what the end-users have actually understood after the strategic briefing phase (WPC)	x	
End-users have difficulties in understanding the design phase and sketches (WPC, WPS)	x	
Boundary 2: the end-users' ability to express their needs and development plans in relation to workflows and spaces		
Establish the level of change (e.g. willingness to change) within the end-user organization (WPC)	x	
Changes in the end-user organization, especially if top management creates changes (new senior managers want to do things their way) (WPS)	x	
Personal dreams and corporate visions are sometimes mixed (WPC and A)	x	x
If top management in the end-user organization is not committed to the project, the project will fail (WPS, IPM)	x	
End-users are more conservative than the ministry (A)	x	x
Younger end-users are less conservative than older end-users (A)	x	
Boundary 3: the knowledge brokers' ability to understand the end-user organization and its development plans		
Understand end-user culture (WPC, FP)	x	x
Understand aspects in need of improvement in the end-user organization (WPC)	x	
Understand end-users' use of language (WPC)	x	
Needs and requirements are often individual; who one asks in the end-user organization will, to some extent, influence the response received (BC)	x	
Boundary 4: the construction professional managers' ability to understand the end-users' needs		
Efficient information sharing, both internal and external, is difficult to obtain (WPS)	x	
Misinterpretation/loss of end-user information between the WPM and construction process (BC, WPS)	x	
Too narrow view among the expertise in construction process, they do not see the bigger picture (e.g. the needs of the end-users) (WPS)	x	
Misunderstandings and confrontations easily appeared due to differences in culture, use of language and possession of knowledge (PM, FP, EPM)	x	x
Boundary 5: each party's ability to understand the other parties' perspectives		
Parties do often not understand a phenomenon similar and/or its complexity (WPC)	x	
Personnel turnover reduces ability to understand and causes delays (EPM, PM)		x
Boundary 6: the ability to learn and improve between projects		
Asymmetry of knowledge and no systematic knowledge sharing among professional parties (FP, PM)		x
The parties (architects, consultants and real estate organization) consider themselves to be learning organizations but they are not commonly sharing tacit knowledge on an inter-organizational level (A, WPC, WPS, IPM)	x	
Territorial thinking, concerning power and interests, between professional managers (FP, EPM, PM, A)		x
Knowledge sharing is on a voluntary basis—some are not interested in sharing (WPS)	x	x

high level of understanding of the construction process at an early stage of the project as a means for helping them make proper decisions. The architects, on the other hand, did not consider that end-users had to understand the complexity of the processes within projects. The parties did agree that it was important to understand each other's needs and so ensure that conflicts did not arise due simply to misunderstandings between them. The interviewees did not advocate the syntactic approach (compare with Carlile, 2002, 2004), because they found it far more important to communicate skilfully and inform accurately to avoid misinterpretations or conflict.

The WPCs used the semantic approach as they explicitly expressed their belief that the more translations and interpretations, i.e. the more interaction, the better outcome of the process. Each interviewee was acting as translator and interpreter; but when it came to being a negotiator, the BC held back. The FP, WPC and BC are knowledge brokers as they are, in effect, acting as a third party. Even so, they exhibit strong similarities of a boundary organization because they enable collaboration between the project, real estate and end-user organizations. Since they attempt to solve conflicts, they are not strictly a boundary organization and could therefore be classified as relationship promoters. The WPCs have, nonetheless, a strong case for being regarded as knowledge transformers. The WPS is not connected to a certain project, like the relationship promoter

Table 2 Strategies for bridging boundaries

Strategies for bridging boundaries	Finland	Sweden
Strategy 1: Translate		
Be able to speak the language of end-users and the construction sector (WPC, WPS, FP)	x	x
Adapt the use of language to the end-users' context and pre-skills (WPC, WPS)	x	
Cross-disciplinary team (WPC, WPS, IPM)	x	
Careful formulation of sentences to avoid misinterpretations and keep documents concise (BC)	x	
Explain the meaning of different opinions in a straightforward way to reach a common understanding (PM)		x
Ensure that information exchanges are as transparent as possible (WPC)	x	
Use of boundary objects (e.g. project banks, intranet systems, BIM, websites, guidelines, e-mails, simulations of workflows, drawings and illustrations in 2D and 3D, study tours, mock-ups and workshops) (WPS, WPC, PM, BC)	x	x
Strategy 2: Educate		
Educating top management (WPS)	x	
Increase end-users' awareness, so that they can take appropriate decisions in time in the construction process (WPC, FP)	x	x
Face-to-face interaction is more efficient than information systems as it is much richer (BC)	x	
Help end-users to understand sketches, 2D and 3D simulations/illustrations (WPS, WPC)	x	
Explain the consequences of different solutions (WPC)	x	
Strategy 3: Interpret		
Understand the needs and goals of the organizations involved (for example look at their websites, goals and strategies) to receive a holistic picture of the situation and the flexibility needed and then communicate this to participants (WPS)	x	
Listen to what they are saying and try to read between the lines, i.e. have an open mind, eyes and ears to be able to improve and learn from activities (PM, WPC)	x	x
Cross-disciplinary team (WPC, WPS, IPM)	x	
Be skilled to understand the end-users' business and core operations (WPC, WPS)	x	
Convey messages between two parties in conflict by communicating results from analysis and surveys (WPC)	x	
Strategy 4: Evaluate and learn		
Ensure that needs, requirements, goals and wants are realistic (WPC, PM, WPS, BC and A)	x	x
Internal knowledge sharing activities to improve brokering skills (WPC, WPS, PM, A)	x	x
Knowledge sharing between projects, e.g. POE (WPS)	x	
Ensure that there is no gap among parties as to what has been promised (WPC)	x	
Show possibilities and difficulties objectively—do not judge (BC)	x	
Communicate on regular basis with end-users to follow up the project and support their change process (WPS)	x	
Organize internal and external meetings to share knowledge (WPS)	x	
Strategy 5: Encourage change and support		
Keep emphasis of new ways of working within the end-user organization (WPC)	x	
Change management (WPC, WPS)	x	
Be reliable and trustworthy—react to their needs and be responsible in order to build trust (WPS, PM, FP)	x	x
Ask questions and challenge end-users, but no criticism (WPC, WPS, BC)	x	
Not being emotionally, culturally or commercially connected to either the end-user or the real estate organization, i.e. an outsider, to bring new perspective (BC)	x	
Support creation of communication plans in the end-user organization and a website for the project (WPC)	x	
Design a flexible building (A)	x	x
Push end-users so they receive awareness of what is important for them when it comes to strategy and workflows (PM, WPC)	x	x
Arrange workshops and information sessions (WPC)	x	
Increase interaction and communication: the more the better the outcome will be (WPC)	x	
Adapt the use of different tools to the context (WPS)	x	
Skills in pedagogy and human behaviour with sensitivity to adapt to the current situation: concerning both timing in communication and use of appropriate interaction methods (EPM, PM)		x

Table 2 (*Continued*)

Strategies for bridging boundaries	Finland	Sweden
Strategy 6: Stereotyping		
Adapt the strategies to the end-users characteristics' (working in public–private sector, age of the end-users) (WPC, FP)	x	x
Strategy 7: Protecting		
Protect end-user information between different phases in the construction process (WPS, WPC, FP, EPM)	x	x

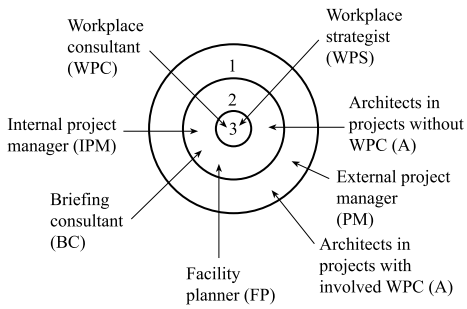

Figure 2 Depth of boundary penetration in the end-user organization: outer circle/boundary (1) = building and space; inner circle/boundary (2) = workflows; and core/boundary (3) = business goals and strategies

and can therefore be regarded as a gatekeeper. The IPM and the EPM are acting as boundary spanners between end-users and their own organization, while the PM is a spanner for the project organization.

All four kinds of boundary objects, defined by Star and Griesemer (1989), were found in the cases (see Tables 1 and 2) for translating between organizations. A majority of interviewees found the boundary objects to be useful in communicating explicit knowledge, but found it necessary to support end-users as they most often have difficulty in understanding the messages of the objects. Face-to-face interactions were considered important and necessary to reduce misunderstanding. This confirms previous research that has stressed the importance of combining the boundary object with the right activities (Pawlowski and Robey, 2004).

Each organization had developed a number of internal learning activities, but there was little willingness to share on an inter-organizational level. The consultancies, both in Sweden and in Finland, showed signs of territorial thinking that inhibited learning across boundaries. The project and project-based organization were found to be loosely coupled systems, thereby confirming earlier findings. Moreover, they showed signs of a cognitive distance, implying that the units were not sufficiently embedded in a common network. The most 'open' organizations, when it came to knowledge sharing, seemed to be the real estate companies. External sharing was most systematically conducted in the Finnish real estate company through, primarily, post-occupancy evaluation (POE) and the use of various databases for storing project-related information. As noted in the introduction, only explicit information is shared in document form, which limits its contribution to learning.

Discussion

Projects are influenced by their contextual setting, implying that boundary bridging requires an ability to manage a broad range of roles (for example knowledge broker, spanner and gatekeeper) and activities (for example ambassador and guard). It is therefore vital that real estate companies possess sufficient knowledge/competence and are flexible enough to adapt the boundary activities to the current situation. A real estate company needs to (1) be aware of the boundaries that exist at the interface between it and end-user organizations; and (2) be competent enough to use appropriate strategies to bridge those boundaries.

The results revealed a number of boundaries in both Sweden and Finland, implying that they were not strictly context dependent, even though the approaches to bridging them were. The projects had

various degrees of involvement in the end-user organization resulting in the boundaries impacting on the process differently. The Swedish cases showed that if the PM confirmed, listened to and carefully considered different initiatives, end-users were often satisfied (i.e. they attempted to create consensus among partners), but this strategy was not always enough. If the broker had insufficient competence, or if the bridging activities were not properly aligned with the construction process, there was a considerable risk that the broker caused more harm than good. This implies that the structured workplace management approach and a cross-disciplinary team could possibly add value to the process. It appeared that most of the strategies used were to a large extent experience-based. Designated teams or persons working solely with workplace designs have a greater opportunity for gaining much needed experience than those who are more generalist.

Depending on development needs in the end-user organizations, the processes for development and optimization of end-users' workflows can take a considerable amount of time (for example, accommodating cultural changes). This questions whether or not the project is long enough to manage those developments, i.e. the validity of using a strategy-based workplace management as represented in the core (see Figure 2). A longer duration of the interaction would probably be beneficial as a means for bridging boundaries and to avoid losing tacit knowledge embodied in that person (Wong and Radcliffe, 2000), implying that a step-by-step improvement process with which the end-users can align, and further develop after project completion and during occupancy, would be beneficial.

The opportunity to prevent conflicts stimulated the adoption of bridging activities in all cases. The findings do however reveal an unwillingness to forget old working procedures, i.e. the broker interfered in the traditional role structure which caused territorial thinking between professional managers and which can inhibit development and learning. Such findings are in agreement with earlier studies, for example Lundvall (1992).

The organization's capacity to formulate and use strategies for crossing boundaries is influenced by prevailing institutional factors that, in turn, affect the ability to reflect critically upon, acknowledge and adapt to each situation as it arises. In Finland, institutional factors such as rules, norms and routines for managing end-users were more explicitly stated than in Sweden. Strategies in the former case might therefore be more readily applied to suit the current project context since a 'toolbox of strategies' is visible and available. On the other hand, if the organization leans too heavily on toolboxes there is a risk of failing to think 'outside the box' with the result that unknown or new boundaries might not be recognized.

Conclusions

The objective has been to explore how the boundaries between organizations in a project can be bridged efficiently to support knowledge exchange. The findings reported increase understanding of the process of bridging boundaries between end-users and real estate companies in a project context. It has been argued that a gap exists in previous research concerning the competences needed to skilfully bridge boundaries in connection with the management of end-users in the project organization.

The depth of involvement in the end-user organization varies widely, which impacted on the urgency associated with finding strategies for different boundaries. The main benefits of using boundary strategies were found to be reducing conflicts, improving collaboration and achieving a mutual understanding that resulted in a smoother process. Commonly used strategies to bridge boundaries were to translate, educate, interpret, evaluate and learn, encourage change and provide support, stereotyping and protecting (Table 2). Real estate companies need, therefore, to be competent in finding bridging strategies for the current situation, thereby creating collaborations that foster learning, within and between projects, over the longer term.

One potential explanation for the diverse approaches is that they might be a result of different contextual settings. In Sweden, where the general focus is on collaboration and consensus building, the approaches were based on creating understanding of the perceived needs of end-users. In Finland though, with the tradition of controlling and structuring, the approaches were more in the way of self-assured attitudes that foresaw the need to educate end-users. The implication of this finding is that the approaches chosen for bridging boundaries have to be aligned with the prevailing business system and cultural context. Adopting a standard approach irrespective of system and context would therefore be self-defeating.

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Appendix I

In this appendix are the acronyms of the informants, used in the text, listed in alphabetic order with additional information concerning their nationality.

A	Architect	Finland and Sweden
BC	Briefing consultant	Finland
EPM	End-user project manager	Sweden
FP	Facility planner	Sweden
IPM	Internal project manager	Finland
PM	Project manager	Sweden
WPC	Workplace consultant	Finland
WPS	Workplace strategist	Finland

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Project management office a knowledge broker in project-based organisations

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Abstract

Current research into project management offices (PMOs) has stressed the PMOs' potential to act as knowledge brokers between projects, and between project and top management. Nonetheless, the literature does not provide sufficient evidence of the brokering role of PMOs. The research reported here aims to examine PMO's functions from a knowledge sharing perspective and explore whether or not these functions reflect the knowledge sharing needs of project managers (PMs). These issues are investigated through a cross-case analysis of seven organisations. The main contribution is insight into how PMs share knowledge and awareness of the need to structure PMOs to align with PMs' nature, needs and expectations in order to improve knowledge sharing in PBOs. Finally, some practical steps for helping PMOs to better adapt their functions to the needs of PMs and their learning and knowledge sharing style are proposed.

Keywords: Knowledge management; Knowledge sharing; Project management office; Project manager; Project-based organisation

1. Introduction

Projects are temporary organisations, with an intentional death, purposefully designed to provide benefits for a permanent organisation or certain stakeholders through complex problem-solving processes (Söderlund, 2011). Projects are often regarded as an efficient means for combining knowledge and thereby optimising value from investments. Although projects are considered temporary organisations, they exist within the boundary of a project-based organisation (PBO). PBOs have no standard form and previous researchers have discussed project-based firms (Lindkvist, 2004; Whitley, 2006), other project-based organisations (Turner and Keegan, 2000) or project-based companies (Huemann et al., 2007). PBOs are here defined as organisations in which the majority of products or services are produced through projects for either internal or external customers. The PBO may be a standalone organisation or a subsidiary of a larger organisation (Turner and Keegan, 2000), but characteristically for both types, it's an organisation that is capable of handling many projects (Artto et al., 2011).

The expected benefits of establishing a PBO are that the temporary project organisation and the PBO should work jointly. Moreover, new ideas, challenges and learning gained in projects should be transferred to the PBO (Söderlund and Tell, 2011). Therefore, PBO has to ensure effective knowledge sharing (KS) and integration within and between projects to avoid the risk of reinventing the wheel and so repeating the same mistakes (Schindler and Eppler, 2003). Nevertheless, although PBOs have knowledge transfer processes in place, these are often ineffective (Swan et al., 2010). This is mostly because PBOs are fragmented and have a high degree of autonomy between PBO's sub-units, as suggested by Lindkvist (2004) and Orton and Weick (1990).

A project management office (PMO) is a formal layer of control between top management and project management within a PBO (Kerzner, 2003; Liu and Yetton, 2007) that is, an institutionalisation of governance strategies (Müller, 2009). The shapes and roles of PMO's functions vary according to the context within which they are incorporated (Aubry et al., 2010; Hobbs and Aubry, 2007, 2008) and although many PBOs do not have an explicit PMOs, the PMO functions are often

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incorporated within the parent organisation (Dietrich et al., 2010). The complexity and variety of PMOs have evidently resulted in a number of interpretations of what a PMO actually is and should do, both in practice and in research terms. For instance, Aubry et al. (2010) found that many organisations implement PMOs without a clear direction and vision of what role they want the PMO to play; they simply adopt existing PMO archetypes without considering organisational needs. From a knowledge perspective, the PMO can be regarded as an organisational unit facilitating coordination of knowledge and other resources between the PBO and its projects, and can therefore act as a bridge over organisational and knowledge boundaries. This perspective of a PMO as a knowledge broker was investigated in two studies (Desouza and Evaristo, 2006; Julian, 2008). These studies provided an insight into PMO's knowledge brokering role from the perspective of a PMO's personnel, but lacked insights into PMs' knowledge needs and expectations. Accordingly, the research conducted so far on PMOs as knowledge brokers is limited and requires further investigation. There are areas in need for further investigation, which brings the nature and knowledge needs of PMs into the picture. From the above, we have identified the following research question: *what capabilities do the PMO have to possess to become a knowledge-broker and meet PMs' knowledge sharing needs?* More specifically, the research reported here aims to examine PMO's functions from a knowledge sharing perspective and to explore whether or not these functions reflect the knowledge sharing needs of PMs.

Scarbrough et al. (2004) noted that in existing studies on organisational learning and knowledge sharing in the project environment, the level of analysis tends to be the project itself (e.g. Lindkvist et al., 1998; Prencipe and Tell, 2001). Relatively less attention is paid to project-to-organisation or inter-project KS behaviours. In this research, the unit of analysis is the relationship between PMO's knowledge brokering activities and PMs' knowledge sharing behaviours. The research is set in Sweden and Australia and includes subsidiary PBOs. The paper begins with a discussion on knowledge sharing in PBOs, which includes PMs' knowledge sharing and integrating behaviours, and the role of a PMO as a knowledge broker. It then continues with a description of the methods used in the study. A cross-case analysis is then presented followed by a discussion on the results and their implications.

2. Literature review

The main focus of this section is on knowledge sharing practices between projects and from projects to parent organisation; in particular, this review of the literature focuses on: knowledge sharing challenges in PBOs, the role of PMO as a potential knowledge boundary spanner between projects and PBO, and PMs' knowledge sharing behaviours.

2.1. Knowledge sharing challenges in PBOs

The PBO mainly learns from the projects through an accumulation of experiences among the project participants and project members (Swan et al., 2010). Nevertheless, the project nature tends to hamper knowledge sharing as PMs' primary focus is on time and product, or service, delivery, rather than on knowledge sharing activities. Time pressure and temporary nature of the project mean that the end of the project is often the end of collective learning. Furthermore, it is a common practice that project lessons are evaluated at the end of the project and regarded superfluous. This results in low quality of best practices and lessons learned, causing a lack of cross-project learning and communication such that project experiences are captured and shared infrequently (Ajmal and Koskinen, 2008; Eskerod and Skriver, 2007; Keegan and Turner, 2001; Newell et al., 2006; Schindler and Eppler, 2003; Turner et al., 2000). Crucially, problems of cross-project learning have wider implications for processes of organisational learning and the development of organisational and project management capabilities (Scarbrough et al., 2004).

KS on the project level takes place as social communication between project stakeholders and through different explicit information channels such as project documents (Arenius et al., 2003). Accumulated knowledge throughout the project, if not effectively shared with other projects and the parent organisation, can be irretrievably lost. Thus, the risk of a knowledge loss at the project's end is a serious problem for PBOs. It is therefore apparent that the transfer of knowledge and learning generated within projects, either to other projects or to the parent organisation, does not happen without difficulty (Scarbrough et al., 2004).

The main reason why the PBO is weak in coordinating processes, resources and capabilities across projects is because of the specific characteristics of projects. Even though projects have been found to be impacted by its history and context (Engwall, 2003), projects act almost like separate organisations. This means that project work is highly independent, hence there is limited coordination across project lines and, in effect, the learning process is interrupted causing 'learning closure' (Hobday, 2000). The result of this project autonomy makes learning and KS across projects difficult. As suggested by Scarbrough et al. (2004), project autonomy can be advantageous for learning by allowing the development of practices which are distinctively different to mainstream organisational practices. However, the integration of learning or sharing capabilities is the main challenge for PBOs. Moreover, another challenge for effective inter-project KS and KS from project to parent organisation is the finite character of projects, wherein project members, ever mindful of time pressures, become focused primarily on product or service delivery rather than on KS activities. This hinders the transfer of best practices, causing a lack of cross-project learning and communication (Davenport et al., 1998; Kotnour, 1999; Loo, 2002). Additionally, when a project finishes, people are reassigned to work on another project. Members of the disbanded team often have little time and motivation to reflect on their experience and document transferable knowledge for recycling in the future (Brady and Davies, 2004). Thus, the tendency to reinvent the process rather than learn from the experiences of previous projects is common in PBOs (Prusak, 1997). Not surprisingly then, studies that

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investigated inter-project KS practices (Eskerod and Skriver, 2007; Newell et al., 2006) found that KS between projects and from projects to the rest of their respective organisations was generally poor. For instance Newell et al. (2006) found that transfer of project lessons is fragmented and lessons are focused on what was achieved by a project team (product knowledge) rather than how this had been achieved or why it worked or did not work (process knowledge). Other reasons, including a weak communication links between geographically dispersed projects hinders KS (Hobday, 2000) and lack of integration of KM strategies into the company goals (Riege, 2005) were also highlighted in the literature.

Evident boundaries between projects and between projects and the parent organisation mean that KS and, consequently, the development of PBO's capabilities remain a challenge. The following section discusses the potential of PMO to act as a boundary spanner between projects and the parent organisation in relation to KS endeavours.

2.2. PMO as a knowledge broker

The PBO needs coordination mechanisms to facilitate the integration and management of knowledge across project groups and business units (Gann and Salter, 2000). The PMO has potential to act as a bridge over organisational and knowledge boundaries in the PBO as it spans at least three organisational levels: upper management, PMO personnel and project teams (Julian, 2008). PMOs can thereby promote individual and group learning by providing a knowledge network structure that enhances KS through sharing expertise knowledge and insights on individual, group and organisational levels (Walker and Christenson, 2005).

Previous research has found that effective knowledge brokers have to be capable of translating, coordinating and aligning different perspectives (Pawlowski and Robey, 2004; Wenger, 2008). Brokering activities are social processes with the broker participating in the interactions (Brown and Duguid, 1998). Knowledge brokers therefore contribute to KS between organisations by providing and integrating different perspectives, as a means to, for example, increase the understanding of other parties' needs. Boundary objects, that is, sketches and guidelines, and boundary endeavours, such as workshops, meetings and study tours, are often used as tools to bridge boundaries between, for example, the project and the end-user organisation. Additionally, capabilities for adapting the use of boundary roles, for example, interpreter, negotiator, ambassador, educator and translator, have be found to be essential for efficient bridging (Pemsel and Widén, 2011).

Desouza and Evaristo (2006) categorised PMOs in IT projects along two dimensions: administrative and knowledge-intensive. Unsurprisingly, administrative PMOs provide PMs with administrative support. Knowledge-intensive PMOs, on the other hand, take an active role in managing the best practices of project management, learning from projects (both failures and successes) and improving the maturity of project management in the organisation. Desouza and Evaristo (2006) distinguished between four PMO knowledge archetypes: *the supporter*, *the information manager*, *the knowledge manager* and *the coach*. The supporter is purely administrative. The information manager's function is to track and report the progress of projects, and to serve as a source of information about projects and consolidated status updates. This is a knowledge-intensive PMO with a partial administrative function. However, this PMO rarely takes the initiative and has no enforcement authority. The knowledge intensive PMO is a repository of best practices, but has no administrative responsibility. It is a knowledge-base that provides project expertise, mentoring and training, and is recognised as the organisation's authority on all knowledge related to project management. The coach is the most knowledge-intensive archetype, its role involves both enforcement and control of KS as well as acting as a house of best practices and knowledge (Desouza and Evaristo, 2006). The coach archetype provides a proactive and active approach to KS and learning, and focuses on strategic and corporate activities to coordinate and improve project management within the organisation. It moves towards the concept of a centre of excellence in project management by creating an environment to deliver a continuous stream of successfully managed projects (Kerzner, 2003; Walker and Christenson, 2005).

In the role of knowledge broker, the PMO develops and maintains a set of standards and methods (Dai and Wells, 2004) by providing centralised archives of systematically collected and stored project knowledge in a form of lessons learned and project templates. In addition, the PMO also provides project administrative support, project management consulting and mentoring, as well as arranging project management training (Julian, 2008). Julian found that, in order to bridge boundaries, the PMO needs to support networks (i.e. be a relationship promoter), encourage learning from both successful and less successful projects, emphasising both product and process, and using a facilitator to support reflection during lessons learned assignments. To achieve more effective knowledge sharing and integration, the PMO has to be capable of managing retrospective learning, which refers to generating knowledge from past projects, as well as prospective learning that refers to transferring knowledge from past experience to future projects. In other words, the aim is to provide both feedback and feed-forward across projects to ensure KS (Liu and Yetton, 2007). Thus, the PMO has to manage continual change and reinvent itself in terms of goals, objectives and processes, whilst maintaining focus on improving project management in the PBO in order to remain effective (Hurt and Thomas, 2009). Additionally, the PMO requires capabilities to manage different kinds of knowledge areas and knowledge types (Julian, 2008), as in the case of the five knowledge types presented earlier (Blacker, 1995; Collins, 1993) and with respect to project specific knowledge such as, technical, procedural, and organisational. Technical knowledge is about the product, its parts, and technologies. Procedural knowledge concerns production, the utilisation of a product and action in a project. Organisational knowledge concentrates on communication and collaboration (Kasvi et al., 2003). Accordingly, it is critical for the PMO to possess competence in brokering and managing

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project knowledge to be able to facilitate coordination and, by implication, has to take an active role in promoting learning and KS activities.

2.3. PMs' knowledge sharing and integrating behaviour

PMs have been found to emphasis their individual project, neglecting the broader and longer term perspective of the PBO and resulting in tight couplings within projects and loose couplings in the PBO (Dubois and Gadde, 2002). Furthermore, Bresnen (2007) found that project teams have a few incentives to collect and reflect upon their experiences, particularly as they often have new projects before them. This situation is unfortunate as an organisational competence develops through learning and, in a project context, the PBO requires competence to support and contribute to project goals (Sense and Antoni, 2003). It therefore becomes hard to develop appropriate competences if the PMs do not share their experiences and insights with the PBO.

Previous research found that PMs have distinct learning and sharing behaviours; for example, Eskerod and Skriver (2007) and Newell (2004) investigated PMs' inherent attitudes affecting KS activities and how they preferred to learn. Newell (2004) found that PMs prefer learning by doing rather than learning from others. Eskerod and Skriver (2007) uncovered six assumptions that influence KS between PMs related to: (1) masculine values that PMs commonly possess; (2) perception of time as scarce; (3) lack of concern about the past; (4) limited concern about the future; (5) relationships based on respect and no unrequested interference; and (6) PMs' independence and private ownership of projects. These culture-related assumptions were found to hamper PMs' willingness to become involved in KS and lessons learned (LL) activities (Eskerod and Skriver, 2007).

In summary, from a knowledge creation and sharing perspective, there has been limited research concerning the implications of PMs' learning behaviours and their preferences to learn, share and integrate knowledge in relation to the PMOs' functions and activities. This research attempts to investigate PMOs' abilities to act as a knowledge broker, that is, if the PBO understands and supports PMs' learning and knowledge sharing processes (Fig. 1).

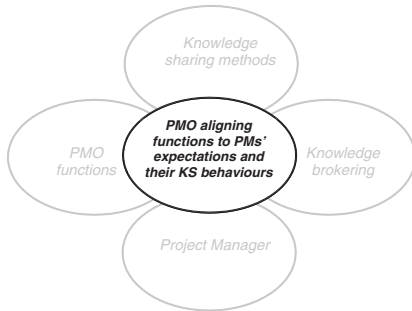

Fig. 1. Research focus.

3. Research method

A qualitative multi-case study approach was adopted from a realism perspective. Adoption of this approach supported the investigation of a complex and contemporary phenomenon of PMs' KS behaviours and PMO's knowledge brokering role, over which the investigator had little or no control (Eisenhardt, 1989; Yin, 2009).

3.1. Data collection instrument and process

As outlined in the literature review section, existing research on PMO's knowledge brokering functions does not provide sufficient evidence to support the formulation of testable hypotheses. Instead, the review discovered the need to extend existing theory and further query the phenomenon under study to improve understanding of the PMO knowledge brokering role. The data collection process started with the design of a case study protocol, which was developed to increase the consistency of the research (Yin, 2009). Accordingly, every interview in each case followed similar case study questions and data collection procedures. The protocol focused on areas of PMs' knowledge sharing behaviours and PMOs' knowledge brokering functions. The use of the case study protocol enhanced the reliability of the research by providing clear guidance for the data collection process ensuring the consistency of the study (Yin, 2009).

Overall, 64 semi-structured interviews were conducted, each of which lasted approximately 1 h: all interviews were recorded and transcribed. The majority of respondents were PMs. PMO personnel provided data about PMO functions and their experience of interacting with PMs. This use of data triangulation achieved by collecting information from multiple sources, with the aim of corroborating the same fact or phenomenon (Yin, 2009), ensured validity of the findings.

3.2. Data analysis

The analysis adopted a case-oriented approach (opposite to variable-oriented) due to the limited number of cases (Miles and Huberman, 1994). The data analysis process followed Miles and Huberman's suggestion of data collection, data display, data reduction and data verification. The analysis began with several rounds of coding of the transcribed interviews, case-by-case, to abstract and transform the data into emerging pattern codes and then into categories. At this stage, no comparison between cases was made. The comparison started during a selective coding process, where core categories from each case were compared and further abstracted into a higher level of categories that incorporated instances from each case. The analysis resulted in three main categories, namely: PMs' attitudes that impacted KS, actual PMO functions and PMs' expectations of the PMO. These categories and their respective themes are illustrated in Table 1 and further

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Table 1
Categories that emerged through the cross-case analysis.

PMs' attitudes impacting KS	PMO functions and PM expectations
People oriented	Repository for LL
Free-thinkers	Active KS
Passionate	Training, workshops, seminars
Autocratic	Formal and informal social interactions
Conservative	Control and quality assurance
Pragmatic	Project standard and procedures

explained and analysed in the cross-case analysis section below. Furthermore, pattern-matching, data displays and explanation-building analytical techniques (Yin, 2009) were used primarily in cross-case analysis. Using pattern-matching allowed comparison of cases and a means for determining similarities and differences between them (Eisenhardt, 1989) (i.e. compare PMO functions and PMs expectations across cases), whereas explanation-building analysis, predominantly used in the discussion section, assisted in the explanatory stage of the research. This approach helped in drawing conclusions by searching for patterns, themes, making contrasts and comparisons and verifying them against the literature (Miles and Huberman, 1994; Yin, 2009). Careful use of these analytical techniques and a rigorous coding process helped to achieve internal validity of the research (Yin, 2009).

4. Description of cases

The primary criterion for choosing a case for inclusion in this research was that it had to be a PBO deploying any form of PMO. Seven cases were selected for the study: four from Australia and three from Sweden. An overview of them is given in Table 1. Each case was a PBO, as per the definition provided by PMBoK (2008) and each delivered projects to large clients. The sizes of their projects varied from small to medium and large. The cases came from a range of industries including engineering, telecommunication, communication services, mining technology and property. The selection of specific sectors allowed to control environmental variations (Eisenhardt and Graebner, 2007).

According to the typology presented by Cleland and Ireland (1994), the PBOs in all cases except one (mining), delivered projects of a kind that, to some extent, had been done before. This meant that the projects had a majority of tasks that were repetitive, and so a prior knowledge base existed. The mining case covered mostly innovative projects that, by definition, were of a kind that had not been attempted before. All Swedish cases were from the property sector and were designated *Education*, *Health care* and *Residential* in accordance with the products they delivered. The cases from Australia varied across a range of different industries and were designated accordingly: the *Engineering* case was from the heavy engineering sector, *Telecom* case represented telecommunication, *Support Services* provided communication services and the *Mining* case was from the mining sector. Cases ranged from public to private. The Health Care, Education, Residential, Mining and Support Services cases were set in the public sector; whereas the Engineering and Telecom cases were set in the private sector. The PMOs of each organisation appeared to have different functions and status. At the time of data collection, the *Engineering* case had a newly established PMO providing mostly administrative support. The PMO in *Telecom* had gone through the transition from a purely administrative operating function to more of controlling and monitoring unit. Support Services had a well-established PMO, which was recently transformed into a project programme office (PPO) to provide wider support for projects. The *Mining* case did not have an explicitly dedicated PMO. However, the PMO functions were present in administration, commercial and legal support functions as well as support for the PMs in their operations. Similarly, the *Education* case did not have an explicitly established PMO, but it had technical experts and PM directors who performed duties assigned to PMO functions, for example, supporting processes and managerial support. The PBO in *Health Care* had an explicitly stated PMO with four PMO directors and a number of administrative personnel. The *Residential* case had a small project department with six PMs and one PM director. Although the company did not have an explicitly designated PMO, the PM director had administrative PMO functions that supported the PMs. Furthermore, due to the relatively few numbers of PMs in the organisation, much KS and integration occurred during meetings.

5. Cross-case analysis

A detailed analytical process, outlined in the previous section, resulted in a selection of three main categories, namely: (1) PMOs' KS functions, (2) PMs' KS expectations of the PMO, and (3) PMs' attitudes that impacted KS, the discussion of which is provided below.

5.1. PMOs' KS functions versus PMs' expectations of the PMO

Pattern-matching analysis revealed that *PMOs' KS functions* and *PM's KS expectations of the PMO* were highly overlapping and related to six areas: (1) a repository for LL; (2) active KS; (3) training, workshops and seminars; (4) formal and informal social interactions; (5) control and quality assurance; and (6) project standard and procedures (see Table 2). Nevertheless, the cross-case analysis revealed that not every PMO satisfied the expectations of PMs, which can be seen in Table 3. The respective PMO's KS functions and the PM's expectations towards the PMO are further explained in the following subsections.

5.1.1. Repository for lessons learned

Data across all seven cases revealed that PMs expect the PMO to manage and provide a repository for lessons learned. In a majority of these cases the PMO was not fully involved in the process of storing and maintaining lessons learned. These duties were primarily assigned to PMs, who often did not have the time or motivation to produce and store lessons learned for future projects. PMs reported that lessons learned databases contained large information that is not systematically organised. As a consequence, PMs commented that those lessons learned

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Table 2
Summary of case organisations.

Categories/case	Engineering	Telecom	Support service	Mining	Education	Health care	Residential
# of interviews	9	7	14	9	15	5	5
Industry area	Engineering	Telecommunication	Communication services	Mining technology	Property	Property	Property
Size of company	Large	Large	Large	Large	Large	Large	Medium
(approx # of employees)	>1000	>1000	>300	>1000	>300	>300	<200
Country	Australia	Australia	Australia	Australia	Sweden	Sweden	Sweden
Types of projects	Majority of tasks are repetitive.	Majority of tasks are repetitive.	Majority of tasks are repetitive.	Majority of tasks are novel.	Majority of tasks are repetitive, but for large projects novel tasks.	Majority of tasks are repetitive but for large projects novel tasks.	Majority of tasks are repetitive.
Project size [a]	Large	Med–large	Small–med	Med–large	Small - large	Small–large	Small–large
Client size	Large	Large	Large	Large	Large	Large	Large
PMO type	PMO	PMO	PMO	NED	NED	PMO	NED
PMO knowledge archetypes [b]	In transition from supporter to information manager	In transition from supporter to information manager	Information manager	Supporter	Between information and knowledge manager	Supporter	In transition from supporter to information manager

PMO — Explicitly dedicated PMO.
NED — Not explicitly dedicated PMO.
[a] In line with Turner, R., Ledwith, A. and Kelly, J. (2010) Project management in small to medium-sized enterprises: matching processes to the nature of the firm. *International Journal of Project Management*, 28(8), 744–755.
[b] In line with Desouza, K.C. and Evaristo, J.R. (2006) Project management offices: a case of knowledge-based archetypes. *International Journal of Information Management*, 26(5), 414–423.

databases were underutilised and most PMs did not make use of them as a source of knowledge in future projects. PMOs thus struggled to make the PMs utilise these lessons learned repositories.

5.1.2. Active KS

The findings from the within-case analysis showed that PMs from all seven cases expected the PMO to provide active support related to the best practices for work procedures through improved integration and collaboration among PMs. Yet, in most cases, such active support did not occur. The exception was two cases: Education and Support Services. The Education case employed experts to provide knowledge for PMs as a way of actively sharing lessons learned. Knowledge provided by those experts related primarily to technical expertise and, to some degree, financial expertise. However, they did not provide knowledge about how to deal with customers or how to solve leadership and group dynamic issues. Furthermore, at Support Services, the PMO was a source of information about risks and lessons from past projects and the PMs often approached PMO personnel for knowledge and expertise.

5.1.3. Training, workshops and seminars

Pattern-matching analysis helped to reveal that PMs from at least four cases (Telecom, Support Services, Education and Health Care) reported the need for more training and certification. Cross-case analysis also revealed that PMOs from Education, Engineering and Support Services provided such support for PMs. Common to all organisations was the reactive approach the PMO had when organising training and workshops that is, each was set up on a needs-only basis. Training and workshops were conducted mostly around basic project management skills such as scheduling and scoping, and did not cover softer issues including stakeholder management, human resources or leadership even though PMs expressed a need for improvement in these areas. This was especially apparent in the PBOs with personnel from non-Engineering backgrounds (i.e. Support Services and Telecom), who provided services and frequently dealt with customers. Since the PMOs did not provide training on stakeholder management, PMs from non-Engineering companies often discussed with colleague matters of how to deal with a certain stakeholder.

Additionally, training and workshops organised by the PMOs were, in some cases, a formality and did not lead to the achievement of continual improvement. For example, in the Education case, it was reported that PMOs provided one-off training on leadership and it was later assumed that PMs had that skill. In addition, the PMs reported that the PBOs do not see the value of having more training sessions around those softer aspects.

5.1.4. Formal and informal social interactions

Respondents from the cases recognised the need for more active KS between projects, as well as between projects and the organisation. Feedback from them revealed that the PMO could play such an active role in facilitating KS. Furthermore, it was reported that PMOs should provide more effective collaboration

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Table 3
Example of PMO functions and PMs' expectations and of PMOs.

Evidential examples from the cases
Repository for lessons learned
"Every lessons learned document we've ever produced is different. It's a different format, it focuses on different questions, there's no set structure, so you read one and it's completely different to the next one so it's really hard to find the common theme" (PM, Engineering case).
"PPO owns Lessons learned they review them and make sure everyone is aware of who has them" (PM from Service Support case).
"I hope in our future mode PMO will be our avenue for lessons learnt and there will be a lot clearer avenue to report on that and to be able to I guess, get the knowledge of other people's lessons learnt from their projects. We don't do that well at the moment" (PM, Telecom case).
"The intranet is quite messy and it is considered hard to use and find what you are looking for. There however exist a project report from each and every project" (PMO personnel, Education case).
Active KS
"We have too much to do to be able to have proper discussions that lead to development and integration of knowledge from different disciplines" (PM, Health Care case).
"[The PMO] has knowledge, experience and well trained staff in that area so I do go there and ask them similar questions to what I'd ask a project manager" (Support Services case).
"I feel comfortable with them [PMO personnel] but I think they're really busy. But they do a lot of quality assignments so I feel comfortable in whatever knowledge they're giving me is accurate" (PM, Support Services Case).
"The PMO hopefully will provide more informal social interaction between project managers and lessons learned" (PM Engineering case).
Training, workshops and seminars
"[If training was provided once] it was believed that you were an expert in it and PBOs do not see the value of having more training sessions around those softer aspects" (Education case).
"PMO offers resources for education, e.g. take external courses, and some internally held courses and seminars, breakfast meetings, half day seminar, lunch meetings with a specific topic. Workshops on emergent/upcoming topics like for example communication in projects which lead to new directions and guidelines" (PMO Personnel, Education Case).
"[Newly establish PMO is now] Organising internal and external project methodology trainings for both, project managers and other areas who work on projects" (PMO Personnel, Support service Case).
"Sometimes they'd [PMs] ask me questions that I didn't really know the answer to. Because they might ask something really intense about Microsoft project and I didn't know enough about it" (PMO personnel, Support Service Case).
"PMO also do a one day SSQ project methodology course and I guess that's good because not everyone's come from one Prince Two background. It gives you some visibility of project management" (PM, Support Service Case).
Formal and informal social interactions
"There is a need for an improved knowledge transfer of knowledge of softer kind, such as for example knowledge of the end/users. PMO needs to support this better. There is a need for an improved support of the knowledge transfer between PMs and property managers. More forums are needed for more structured knowledge sharing; the sharing today is done on an 'ad hoc'-basis. More time for spontaneous meetings" (PM, Education Case).
"I try to encourage people to talk to each other and share their experiences and build relationships" (PMO personnel, Education case).
"I use meetings and face-to-face interactions with the PMs as my main source for understanding their needs and try to give them feedback as often I can. I also support the PMs by solving emergent conflicts as between PMs and other project stakeholders" (PMO Personnel, Education case).
"We need to facilitate more informal social interaction between project managers" (PMO personnel, Engineering Case).

Table 3 (*continued*)

Evidential examples from the cases
Control and quality assurance
"We have follow up meetings were everybody in the organisation from the project department and some from the property department is involved, totally 25 persons that meets 4 times every year" (PMO personnel, Property Case).
"We review and control the project quality concerning fulfilment of promises (through interviews and document reviews) and the outcome but also for example the quality of the procurement and safety. We are also responsible for ensuring that the projects follow the law and that it collects relevant data for the PBO" (PMO Personnel, Education).
"PMO will dictate to us how we do things… and guides project managers in how we report, how…what numbers we use so that it's just..at the moment we can pick and choose what we want to report on and I don't think that's right in terms of the Company and for our customers it's not right.... if you don't have that consistency in that process and that big brother watching you and making sure you're abiding by those things you can do whatever you want" (PM, Engineering Case).
"They [old PMO] were merely and administrational, these are our initiatives and these are our risks and that was it. They didn't do anything with the risks so the PPO is more like a governing organization for our programs, which is what we really need" (PM, Telecom Case).
Project standard and procedures
"The PMO support with guidelines and checklists and manuals – many of those needs to be aligned and updated in order to find the best practice since the organisation struggles with too many 'practices.' And the manuals do not say how you should work, which makes it a bit difficult for new persons to enter the organisation. And there is a fussiness of how to conduct projects here" (PMO personnel, Education case).
"The PMO provides guidelines of how to conduct projects in our organisation" (PM, Property Case).
"I want PMO to provide a scheduling and value management support to the projects, be responsible for project standards and processes, responsible for the certification and training of project managers and become the repository for lessons learned and knowledge management and that across the projects" (PM, Engineering case).

and integration between different subunits. Such active support was provided by Education and Support Services and to some extent by Engineering, whose PMO personnel were actively involved in facilitating both formal and informal face-to-face interactions between PMs. In the Education case, the PMO was also engaged in building relationships between PMs and providing support to handle emergent conflicts between PMs and other project stakeholders. In Support Services, the PMO organised monthly project management forums during which PMs prepared short presentations on challenges they had encountered in their projects and how they resolved them. Moreover, PMs could approach a PMO officer at any time to discuss the issues they encountered in their projects.

5.1.5. Control and quality assurance

PMs from at least three cases (Education, Engineering and Telecom) reported that they expected the PMO to provide a certain level of control and quality assurance in order to obtain consistency in reporting and project management processes. One PM in the Education case reported that the role of PMO personnel as quality assurance provider makes him feel more secure about the project outcome. Respondents in the Engineering case expected the PMO to be responsible for project standards and processes, and provide scheduling and

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value management support to the projects. Similarly, PMs from Telecom expected the PMO to have certain level of control over projects and authority to identify, register and prioritise projects, and to ensure that projects had a proper allocation of resources. Analyses revealed that in at least four cases (Education, Engineering, Health Care and Support Services), the PMO provided a certain level of project control, which included quality control of project management reports, value management support, budget control and gate reviews.

5.1.6. Project standards and procedures

The PMs expected the PMO to provide some form of organisational coordination support and procedural knowledge concerning reporting, how to act in a project and how to follow project management processes. Cross-case analysis revealed that PMOs in each participating organisation did, to some extent, provide PMs with the necessary tools to carry projects, including project management standards, templates and guidelines on how to conduct projects, prepare technical guidelines, checklists and manuals. For example, 28 guides were found in the Education case covering cost management, energy goals, education management and procurement together with brief descriptions of projects that were regarded as successful and recommended references for future projects. There was limited evidence of the PMO providing organisational knowledge. The PMs across all seven cases reported that they often do not search through these guidelines because it is time-consuming and tiresome. They prefer to refer to their colleagues or ask experts for advice.

5.2. PMs' KS behaviours

Although every individual is different and unique, the cross-case analysis revealed that PMs have certain common behaviour-related KS practices. Selective coding, followed by the comparison of cross-case data for pattern-matching allowed grouping of PMs' behaviours according to six qualities: people-oriented, passionate, free-thinkers, autocratic, pragmatic, competent and conservative (see Table 4). These qualities helped in understanding the challenges of managing projects. These, together with findings presented in the previous section, revealed that PMOs have the capabilities to meet PMs needs and are able to manage project knowledge to achieve inter-project learning.

Each case confirmed that PMs are *people-oriented.* The importance of the human aspect in projects was primarily advocated by PMs in the Health Care, Telecom and Support Services cases, each of whom provided services or products that were highly customised. The PMs in those cases appeared to be extraverts, chatty, oriented towards relationship-building and manipulative; for example, they tried to understand the needs of end-users and their daily activities, but they also studiously manipulated and encouraged people to act in a manner that ensured the accomplishment of project goals. The PMs in the other cases also revealed that the management of people is vital for project success and most of the PMs argued that relationship-building and face-to-face interactions with

Table 4
Example of PMs' KS behaviour.

Evidential examples from the cases
People oriented
"You need knowledge of the human nature… personal chemistry matters" (PM from Health Care case).
"I am sort of…a people manager" (PM, Engineering case).
"I'm a verbal communicator, I like to be able to talk it through" (PM, Support Service case).
"I just stick up my head up over the barrier and have a bit of a chat or if she's looking a bit glum I'll say 'oh what's going on'" (PM, Support Services case).
"We've actually just got to talking about the stuff we're both doing and come to some idea of how we can help each other" (PM, Mining case).
Free-thinkers
"Lonely rangers" (PM, Mining case).
"It is a lonely job… it is ok not to be able to collaborate with others, you can manage your project anyway" (PMO personnel, Health Care case).
"Some talk, some do not, I do not know how to make the non-talkers to talk" (PMO personnel, Health Care case).
"They believe that some things are better taken care of if they do it themselves" (PMO personnel from the Education case).
"PMs do not want to be steered" (PMO personnel, Education case).
"Before we built more on a feeling but now, with the new policy, we try to communicate more with the property developers"(PM, Residential case).
Passionate
"It is fun to be a project manager as you are a project manager… you can always improve the projects through more work therefore you always experience that there is a lack of time" (PM, Residential case).
"They have a huge interest for technical aspects of buildings" (PMO personnel, Education case).
"They're always thinking about better ways to improve, so I think it's a healthy thing that they are continuing to learn" (PMO personnel, Support Services case).
Autocratic
"PMs are thrilled by the power situation and the management situation and they become small 'CEOs' for big and complex projects" (PMO, Education case).
"I'm a gatekeeper almost so I have to constantly tell people no… I explain to them, but this is what we need and this is why we need it so when you come with this and I say no, you know, this is why" (PM, Telecom case).
"PM trust their feelings and experiences and do not hesitate to 'drive over' people if needed. They want and require control and are one of a kind, very special" (PMO personnel, Education case).
Conservative
"They follow their own templates and checklists, I have to force them to change their behaviour and actively add new things they have to do, otherwise they use the template they have" (PMO personnel/director, Education case).
"PMs are stuck to old habits and methods, it is hard to teach old dogs new tricks" (PMO personnel, Education case).
"We have an older man that prefers to manage projects after his own 'best practices' so to say" (PM, Health Care case).
"To change their behaviour you have to talk, talk, and talk" (PMO personnel, Education case).
Pragmatic
"We have guidelines but are not very good at using them. Many do not see the value of using them as they do not see their projects from the PBO perspective" (PM, Health Care case).
"One of the main tasks for the PM is to ask questions and they tend to do that in every situation: question it! They ask until they have got an answer they are happy" (PMO personnel/director, Education case).
"I say 'go and talk to this person' so I would direct them to learn from that person" (PM, Support Services).
"If I had a person to talk to I'd go to them before having search for something" (PM, Support Services).

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both project participants and colleagues are needed in order to build trust, understand whether people are honest or not and to share knowledge. A majority of the PMs stated that fellow PMs in the PBOs helped each other and preferred face-to-face interactions instead of writing and reviewing LL. Their preferred choice was to phone or talk to an individual instead of searching in databases or documents for information. The advantage of information gained through a discussion was richer and provided a better understanding of the context and more examples than available in the databases.

The data from each case provided strong evidence that PMs were also *passionate* about their job. PMO personnel found that PMs in general were more interested in getting more complex and interesting projects over time than being faithful to the PBO as their passion was ultimately their project. The PMs from at least three organisations revealed they like to have everything under control; they were confident, unafraid of conflicts and willing to argue. They treated projects very seriously, felt responsible for them and cared about their project's performance. This *autocratic* and *passionate* behaviour resulted in the PMs giving lower priority to everything that did not directly contribute to their project. For example, the interviews revealed that if PMs did not see the direct value of KS or LL documentation for their project, they would simply ignore it or produce LL merely to 'tick the box'.

In at least three cases (Mining, Education and Residential), it was stated explicitly that PMs are *free-thinkers* who rely on their personal experience gained during past projects, and prefer to do the job on their own. This characteristic was also implicitly apparent in two more cases (Engineering and Heath Care) which demonstrated the significance of this PM trait. Some admitted they were not willing to share their failings/shortcomings and preferred to keep them to themselves, because they did not want to lose prestige. PMs prefer to share knowledge with a small circle of people whom they trust. There was evidence that PMs in at least three cases (Education, Health Care and Engineering) were conservative and unwilling to change their old routines or listen to advice from others. Although they claimed to be people-oriented and willing to help each other, it is valid to question how willing they really were to take others' opinions on board and change or improve habits and methods of working. The PMs also appeared to be *pragmatic* when it came to learning, often preferring learning by doing, and relied on their own experience instead of searching through databases for information. Project goal-oriented PMs were willing to learn only if they saw the value of learning for their project's benefit. For example, PMs from the Education and the Mining cases disclosed great interest in technological developments in their area. The Education case had a long history of encouraging the use of new technical solutions in their buildings, which might explain why the organisation attracted PMs with a passion for technical solutions. The pragmatic view to learning was also apparent when PMs described how newcomers learned to become skilful PMs: "*let them go beside a more knowledgeable person to see how things really worked*". When PMs had reached some degree of experience they seemed to prefer to rely on their own experience without asking others for help. They showed signs of being confident about their knowledge, as in the case of free-thinkers, and they preferred to do things on their own.

6. Discussion and implications

This research has examined PMOs' ability to act as knowledge brokers within PBOs, adopting PMs' perspectives and their knowledge sharing behaviours. Although this research was set in two distinct countries, Sweden and Australia, it is notable that similar patterns were observed in almost every case, which helped strengthen the emerging findings.

Data from the cases revealed that PMs are passionate about their projects; however, they often rely on their expertise and are unwilling to share and seek knowledge from other colleagues. This behaviour represents a barrier to inter-project knowledge sharing, and calls for the introduction of a KS broker to facilitate KS between projects. This research extends early work on the brokering role of PMO (Desouza and Evaristo, 2006; Julian, 2008) by taking into account PMs' knowledge sharing behaviours. This enabled a mismatch between PMs' expectations towards PMO and actual PMO functions to be identified.

Findings from this research indicated that in all participating cases, PMOs had developed processes for managing explicit knowledge especially related to technical and procedural knowledge; but the management of tacit knowledge was limited. To facilitate explicit knowledge transfer, PMOs often used boundary objects, for instance standardized forms, repositories and ideal type boundary objects (Star and Griesemer, 1989). However, coincident boundary objects, such as analytical tools (Star and Griesemer, 1989) and boundary encounters, including meetings and workshops (Wenger, 2008) were rarely used.

Furthermore, based on the cross-case comparison of PMs' KS behaviours and expectations of the PMO, it appears that PMs promote more active sharing of knowledge based on social interaction. Moreover that they expect the PMO to provide active support in sharing and integration of knowledge, for example by offering expertise and advice through improved integration and collaboration among PMs. In particular, the analysis of PMs' expectations of the PMO provided strong evidence to show that PMs require support related to leadership and soft skill development, primarily with respect to the maintenance of positive relationships with customers and other stakeholders. Another PMO function that supports active KS engagements is fore example, facilitating cross-project workshops and discussions as well as assistance in managing and maintaining a lessons learned database, was required. In most cases PMOs did not meet these needs. In just two instances were PMs' expectations of the PMO met, and these related to *project standard and procedures* and *control and quality assurance* functions. In relation to the latter, the PMOs applied a boundary organisation function (O'Mahony and Bechky, 2008), that is, it governed, controlled and supported the quality of the project outcome, and this was positively regarded among the PMs. Based on this discussion, the overall finding from this research shows a clear misalignment between PMO knowledge sharing functions and PMs' KS behaviours and their

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KS expectations of the PMO. The PMOs in each case did not entirely meet the requirement of a knowledge broker, which is to provide coordination between projects and between projects and the PBO (Pawlowski and Robey, 2004; Wenger, 2008). None of the PMOs provided an active role engaging in social processes (Brown and Duguid, 1998).

Based on these findings, it is suggested that to improve knowledge sharing capabilities, PMOs need to develop their facilitation (Brochner et al., 2004), process promotion (Hauschildt and Schewe, 2000) and relationship promotion (Walter and Gemunden, 2000) capabilities. These capabilities include ensuring efficient knowledge flows between departments through improved relationships at different levels in the organisational hierarchy. Additionally, PMOs have to improve their capabilities in terms of using boundary encounter activities (Wenger, 2008) and coincident boundary objects (Star and Griesemer, 1989). It is therefore recommended that the PMO takes into account the knowledge behaviours of PMs and is consultative and supporting. Furthermore, analysis also revealed that PMs were protective and preferred to rely on experiences instead of engaging in knowledge sharing activities. Accordingly, it is suggested that more commanding or law making knowledge governance strategies might be required and suitable to change current behaviours. PMOs therefore require capabilities of enabling and commanding governance strategies with knowledge of when to adopt them in order to become efficient knowledge brokers.

Most PMO functions appeared to be focused on retrospective learning that refers to generating knowledge from past projects through repositories and standardized forms as boundary objects (Star and Griesemer, 1989), including lessons learned, best practices and guidelines, rather than prospective learning. The latter refers to transferring knowledge from past experience to future projects, (Julian (2008) that is through coincident boundary objects that allow for more active interactions (Star and Griesemer, 1989), such as value management sessions, job rotation and mentorship — see Table 5. It was also notable that many of the retrospective learning activities were not performed enthusiastically by the PMs and the need for prospective learning was apparent. This is consistent with past research (Newell, 2004) suggesting that PMs are prospective in their learning as they prefer learning by doing and therefore stress the need for the PMO to provide prospective learning. Furthermore, PMs' urge to see immediate value from their projects confirms that their ties with projects are stronger than their ties with the PBO as suggested by Dubois and Gadde (2002), which further seems to support the notion of prospective learning. Accordingly, the PMO would benefit from possessing capabilities of a coach (Bredin and Söderlund, 2007; Desouza and Evaristo, 2006), a relationship promoter and facilitator to improve their brokering capacity.

This research has also revealed that to improve KS endeavours in PBOs, it is important to consider PMs' knowledge sharing behaviours. Previous research tends to offer a simplistic description of PMs' knowledge sharing behaviours, suggesting they mainly learn from their own experience (e.g. Ajmal and Koskinen, 2008). The novelty of this research is that it provides a more comprehensive view of PMs, implying that they appear to be people-oriented, free-thinkers, passionate, autocratic, conservative and pragmatic, and that these characteristics play an important role in knowledge sharing behaviours and shape a specific need for the PMO's brokering role. This extends previous studies conducted by Eskerod and Skriver (2007), which drew attention to how PMs' nature affects their KS behaviour (see Table 5).

Overall, this research suggests that in order to improve knowledge sharing and integration in PBOs, the PMO needs to possess capabilities for managing active KS and relationship-building activities. This involves strategically using various boundary objects, roles and encounters, promoting both prospective and retrospective learning and embracing both horizontal and vertical boundaries within PBOs. In doing so, they are likely to succeed as knowledge brokers.

7. Conclusions

The aim of this research was to examine PMO functions from a knowledge sharing perspective and to determine whether or not these functions reflect the knowledge sharing behaviours of PMs. This was investigated in a cross-case study of seven organisations. This research found that the PMO needs to possess multiple knowledge brokering capabilities in order to support and meet PMs' knowledge sharing behaviours. The suggested capabilities are: (a) facilitating and promoting the strategic development of PMs' relationships with diverse stakeholder groups, strategic use of boundary objects and endeavours when

Table 5
Mapping the results of this study against the findings of Desouza and Evaristo (2006), Julian (2008), and Eskerod and Skriver (2007).

PMs expectations towards PMO functions	PMO functions according to Desouza and Evaristo (2006) typology	PMO learning functions according to Julian (2008)	PMO brokering functions according to (ibid)	PMs attitudes impacting knowledge sharing	PMs characteristics according to Eskeröd and Skriver (2007)
Repository for LL	Administrative	Retrospective learning	Translation and alignment	People oriented	
Project standard and procedures	Administrative	Retrospective learning	Alignment	Free-thinkers	✓
Control and quality assurance	Administrative/knowledge intensive	Retrospective learning	Alignment	Passionate	
Training, workshops, and seminars	Knowledge intensive	Prospective learning	Reflection and coordination	Autocratic	✓
Formal and informal interactions	Knowledge intensive	Prospective learning	Coordination	Conservative	✓
Active KS	Knowledge intensive	Prospective learning	Translation and reflection	Pragmatic	✓

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interacting with PMs. Moreover, the PMOs need capabilities in educating PMs to strategically use similar boundary objects and endeavours in their operations; (b) govern, control and support PMs in their operation to ensure efficient knowledge flows; (c) adopt coaching, negotiating and training roles to ensure competence development, which were found to require an interplay of commanding and enabling strategies. PMs were found to be people-oriented, free-thinkers, passionate, autocratic, conservative and pragmatic. Even so, in some cases, these traits hampered cross-project sharing of expertise and knowledge integration.

The findings from this research demonstrate that PMO functions are not fully aligned with the PMs' KS behaviour or the PMs' exceptions of the PMO. Accordingly, this research extends early studies on the brokering role of the PMO (Desouza and Evaristo, 2006; Julian, 2008) and PMO functions (Aubry et al., 2010) by focusing on relationships between PMs' knowledge sharing behaviour and PMOs' capabilities as knowledge brokers. The contribution of the research is an improved understanding of the connection between PMs' knowledge sharing behaviours and how these align with PMO functions. The overall conclusion is that PBOs and PMOs do not truly understand PMs' knowledge sharing needs and expectations and that might explain why KS endeavours are often ineffective in PBOs.

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The governance of knowledge in project-based organizations

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Abstract

This research investigates patterns of knowledge governance practices in project-based organizations (PBOs). Five propositions about knowledge governance in PBOs were deductively and empirically tested using qualitative data from 82 interviews. The results were triangulated with those of prior studies. Results indicate that knowledge governance practices in PBOs are impacted by structural and situational factors, such as being a subsidiary or standalone PBO, a PBO striving for excellence or not, as well as some preconditions, such as the executives' competence in project governance. The results show that informal governance mechanisms are more useful than formal when it comes to knowledge creating processes. Governance of informal knowledge creating mechanisms appears to be complex for executives and their preconceptions showed either to be enablers or barriers to productive knowledge governance practices. Executive's competence and preconditions, concerning aspects like human capabilities and attitudes to professional ethos, seems to impact knowledge governance strategies. In subsidiary PBOs knowledge governance provides practitioners with proper assistance to avoid unbeneficial situations of having knowledge silos among loosely coupled islands.

Keywords: Knowledge governance; Project-based organizations; Project-oriented organizations; Knowledge management; End-users

1. Introduction

The rise of knowledge management as an important issue for long term survival of organizations has created the need to govern the knowledge management efforts in organizations. Knowledge governance involves "…choosing organizational structures and mechanisms that can influence the process of using, sharing, integrating, and creating knowledge in preferred directions and toward preferred levels" (Foss et al., 2010, p. 456). Knowledge governance mechanisms are either formal or informal. Formal mechanisms include deployment of information systems, reward systems, decision rights etc. while informal mechanisms comprise culture, networks and communities of practice (Foss, 2007). The concepts of knowledge governance emerge hereby as an attempt to steer knowledge management efforts by combining the macro-organizational (group) level with the micro-organizational (individual) level (Foss, 2007). However, research in both areas is unbalanced. Foss et al. (2010) reviewed research conducted on the relationship between governance issues and knowledge processes and found a gap, both theoretically and empirically. The empirical scarcity of knowledge management governance was also emphasized by Kannabrian and Pandyan (2010).

Corporate governance and knowledge governance have traditionally been two distinct units of analysis with different interests (i.e. focus on shareholder respectively stakeholders) and perspectives of, for example, knowledge (Keenan and Aggestam, 2001; Krafft and Ravix, 2008). Recent research on corporate governance has shifted to be more stakeholder oriented (Thiry and Deguire, 2007). The distinct views of knowledge, thus, still remain. Krafft and Ravix (2008) argue that corporate governance theories view knowledge as information that easily can be transferred while knowledge governance views knowledge as localized, specialized, dispersed and dynamic. Despite these distinctions, Krafft and Ravix (2008) and Keenan and Aggestam (2001), try to combine the two units of analysis

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mainly through advocating that knowledge governance shapes the corporate governance mechanisms. The corporate governance perspective is often based upon transaction cost economics (TCE) (Williamson, 1995), while for example the knowledge based-view of the firm (Grant, 1996b; Kogut and Zander, 1992; Nonaka, 1994; Simon, 1991) is an outgrow of the Resource Based Theory (Penrose, 1959) which sees knowledge as the most important resource in a firm (Grant, 1996b). Nickerson and Zenger (2004) develop this theory further by including elements from transaction cost economics like hierarchies and opportunistic behavior. The subjects are thereby partly integrated. Knowledge governance is claimed to be an established body of analysis (Krafft and Ravix, 2008), however, there is room for development. For example, if different governance practices are suitable for different subunits or the impact of different organizational forms are rarely discussed. Thus few examples exist, such as Scarbrough and Amaeshi (2009) who developed a model for knowledge governance challenges in open innovation projects; Bosch-Sijtsema and Postma (2010) explore governance factors as enabling knowledge transfer in inter-organizational development projects; and Lindkvist (2004) investigates a R&D organization and discovered that the governance was distinct from traditional bureaucratic organizations. This, even though, knowledge management theories have reflected upon the need to adjust strategies after organizational characteristics, like structure, membership and relationship (see for instance Magnier-Watanabe and Senoo, 2008). The stressed importance of structural impact differs among researchers. Van den Bosch et al. (1999) advocate that the organizational structure of an organization impacts internal knowledge processes while, for example Foss et al. (2010) believe that the structure does not provide a direct impact. In summary it can be said that these studies add-up to a fragmented view of the subject, which calls for a more comprehensive investigation.

1.1. Impact of organizational structure

Internal knowledge processes have been found scarce in functional, matrix and project-based organizations (Hobday, 2000; PMI, 2004) inclusive. Functional organizations are found to be knowledge silos (Prencipe and Tell, 2001), matrix organizations to be inefficient in identifying and creating value out of existing knowledge (Van den Bosch et al., 1999) and project-based organizations (PBOs) to consist of isolated islands in a loosely coupled system (Lindkvist, 2004; Orton and Weick, 1990). Additionally, many 'modern' organizations are in fact a combination of the before mentioned structures, often labeled composite organization (PMI, 2004).

PBOs are defined as organizations in which the majority of products or services are produced through projects for either internal or external customers. The PBO may hereby be a standalone organization or a subsidiary of a larger corporation (Turner and Keegan, 2000). Thiry and Deguire's (2007) adoption of PBO includes both the project-based and project-led organizational forms proposed by Hobday (2000). We assume that both the temporality of projects and the particular charter of projects, as an agent for change (in the sense of Turner and Müller (2003)), provide a context of individual semi-autonomous projects in need for integration at the organizational level, however, at the risk that the attention toward short-term organizational goal achievement distracts from knowledge integration efforts. We thereby find it valid to propose that, in order to understand how knowledge governance practices have emerged, there is a need to take different perspectives into account due to the structural complexity of PBOs.

From the above we identify the following research question: *What are the mechanisms behind knowledge governance practices in PBOs?*

More specifically, the purpose of this research is to investigate if common patterns exist behind knowledge governance practices in PBOs. We investigate this through examining the implications for PBOs concerning (1) governance of knowledge creating processes; and (2) knowledge governance in intra- and inter-firm relationships. The unit of analysis is the relationship between knowledge governance practices and mechanisms behind them. The research context is the real estate sector in Australia and includes both standalone and subsidiary PBOs. This contextual setting is rather unexplored and needs further investigation as much research in the construction industry, in where the real estate sector is part of, focus solely on the contractor side (Jones and Lichtenstein, 2008) neglecting the client (real estate organization). Even though the client plays an important role in the sector (Widén et al., 2008). In the UK, a client led revolution has been noticed, but the quality of client performance often is poor, characterized by for example short-term thinking and uninformed decisions (Cole-Colander, 2003). This scarcity has also been found in studies in the Swedish real estate sector (see for instance Lindahl and Ryd, 2007; Pemsel and Widén, 2010, 2011; Pemsel et al., 2010). This research combines previous findings set in the real estate sector in Sweden and Finland to investigate the subject further as it provides contextual opportunities for extending the existing body of knowledge.

The paper continues with the related literature review, from which five propositions are developed. The subsequent methodology chapter describes the research design and methods used to test these propositions. This is followed by the analysis of the empirical findings. The paper finishes with a discussion and conclusion on the results

2. Literature review

In line with the research question the following review addresses the three categories of knowledge governance literature:

- Governance of knowledge in organizations
- Governance of knowledge creating processes
- Governance of knowledge in inter- and intra-organizational relationships.

2.1. Governance of knowledge in organizations

Nickerson and Zenger's (2004) knowledge based theory focuses on problem-solving skills required for a task and its

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connection with appropriate governance styles in order to generate knowledge in organizations. They discovered three distinct governance choices in supporting knowledge formation: market (when directional search is needed to solve a problem), authority-based hierarchy (vertical communication channels, for decomposable problems) and consensus-based hierarchy (horizontal communication channels, for non-decomposable problems that needs heuristic search) (Nickerson and Zenger, 2004). Decomposable problems require hereby only low levels of interaction between individuals with different knowledge sets whereas non-decomposable problems require high levels of interaction (Foss, 2007; Nickerson and Zenger, 2004). They are mainly concerned with mitigation of risk for opportunistic behavior and focus on knowledge generation in firms. Thus, Hoetker and Mellewigt (2009) argue that TCE is most appropriate for formal governance mechanisms (i.e. business plans, reports, economic efficiency calculation etc.) in alliances. They emphasize the need for relational governance mechanisms (i.e. steering committees, project groups, expert committees and face-to-face meetings at top-management level etc) when dealing with knowledge-based activities (i.e. knowledge of marketing and know-how, planning networks, customer care etc.) in alliances (Hoetker and Mellewigt, 2009). Kannabiran and Pandyan (2010), thus, advocates the need of formal governance in planning and implementation of knowledge management strategies and a designated committee to which knowledge management initiatives are reported and reviewed. It therefore seems reasonable to advocate that PBOs needs both formal and relational governance mechanisms but adopts a significant number of relational governance mechanisms when managing knowledge-based activities. These project-based companies are characterized by having dynamic boundaries and contexts, a culture of empowering its staff, close interaction with customers and a high degree of team work (Huemann et al., 2007). The PBO's capability to develop strategies for managing social contexts and relationships in diverse projects have been found vital for its ability to learn and become competitive, due to the significant degree of embedded knowledge in projects (Sense, 2004, 2007). Moreover, many project based firms are multifaceted as they act in different sectors and markets, have different customers, products and services, number and size of projects and are incorporated in different institutions (Whitley, 2006). They therefore need different coordination mechanisms. Whitley (2006) categorized project based organizations by their uniqueness of products and services and their predictability of roles, tasks and expertise over projects. This is supported by Turner and Keegan (2000) who found that governance control processes in PBOs are impacted by size and number of projects respectively clients. Keenan and Aggestam (2001) combined corporate governance theory with human resource theories on knowledge issues, for instance, the combination of intellectual capital theory with corporate governance theory. van Ees et al. (2009) attempted developing a behavioral theory of corporate governance. These streams indicate an enhanced need for viewing knowledge as dynamic and localized and not simplified and reduced to information. A study showed that project managers in PBOs tend to easily report aspects related to time, budget and technology but resist when it comes to documenting lessons learned, evaluations of leadership, customer care, that is, existing knowledge. These managers relied on personal networks and arm's length activities for these endeavors (Pemsel and Wiewiora, conditionally accepted January, 2012). Due to the tacit component of know-how knowledge it is often not effective (technically capable, in the sense of (Grandori, 2001)) to capture the knowledge in explicit documents. Based on that we formulate Proposition 1:

Proposition 1. *Formal governance mechanisms are less effective than relational ones for knowledge governance practices in PBOs.*

The review above shows that more research is needed to understand knowledge governance mechanisms in PBOs. A review of previous research focusing on knowledge governance from (1) a knowledge creating process and (2) an inter- and intra-organizational relationship perspective, with PBOs in mind and the particular focus of PBOs in the real estate sector is presented in following sections. In the sense of Nonaka and Toyama (2005), we define the relation between knowledge creation vs. knowledge creating and individual vs. firm as follows: a firm can define the means and support for knowledge creating processes and activities; however, knowledge creation occurs through individual and collective interaction and reflection, which may be independent of such means and support.

2.2. Governance of knowledge creating processes

Polanyi (1983) observes that knowledge has both tacit and explicit dimensions as we can know more than we can tell. Cook and Brown (1999) argue that tacit knowledge is a tool for action needed for know-how, know-when, know-why etc. Polanyi (1983) considers the tacit and the explicit parts of knowledge to have different natures which cannot be converted into the other. Senge (2002) and Nooteboom (2004) find this valid due to the cognitive distance that exists between individuals. Nonaka (1994), however, advocates that tacit and explicit knowledge can convert into each other in a knowledge creating process consisting of: socialization, externalization, combination and internalization. Others have claimed that knowledge is rarely completely tacit or explicit, but contains elements of each, and that knowledge has to have both dimensions to be useful (Wong and Radcliffe, 2000). Knowledge from a cognitive and organizational perspective can be embedded (tacit and collective), embodied (tacit and individual), embrained (explicit and individual) and encoded (explicit and collective) (Lam, 2000). From this Lam (2000) proposes that different types of organizations (like bureaucracies or adhocracies etc.) are dominated by different kinds of knowledge due to their governance mechanisms and this results in different dynamics of learning and innovation in the organizations.

PBOs are struggling with creating knowledge processes between projects as well as between project and other subunits in the PBO, like marketing and real estate department (see for

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example Pemsel and Widén, 2010). This may be a consequence of incommensurability of knowledge types in different organizational forms due to for example high degree of embeddedness. That is, contextual understanding necessary to understand the knowledge, or proper use of knowledge governance mechanisms. The governance of knowledge, therefore, contains tacit knowledge, as well as the how, why and when of different knowledge mechanisms and their appropriateness for stimulating different knowledge creating processes. Grandori (2001) states that databanks are appropriate knowledge governance mechanisms for low complexity problems but if knowledge differentiation is added, actors need assistance of knowledge translators and disseminators. Moreover project based firms tends to focus on the outcome of knowledge processes rather than the process themselves (Prencipe and Tell, 2001).

Processes leading to knowledge creation or accumulation are numerous and have often been used interchangeably without clear distinction in previous research (Foss et al., 2010). Knowledge can be created in groups through two distinct processes with different antecedents and outcomes, namely; knowledge sharing and knowledge integration (Okhuysen and Eisenhardt, 2002). Previous literature has defined knowledge sharing as a problem solving process that consists of identifying and expressing the uniquely held knowledge (Hansen, 1999; Okhuysen and Eisenhardt, 2002). Knowledge integration also involves a process of sharing individual knowledge within the group but with the intention of combining it in order to create new knowledge (Okhuysen and Eisenhardt, 2002). Knowledge integration is thereby a dynamic process since when, where and how the integration is conducted impacts on the knowledge created (Okhuysen and Eisenhardt, 2002; Söderlund, 2010) and is a part of the firms absorptive capacity (Van den Bosch et al., 1999). This is most likely valid for all knowledge processes due to the dynamic nature of knowledge as such. The distinction of knowledge sharing and integration and its precursors also questions the validity of emphasizing either knowledge sharing or knowledge integration. Instead we argue, in line with Grant (1996b) and Grandori (2001), that the organization, through the top-management (or executives), need to be competent in managing and governing both knowledge integration and sharing in order to achieve efficient knowledge management in the organization. We formulate Proposition 2:

Proposition 2. *Knowledge governance mechanisms used in PBOs reflect executives' knowledge of antecedents for knowledge creation processes.*

Antonelli (2006) creates an extensive framework, based on TCE, that combines knowledge governance mechanisms with knowledge characteristics and forms of knowledge. Antonelli (2006) focus on technological knowledge and identifies three main knowledge governance mechanisms: (1) quasi-hierarchical command of tacit and sticky knowledge; (2) constructed interaction for articulable knowledge; and (3) coordinated transactions for codified knowledge (Antonelli, 2006). The three forms of knowledge are similar to Prencipe and Tell's (2001) learning processes: experience accumulation (i.e. learning by doing and using), knowledge articulation (learning by reflecting, thinking and confronting) and knowledge codification (learning by writing, implementing and adapting). Antonelli (2006) argues that tacit knowledge cannot be separated from individuals leading to a knowledge governance strategy that focuses on internal coordination. Governance mechanisms here are in-house outsourcing, technology platforms and joint ventures. Codified knowledge is often found in mature and stable fields and markets and has been found to play a central role for knowledge governance initiatives. This means that the organization explores external sources of knowledge and knowledge outsourcing becomes common practice. Articulable knowledge is a mix of tacit and codified knowledge and is a step in the process of codification. Network activities, standardization committees and technological clubs are effective knowledge governance mechanisms for articulable knowledge (Antonelli, 2006). Antonelli (2006) does not distinguish between different levels of analysis in the organization which Prencipe and Tell (2001) do when studying inter-project learning in project based firms. They divide the organization into three analysis levels: individual, group/project and organizational, and identify three distinct learning landscapes depending on the emphasis on learning mechanisms. Both Prencipe and Tell (2001) and Antonelli (2006) assume that tacit knowledge can be codified if right knowledge creating mechanisms are used and that it is desirable to do so. Prencipe and Tell's (2001) study highlights that organizations emphasis on individual, group and organizational learning differs while Leidner et al. (2006) advocates that PBOs fosters individualistic rather that cooperative cultures, resulting in inhibited knowledge sharing. This may be due to the firms' dependence on the individuals' ability to self-organize their work (Lindkvist, 2004). Managers in PBOs often rely on their own experiences, that is, tacit and localized knowledge and the top-management often let them act autocratic and independent. Explicit documents, like lessons learned, guidelines and standards often are considered necessary but the usability of them regarded limited (Pemsel and Widén, 2011; Pemsel and Wiewiora, conditionally accepted January, 2012). Whether this is efficient (cost effective) or not may be questioned but has implications for knowledge creating initiatives and we formulate Proposition 3:

Proposition 3. *For PBOs to be efficient in knowledge governance, their knowledge governance mechanisms need to be adjusted to appropriate their learning landscapes.*

2.3. Governance of knowledge in inter- and intra-organizational relationships

Firms whose critical knowledge resource is embodied in human resources, like PBOs, should favor mutual learning and generation of new knowledge, though, this is not always the case (Grandori, 2001). Grandori (2001) discovers three main cognitive failures of knowledge governance mechanism; knowledge differentiation, complexity and conflict of interests. She argues that all failures need to be considered in a firm's

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knowledge governance mechanisms. The study proposes a multiple boundary view of the firm in-where the boundaries may include internal and external relationships. Brokering and intermediating functions become critical in order to manage knowledge differentiations and conflicts of interests. Swart and Harvey (2011) suggest that managing knowledge boundaries is beneficial as interfaces between organizations provide dynamic knowledge creation opportunities. In addition to that, Antonelli (2006) propose the need for vertical respectively horizontal coordination activities in firms to govern different knowledge creating processes. Knowledge generated through the synthesis of different knowledge modules is most effectively governed through horizontal mechanisms (Antonelli, 2006). PBOs are repeatedly found to be loosely coupled systems (Orton and Weick, 1990; Slater and Narver, 1995) and often use project management offices (PMO) to coordinate knowledge between project, program and top-management (Thiry and Deguire, 2007). A study of PMOs as a knowledge broker in PBOs shows that PMOs have potential to act as knowledge broker internally if taking an active broker role and possessing expertise knowledge (Pemsel and Wiewiora, conditionally accepted January, 2012), that is, both vertical and horizontal coordination. Another study found that PBOs benefit from using managers with well developed brokering capabilities (i.e. translating, interpreting, educating etc.) when interacting with customers and end-users (Pemsel and Widén, 2011). We formulate Proposition 4:

Proposition 4. *Knowledge brokering activities are suitable knowledge governance mechanisms for managing knowledge differentiation and conflict of interests in PBOs.*

Knowledge creation is foremost an individual activity which firms use in the production of goods and services (Grant, 1996a). Foss et al. (2010) advocate the importance of understanding individuals' attitudes, motivation, goals, intention, behavior etc. to be able to explain knowledge processes in organizations. For instance trust, reputation and professional ethos are acknowledged important aspects impacting knowledge sharing and integration (Grabher, 2004). These three concepts are interlinked as reputation may positively impact motivation to share knowledge (Lucas and Ogilvie, 2006; Yang and Wu, 2008) and high levels of reputation may increase trust, both between individuals and professional/epistemic communities (Antonelli, 2006). However, actors are encouraged differently to share knowledge depending on relational and motivational factors (Boer et al., 2004) and, from a behavioral perspective, influenced by power plays and politics between coalitions (van Ees et al., 2009). A study of in-house knowledge sharing in PBOs revealed that project managers are independent and do not appreciate when other interfere or try to help, because it hampers knowledge sharing activities (Eskerod and Skriver, 2007). Project managers often prefer learning in personal networks of actors they trust (Eskerod and Skriver, 2007; Pemsel and Wiewiora, conditionally accepted January, 2012). Relational-governance strategies are found emergent in PBOs in order to manage social and cultural barriers and attitudes among internal and external actors that also can hamper knowledge sharing activities. Articulated strategies to manage these relational aspects are primarily experience-based and individually held (Pemsel and Widén, 2011; Pemsel et al., 2010). Keenan and Aggestam (2001) emphasize intellectual capital (were attitudes and motivation is incorporated) as embedded in people, structures and processes, which thereby is part of the corporate governance. Proper governance of intellectual capital is therefore essential for knowledge intensive organizations survival (Keenan and Aggestam, 2001). The study states that these aspects should be governed but it does not suggest how this should be accomplished. Wang et al. (2009) take a resource-based view of the firm and investigate relationship-based employee governance mechanisms. They propose that trusting relationships is a governance mechanism that encourages employees to invest and contribute in firm-specific knowledge activities. However, more mechanisms are needed, like the impact of motivation (especially from executives) on exploiting firm-specific resources (Wang et al., 2009). It is thereby evident that a comprehensive understanding of governance of relational aspects is currently lacking in the literature on knowledge governance and we formulate Proposition 5:

Proposition 5. *Executives' relational governance impacts knowledge exploitation in PBOs.*

In summary we suggest that in order to understand the underlying mechanisms of knowledge governance practices in PBOs the practices need to be examined in relation to knowledge creating processes and intra- and inter-organizational relationships.

3. Method

The research takes a critical realism perspective in the sense of Bhaskar (2009), assuming a subjective reality, based on an underlying objective reality. The three layers of critical realism are hereby reflected in the underlying *mechanics* of objective knowledge management processes and policies, which give raise to their use in projects as *events* of possible knowledge integration, which, in turn gives raise to individuals *experiences* of adopting or avoiding knowledge creating processes in organizations.

A deductive approach is chosen for maximizing reliability and credibility in the results. The just presented literature review and development of the five propositions are based on existing literature and on results from earlier conducted studies (see Section 3.1 for further information). These five propositions are, in this study, empirically tested in a qualitative mono-method, cross-sectional study based on semi-structured interviews. This study's results are hereby triangulated with results from earlier studies, in the sense of (Denzin, 2011). The support for the propositions is based upon the analysis of the collected data. If a majority of the respondents confirm the proposition it is regarded to be supported. If the propositions are supported but emerge to impact other aspects of knowledge

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processes or knowledge governance practices in the PBO these notions are remarked. This in order to improve the understanding of what mechanisms impact knowledge governance practices in PBOs.

3.1. Development of the data collection instrument

The data collection instrument was developed from a literature review in conjunction with four conducted and published studies, (i.e. Pemsel and Widén, 2010, 2011; Pemsel and Wiewiora, conditionally accepted January, 2012; Pemsel et al., 2010), resulting in an interview protocol. The interview protocols for these four studies were developed and validated through four literature reviews, 18 workshops with practitioner and researcher from the Nordic countries, before used in altogether 82 semi-structured interviews. These studies were conducted from 2008 to 2010 in Sweden, Finland and Australia.

These four studies and a new literature review resulted in five theoretical propositions to be tested deductively in accordance with Saunders et al.'s (2009) recommendations. The interview protocol focused on three main themes aligned with the propositions namely what strategies real estate organizations use to ensures that their facilities support the needs of end-users, legislations and trend on the market; how they ensure that knowledge is shared and integrated between subunits in the organization; what boundaries they need to bridge to achieve intra-organizational knowledge creation both on an individual and an organizational level.

3.2. Data collection

Data were collected through 18 semi-structured interviews with 19 persons in 14 companies. The interviews were conducted in Queensland, Victoria and New South Wales in Australia. The intention with the survey was to investigate whether findings from the four previous studies are valid in another context since they were conducted in Sweden, Finland and Australia (but different sectors in Australia). Every interview was recorded, transcribed and sent back to the respondent in order to let them validate the transcriptions (Table 1).

3.3. Sampling approach

Data collection was done until theoretical saturation was reached, that is another interview would not bring anymore insight. The survey organizations were chosen after the following criteria:

- Manage construction projects
- Properties are their main service or product
- Having either excellent or poor performance concerning management of end-users and their needs.

The interviewees were chosen in accordance with the following criteria:

- Represent different parts of PBOs and be involved in management of projects, or their managers, and end-users in conjunction with construction projects

Table 1
Summary of the survey companies and the respondents.

Company	Organizations role	Kind of projects and customers (Turner and Keegan, 2000)	Subsidiary or standalone PBO	Number of respondents and their role
A	Provide service and coordinate projects	Big projects — few customers	Subsidiary	1 middle manager
B	Provide service and coordinate projects	Small projects — many customers	Subsidiary	1 middle manager
C	Provide service and coordinate project	Big and small projects [a] — few customers	Subsidiary	1 middle manager
D	Provide service and coordinate project	Big and small projects — few customers	Subsidiary	1 top manager 1 middle manager
E	Sells services	Small projects — many customers	Standalone	2 middle managers
F	Provide service and coordinate project	Big and small project — few customers	Subsidiary	1 top manager 1 middle manager
G	Develop, sale, lease	Small projects — many customers	Subsidiary	1 middle manager 1 trainer
H	Sells services	Small projects — many customers	Standalone	1 middle manager
I	Provide service and coordinate project	Big and small projects -few customers	Subsidiary	1 middle manager
J	Trader [b]	Small projects — many customers	Standalone	1 middle manager
K	Develop, coordinate projects and lease	Small projects — many customers	Subsidiary	1 top manager
L	Provide service and coordinate project	Big and small projects — few customers	Subsidiary	1 middle manager 1 expert
Outsider 1 [c]	–	–	–	1 end user
Outsider 2	–	–	–	1 top manager

[a] The organization both provides big new facility construction projects and small refurbishment schemes.
[b] Trader refers to an organization that develops, construct and then sells facilities.
[c] There are 2 outsiders among the interviewees that do not fit in to the above described criteria. One is a CEO for an institute for a certain kinds of properties in Australia. 90% of the professional organizations are members in this institution. This institute has the end-users' interest in mind and provide obligatory training for its organizational member and thereby act as an external knowledge sharing force to those organizations. The second outsider is an end-user to one of the organizations. The end-user was earlier working in a facility management organization and is now the end-user organization's internal project manager when interacting with Company I. This interview was conducted in order to validate the interview conducted in Company I.

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- Belong to middle or top management in the organization and be aware of the strategies in the organization
- Have specialist expertise concerning the research subject.

3.4. Data analysis

The transcribed interviews were summarized by company to get a more condensed and comprehensive understanding of each organization. Data analysis was done following Saunders et al. (2009). Deductive pattern matching was used as analysis technique to identify support for the theoretically derived propositions. The interviews were coded and analyzed in several rounds into categories. Analysis of categories identified patterns, relationships, characteristics, which were, or were not, in line with existing literature. Furthermore, the richness of the data allowed for identification of three mechanisms.

The analysis process searched structurally of explanations among the dependent and independent variables that build up the propositions, that is, a constant comparison and testing between literature and empirical data. Through this process mechanism and structures were searched for that explained how the governance of knowledge creating processes as well as knowledge governance in intra- and inter-firm relationships had emerged within the sample-survey organizations. The process led to development of three mechanisms which jointly appeared to impact knowledge governance strategies and practices in PBOs in this study. It is possible that further mechanisms exist but they were not identified in this analysis.

4. Analysis

This section explores mechanisms behind adopted knowledge governance practices in PBOs in the search for support of the five propositions. The companies revealed distinct strategies for knowledge governance related aspects, illustrated by the two following citations:

> "It's tacit knowledge really. I guess we're small enough... you know translating that type of background knowledge into a database becomes almost…it's almost facile. What it really is about, the most powerful thing that you inculcate in a successful business is its culture. And its culture is underpinned by habit. You know, it's really the way you do things around here and the way you do things around here is sharing knowledge. So we share it through forums, we share it through processes and systems and we share it through, just sort of day to day interaction." (Company H)

> "I don't consider us as a learning organization, no. If you want people to learn new things it requires quite a lot of pushing. But once you have pushed it happens. Many people are quite happy just doing what they do and don't want to extend themselves." (Company B)

These quotes illustrate two distinct knowledge governance strategies that were commonly found in this survey. Companies striving for excellence when it comes to their products or service offers appear to have a culture of sharing knowledge, continuous development and inclusiveness. The employees have to adopt the culture and fit in otherwise they are unwelcome to stay, that is, the company has a demanding and clearly stated knowledge governance strategy. The other kind of company has an unconcerned view of knowledge governance; they think they are good enough as long as they are profitable. If they want things to happen they have to use a command governance style as the employees are, and prefer to be, self-governed. The companies' objectives, goals, culture and size thereby impact adopted knowledge governance strategies in accordance with the citations above.

Nevertheless, every respondent emphasizes a need to use relational activities, like face-to-face interactions and communications both internally and externally, in order to achieve knowledge sharing and integration. The formal governing mechanisms impact indirectly on executives' ambitions concerning knowledge governance practices through the organization's goals and objectives. The relational mechanisms emerge to be vital for knowledge creating processes. "There is a desire and a strong passion to have the healthiest and most sustainable buildings that are the most attractive detective that is a strong focus for us... By getting people to work in teams...weekly and monthly meetings, workshops…and we constantly train people on the job. Bringing young people in to support the other members of the established team." (Company J) This confirms Proposition 1, that is, PBOs benefit from using relational governance mechanisms. Thus, the refinement and use of relational mechanisms differ among the companies and its departments, this will be further analyzed.

4.1. Knowledge governance of knowledge creating processes

The most commonly used learning process found in this sample survey is experience accumulation. On-job-trainings, person-to-person communication and informal encounters were present in almost every surveyed organization. "There are things that you cannot really learn except that from being in that situation before." (Company J). However, organizations striving for excellence had a higher emphasis on knowledge articulation processes, like value management sessions and project control group meetings. Those formal sessions emerge to be necessary to achieve knowledge creating processes across departments in PBOs. In subsidiary PBOs communication most often needed assistance across departments to happen due to a high degree of knowledge differentiations and conflict of interests. Without assistance it was shown that differentiations tend to hamper knowledge creating initiatives. In standalone PBOs the degree of knowledge differentiations and conflict of interests are lower. The standalone PBOs are however also using a number of supporting and assisting knowledge articulation endeavors like brainstorming, reviews and lessons learned discussion sessions.

The value of training was regarded different among departments in subsidiary PBOs. Sales and marketing departments found training invaluable, they found it necessary to reflect,

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relearn and refine what they had learned by doing and using. In project departments this was often considered unthinkable. Project departments foster a different learning culture wherein the individual's independency was much higher, that is, no interference. Thus, in the standalone PBOs project managers were less autonomous in their learning by doing through organized mentoring, working in pairs and training activities.

Codified knowledge was mainly used as a reference. Most executives found it necessary but not always easily used in practice. "You often have a spoon of knowledge in a sea of information." (Company H). Individuals working with strategic questions however experienced codified knowledge more valuable. They used lessons learned documents and research reports frequently but mainly used them as a way to find contact information to the authors of the reports. The respondents expressed a need to get it interpreted and translated by the author, that is, they needed a contextual understanding of it to make use of it. Some respondents found that the employees were not capable in performing this self-evaluating and reflecting assignments. "People see the value of learning and that is often more verbal than written...Not everybody working in projects necessarily have academic skills, writing skills or research skills." (Company D). Others believed that nobody used evaluation documents and therefore did not emphasize these learning activities.

All together this implies knowledge governance mechanisms need to be active, ongoing and supportive to achieve knowledge creating processes in PBOs on levels that are more advanced than experience accumulations. In companies with a laidback and non-strategic attitude toward knowledge governance, the individual experiences tended to be accumulations shared to those they had trustful relationships. This further implies that mechanisms behind the governance practices may not always bring out the most efficient practices but those that were accepted in a specific context. Proposition 3 is thereby supported: the companies adjust the governance practices to their learning landscapes, which can be regarded as efficient. But that may not always be the most effective strategy from an overall knowledge creating perspective. This implies that even though the organization adapts its strategies to their learning landscapes there is no assurance it becomes a learning organization.

The executives' knowledge of antecedents to governance tends to be experienced-based and influenced by organizational routines and norms. The executives expressed the importance of enabling relational governance mechanisms to achieve knowledge creating processes. Knowledge was expressed to be integrated in projects, shared between colleagues and departments on an as needed basis and transferred via documents within the PBOs. The executives show they have some insight of antecedents for knowledge creating processes, which supports Proposition 2. However, the use of them appears to be influenced by personal beliefs and attitudes toward human nature and different professional ethos. "We have a customer relations department and they are people that are service orientated, who can say No with a smile on their face without people getting upset. Yes, very different types of people. They are very amiable and effable in contrary to the very driven and left brain dominant development managers." (Company K) and "I mean, look there is no point in trying to be Elvis Presley if you cannot sing." (Company E). The efficiency of the application of their knowledge in the knowledge governance strategies can thereby be questioned and will be discussed in the following section.

4.2. Knowledge governance in inter and intra organizational relationships

Analysis shows that when interacting with end-users in projects a high degree of interaction is needed to understand their needs. The respondents describe this process as a non-decomposable problem in need to be solved. Companies striving for excellence use more consensus-based hierarchy governance strategies than those that are not. Companies believing they are good enough are characterized by a more laidback and reactive knowledge governance style. When problems occur the company uses a command governance style to make the employees adopt it. In the companies striving for excellence the knowledge governance strategy is also demanding, not on an ad hoc basis, but rather on an everyday basis: "Well this is an unusual organization in that it doesn't get you anywhere. So those behaviors won't get you to the top, they'll probably get you out the door." (Company F).

Additionally, when interacting with end-users, the companies used a number of brokering strategies. The companies acknowledge that they have to be skilful negotiators, interpreters and translators to succeed in their interactions with end-users. Some of the respondents have developed experience-based strategies for different end-user organizations as a way to bridge boundaries between the organizations more efficiently. "We use sketches, 3D technologies, mood boards and visits to similar worksites... We adapt strategies to whether the client is informed or not, that is, have done it before or not... sometimes you have to hold people's hands." (Company H).

However, when it comes to internal brokering activities the initiatives and presence of them differ. Every company acknowledges that differences exist among subunits in the organization. The subunits are regarded to have different levels of motivation to create new knowledge, different goals and time perspective, different pre-knowledge as well as willingness to participate in interactions with other units. "The biggest challenge internally quite frankly is to get people to knowledge share." (Company F). This creates problems in the knowledge creating processes and the companies are aware of it, but the governance strategies to solve it differ. "I find that the project manager is very open and the development manager is less so. And the property investment manager, the asset manager, is probably as protective... I try to encourage an atmosphere of openness and everyone, you know, is one big team here and not disrupt bunches of people... it is difficult sometimes." (Company F). Brokering strategies thereby appear to be suitable knowledge governance mechanisms, which supports Proposition 4 with the additional remark that the companies would probably benefit from a more strategic use of internal brokering activities, especially in subsidiary PBOs.

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The executives' stories indicate they hold attitudes to professional ethos and the members within professions. This appears to affect the employees' ability to develop tasks and relationships. Some departments are regarded as unprofessional with customers, others as unwilling to learn and a third as egoistic and ignorant. Ignorance was also present among top and middle managers, for example, "I know what they are thinking before they know and I tell them." (Company I). These attitudes come out to determine assignments given to that group of people. This may be contra-productive as the top and middle managers also believe knowledge not is enough shared or integrated.

Executives further believe the construction sector incorporates a lot of *brutal* (Company C, D, F, I and J) personalities and they avoid employing them if possible. As a consequence many of the companies striving for excellence are headhunting people. An individual's reputation thereby plays a significant role for that person's career. Almost every company uses a knowledge governance strategy of employing experienced and very motivated individuals. There is a naïve belief that employing persons with right mindsets automatically create knowledge creating processes. Moreover, some companies believe that motivation will remain without support and encouragement. In companies striving for excellence, thus, the executives give a more nuanced picture of how to keep up the motivation of its staff, through for instance, personal development plans and continually satisfy their hunger for development through more complex and demanding tasks. The executives' capability of relational governance practices thereby appears to impact the knowledge exploitation; supporting Proposition 5.

Table 2 summarizes the empirical tests of the five propositions, which shows that all proposition were supported by the qualitative empirical data, except Proposition 3, which is only partly supported.

5. Discussion

This research demonstrates the need to take a variety of perspectives into account in order to understand how knowledge governance practices emerge in PBOs. It is not enough to consider, for example, the three governance choices: market, authority-based hierarchy and consensus-based hierarchy as suggested by Nickerson and Zenger (2004). Neither to solely look at the learning landscapes discovered by Prencipe and Tell (2001) or Whitley's (2006) captures the complexity of PBOs. These studies provide a good start in differentiating between different PBOs and their knowledge governance practices, but a more holistic perspective is needed to accommodate contextual differences and integrate theoretical bases. Previous studies on knowledge governance theory are mainly based on TCE or resource based view of firm. Our research supports the simultaneous impact of both streams, but argues for a more integrated perspective to understand knowledge governance practices in PBOs. Three of the most significant differentiators in knowledge governance practices found in this study are (1) whether the PBO is a subsidiary or standalone; (2) if the PBO strives for excellence or not and; (3) the executives' impact on knowledge creating processes.

5.1. Structural mechanisms

First, standalone PBOs often show more subtle knowledge governance practices than subsidiary PBOs. This may be because the former indict a higher project-focus than the latter, where project management is just one of many different business foci and thereby gains less attention, in line with Müller (2009). Top management appears to be too detached from subunits in subsidiary PBO to acknowledge more efficient knowledge governance practices. Subsidiary PBOs are composites of project-based and functional organizations, which results in both struggling from having isolated islands (Orton and Weick, 1990) and maintenance of knowledge silos (Prencipe and Tell, 2001), which may explain the less subtle knowledge governance practices, but at the same time stresses the need for them. Underlying *structural mechanisms* indicate to impact the knowledge governance practices in PBOs.

5.2. Visionary mechanisms

Second, this study suggests that goals and objectives of PBOs impact knowledge governance practices, in line with Whitley (2006). Present research reveals that PBOs striving for excellence in their product and service offers, try to foster a collaborative and inclusive culture in a sector characterized

Table 2
Summary of the propositions' support.

Proposition	Supported/not supported	Comment
1	Supported	Formal mechanisms set the conditions through goals and objectives but relational mechanisms are indispensible for generate knowledge creating processes.
2	Supported	The use of antecedents for knowledge creating processes is shown to be influenced by personal beliefs and attitudes toward the human nature and differences in professional ethos.
3	Partly supported	The research revealed that if knowledge governance was adapted to a learning landscape the knowledge creating processes can be efficient but not necessarily effective.
4	Supported	Brokering activities were strategically used with end-users and clients. Internal brokering strategies tend to be less often strategically used. But the companies using subsidiary PBOs showed signs of having a numbers of boundaries between departments and disciplines in need to be bridged to achieve more efficient knowledge creating processes.
5	Supported	Executives have potential to bridge social and cultural barriers and thereby achieve knowledge exploitation both internally and externally through strategic use of relational knowledge governance practices. Thus the executives' preconceptions toward actors can be enablers or barriers for this to happen.

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by individuality, for instance, valuing individual's reputation. This is partly contrasting to Leidner et al.'s (2006) finding that PBOs foster individualistic cultures. Remarkably in the standalone PBOs that can be regarded as the "purest" PBOs in present research, culture of collectivity was emphasized. The subsidiary PBOs not striving for excellence had the lowest ambition level for inclusiveness and collectivity. The result from this research thereby challenges the notion that PBOs always should foster an individualistic culture. Present research reveals that emphasis and interest of knowledge governance practices appear to be higher in PBOs striving for excellence, both in standalone and subsidiary, than in organizations aiming to be merely good enough. Underlying *visionary mechanisms* appear to impact knowledge governance practices.

5.3. Pragmatic mechanisms

Third, previous research on knowledge governance stresses knowledge sharing at group level forgetting the individual level (Foss et al., 2010). However, present research highlights executives' role in impacting knowledge governance practices through their knowledge of, and interest in, enabling knowledge creating processes in PBOs. The executives' strategies are mainly experienced-based, through trial and error and they express that informal governance strategies are more suitable than formal. The predilection for informal strategies may be founded in their belief in how human learn or lack of knowledge of how to make formal reward systems productive. The executives sometimes appear to be fumbling in the dark when it comes to identify proper practices to generate internal knowledge creating processes. The research indicates that they mix (1) naïve coping strategies, that knowledge creating processes will materialize automatically when employing the right people, with either (2) authoritative and commanding leaderships styles, or (3) coaching attempts to motivate and give the individual freedom to develop. Some of the executives emphasize the need to adjust strategies to every individual and group to achieve desired outcomes. This confirms Singh (2008) recommendation of adjusting leadership style to knowledge management activities to achieve productive outcomes. These findings support the notion that different governance strategies are appropriate for different subunits in PBOs. Additionally, it was found that the executives' preconceptions to human nature, individuals and professional ethos impacts adopted knowledge governance practices. A further research is encouraged concerning connections between knowledge governance outcomes and leadership styles. Thus, in present study *pragmatic mechanisms* appear often to foster knowledge governance practices rather than enlightened innovative mechanisms.

Overall, the analysis indicates that knowledge governance strategies need to consider both holistic and narrow perspective. Firstly, knowledge creating processes across units are often insufficient due to attitudes and lack of informal relational governance practices among subunits. Secondly, subunits are diverse and based on different cultures and appear to belong to distinct communities of practice (in line with Corso et al., 2009). This indicates the need for contingency in adjusting knowledge governance practices to subunits needs.

This research is the first empirical study in knowledge governance in the real estate sector in Australia. Previous studies are either theoretical, for example Antonelli, (2006), Grandori (2001), Keenan and Aggestam (2001), or in other industries with different foci like alliances in telecommunications (Hoetker and Mellewigt, 2009), comparison between software and advertising (Grabher, 2004), implementation of a new organization within a manufacturing company (Lindkvist, 2004) and technological development projects in construction (Bosch-Sijtsema and Postma, 2010).

6. Conclusion

This research investigated patterns in knowledge governance practices in PBOs, done by examining the implications for PBOs concerning (1) governance of knowledge creating processes; and (2) governance of intra- and inter-firm relationships. The research took a deductive approach, developing five propositions investigated in a qualitative sample survey in the real estate sector in Australia. The five propositions were supported with some additional remarks of contextual aspects in need to be considered.

The mechanisms behind knowledge governance practices, from the two dimensions explored, in PBOs are:

- Structural mechanisms
- Visionary mechanisms
- Pragmatic mechanisms.

These three mechanisms occasionally tend to be contra productive resulting in ineffective knowledge governance practices. This as executives seems to be fumbling in the dark concerning their use of leadership styles to generate knowledge creation processes. Keeping knowledge creating processes alive often requires ongoing active demand and support from executives, which is not always the case. It is indicated that underlying structures and preconditions impact adopted knowledge governance practices. These need to be understood to recognize how knowledge creating processes can be improved in PBOs. The research implicates that knowledge governance practices in PBOs are impacted by subsidiary type, ambition level, and executives' competence and preconditions.

The managerial implications of this research indicate that generation of knowledge creating processes requires subtle interplays between commanding and enabling knowledge governance practices. Additionally, to be efficient in knowledge governance, not only practitioners' preconditions toward professional ethos need to be managed but also those of executives. From a theoretical perspective this research contributes with a recommendation of adopting a comprehensive and contingency view of knowledge governance in order to understand underlying mechanisms behind knowledge governance practices in PBOs. The research results suggest that PBOs should use multiple knowledge governance strategies for different subunits due to the structural complexity PBOs.

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The strength of this research is that it combines previous studies in a triangulating manner. The limitation of this research is its sample size, which limits generalizability of the results. However, the richness of the semi-structured interviews allowed for new insights which foster the need for further quantitative studies.

This research contributes to existing body of knowledge by suggesting a contingency theory perspective toward knowledge governance, where knowledge governance strategies are adjusted to organizational characteristics within PBOs in order to allow knowledge processes to prosper between subunits.

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Interviews and workshops

This appendix includes conducted interviews (Table 1) and meetings and workshops (Table 2).

Table 1 Interviews.

Number	Interviewee's position	Duration of the interview	Date of the interview	Paper / Case organisation
1	Project manager REO** 1	80 min	2008-11-19	Facilities, CME**, IJMP** / University (SE)
2	Involved end-user 1	45 min	2008-12-18	Facilities, CME / University (SE)
3	Involved end-user 2	60 min	2008-11-25	Facilities, CME / University (SE)
4	Project manager client 1	50 min	2008-12-08	Facilities and CME, IJMP / University (SE)
5	End-user project manager 1	90 min	2008-12-16	Facilities, CME / University (SE)
6	Not involved end-user 1	25 min	2008-12-15	Facilities / University (SE)
7	Project manager and project coordinator REO	120 min	2008-12-08	Facilities, IJMP / University (SE)
8	Not involved end-user 2	40 min	2008-12-22	Facilities / University (SE)

Table 1 Continued.

Number	Interviewee's position	Duration of the interview	Date of the interview	Paper / Organisation
9	Property manager	30 min	2008-11-28	Facilities / University (SE)
10	Architect	70 min	2009-01-08	Facilities and CME / University (SE)
11	End-user project manager 2	120 min	2009-01-08	Facilities, CME / University (SE)
12	Project manager early phases REO	60 min	2008-12-02	Facilities and CME, IJMP / University (SE)
13	Project manager client 2	90 min	2008-11-27	Facilities and CME, IJMP / University (SE)
14	Project manager early phases client	120 min	2009-03-30	Facilities and CME, IJMP / Hospital
15	End-user project manager	150 min	2009-03-19	Facilities and CME, IJMP / Hospital
16	Project manager external	60 min	2009-04-24	Facilities and CME, IJPM / Hospital
17	Facility planner	40 min	2009-03-05	Facilities and CME / Hospital
18	Two architects*	45 min	2010-02-03	CME / University (FI)
19	External workplace consultant	80 min	2010-02-02	CME / University (FI)
20	Project manager	60 min	2010-02-02	CME / University (FI)
21	Workplace strategy specialist	90 min	2010-02-02	CME / University (FI)
22	Briefing consultant	70 min	2010-02-03	CME / University (FI)

Table 1 Continued.

Number	Interviewee's position	Duration of the interview	Date of the interview	Paper / Organisation
23	Workplace consultant	70 min	2010-02-03	CME / University (FI)
24	Marketing manager	120 min	2009-03-13	PMJ** / Franchise
25	Marketing manager	60 min	2009-03-26	PMJ and IJPM / Housing/Residential
26	Marketing manager	45 min	2009-05-15	PMJ and IJPM / Housing/Residential
27	Marketing manager	45 min	2010-12-20	IJPM / Residential
28	Project manager	40 min	2010-01-24	IJPM / Residential
29	Coordinator between property and project department	20 min	2010-12-20	IJPM / Residential
30	Middle manager project management	60 min	2010-12-28	IJPM / Hospital
31	Project manager	80 min	2011-01-05	IJPM / Hospital
32	Top management regional level	70 min	2010-06-30	IJPM / Education
33	Middle manager project management – PMO	80 min	2010-07-08	IJPM / Education

Table 1 Continued.

Number	Interviewee's position	Duration of the interview	Date of the interview	Paper / Organisation
34	PMO – technical expert 1	75 min	2010-05-26	IJPM / Education
35	PMO - technical expert 2	70 min	2010-05-26	IJPM / Education
36	Top manager 1 – involved in PMO	70 min	2010-09-14	IJPM / Education
37	PMO – technical expert 3	90 min	2010-08-31	IJPM / Education
38	Top manager 2 involved in PMO	55 min	2010-09-10	IJPM / Education
39	Technical engineer	55 min	2010-10-05	Education***
40	Middle manager 1	50 min	2010-08-31	IJPM / Education
41	Technical engineer	45 min	2010-10-14	Education***
42	Top manager 3 involved in PMO	40 min	2010-10-15	IJPM / Education
43	Middle manager 2	90 min	2010-08-31	IJPM / Education
44	Project management director	40 min	2011-02-14	IJPM / Survey, company A
45	Trainer for business development and franchise management	25 min	2011-02-15	IJPM / Survey, Company G
46	Development manager	55 min	2011-02-16	IJPM / Survey, Company B
47	Manager for business standards	50 min	2011-02-17	IJPM / Survey, outsider 2

Table 1 Continued.

Number	Interviewee's position	Duration of the interview	Date of the interview	Paper / Organisation
48	CEO	45 min	2011-02-23	IJPM / Survey, Company F
49	Divisional director project management	50 min	2011-02-23	IJPM / Survey, Company E
50	Managing director project services	50 min	2011-02-28	IJPM / Survey, Company H
51	Divisional asset manager	80 min	2011-03-02	IJPM / Survey, Company I
52	Associate director redevelopment	85 min	2011-03-07	IJPM / Survey, Company C
53	Development director	45 min	2011-03-08	IJPM / Survey, Company F
54	HR/Commercial sales and lease manager	25 min	2011-03-14	IJPM / Survey, Company G
55	Services manager	50 min	2011-03-15	IJPM / Survey, Outsider 1
56	Divisional director project management	70 min	2011-03-16	IJPM / Survey, Company E
57	CEO	50 min	2011-04-05	IJPM / Survey, Company D
58	Principal manager and Accommodation planner*	50 min	2011-04-11	IJPM / Survey, Company L

Table 1 Continued.

Number	Interviewee's position	Duration of the interview	Date of the interview	Paper / Organisation
59	Project manager	55 min	2011-04-12	IJPM / Survey, Company D
60	CEO	35 min	2011-04-15	IJPM / Survey, Company K
61	Project management director	65 min	2011-04-19	IJPM / Survey, Company J

Note: in total 61 interviews were conducted; in two interviews, two interviewees were present (marked with *). Some of the interviewees have changed their working titles and positions during the study and some have different roles and responsibilities resulting in different titles in different papers.

** REO = Real estate organisation, CME = Construction, Management and Economics, PMJ = Project Management Journal, IJPM = International Journal of Project Management.

*** these two interviews contributed to the knowledge of the organisation but have not been used in any paper so far.

Table 2 Meetings and workshops included in the studies.

Number	Purpose	Participants	Facility type/country	Date
1	Introduce the case, better understand its context	Project manager and two researchers	Health care	2009-03-05
2	Evaluate the building, the researcher was invited to listen and take notes	Project manager BE, eight end-users, three project managers, one top manager property company, one architect	University and Office	2008-09-19
3	Pre-study	Four industry partners and four researchers	Residential	2008-04-01
4	Pre-study	Three industrial partners and three researchers	Health care	2008-05-13
5	Pre-study	three industrial partners and four researchers	University and Office	2008-04-22
6	Presentation of result and validation	Three industry members and two researchers	Health care	2010-04-10
7	Presentation of result and validation	Two industrial partners and two researchers	Residential	2010-03-16
8	Presentation of result and validation	Two industrial partners and two researchers	University	2010-03-18

Table 2 Continued.

Number	Purpose	Participants	Case/country	Date
9	Introduction	Three members from the case organisation and two researchers	University	2010-04-30
10	Presentation of pre-study and validation	Three members from the case organisation and three researchers	University	2010-10-24
11	Discuss the subject to develop a proper case study protocol	CREDIT research group	Finland	2008-01-24 – 2008-01-25
12	Discuss the subject to develop a proper case study protocol	CREDIT research group	Norway	2008-05-29 – 2008-05-30
13	Discuss the subject to develop a proper case study protocol	CREDIT research group	Sweden	2008-10-08 – 2008-10-09
14	Discuss the subject to develop a proper case study protocol	CREDIT research group	Lithuania	2009-01-19 – 2009-01-20

Table 2 Continued.

Number	Purpose	Participants	Case/country	Date
15	Discuss the subject and results	CREDIT research group	Iceland	2009-06-08 – 2009-08-09
16	Discuss the subject and results	CREDIT research group	Estonia	2009-10-26 – 2009-10-27
17	Discuss and present results with practitioners and sponsors	CREDIT research group	Denmark	2010-01-25 – 2010-01-26