

A KNOWLEDGE-BASED APPROACH TO INNOVATION: AN APPLICATION FOR PROJECT-BASED FIRMS

Petra Bosch-Sijtsema^a
Theo J.B.M. Postma^b

^{a,b}Faculty of Management and Organization,
University of Groningen, The Netherlands

^a p.m.bosch-sijtsema@bdk.rug.nl

^b t.j.b.m.postma@bdk.rug.nl

Session C-3

Abstract

The knowledge-based view (KBV) of firms has received increasingly attention. A relatively unexplored area is knowledge transfer in project-based organizations (PBOs). The PBO relies upon combining expertise from several internal and external parties in order to deliver their own capabilities in a one-off process. Knowledge over projects is difficult to transfer due to the unique character of projects. Furthermore, the short-term perspective and fluctuating partners make it harder to develop new knowledge in cooperation with parties in the network. The network consists of suppliers, clients, governmental institutions and R&D institutions. This paper aims at developing a conceptual framework for research on the relationship between the PBO and its network. We discuss knowledge properties for innovation of the network, trust-based relationships and the impact of the industrial context on knowledge transfer and we present illustrations from the construction industry.

Keywords: knowledge-based view, innovation, project-based firms, and knowledge transfer.

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Petra Bosch-Sijtsema

Theo J.B.M. Postma

Faculty of Management & Organization

University of Groningen, the Netherlands

p.m.bosch-sijtsema@bdk.rug.nl

t.j.b.m.postma@bdk.rug.nl

To be presented at the European conference on Organizational Knowledge, Learning and Capabilities 2004 (OKLC04) in Innsbruck.

Suggested track:

C Knowledge creation and innovation

Abstract

The knowledge-based view (KBV) of firms has received increasingly attention. A relatively unexplored area is knowledge transfer in project-based organizations (PBOs). The PBO relies upon combining expertise from several internal and external parties in order to deliver their own capabilities in a one-off process. Knowledge over projects is difficult to transfer due to the unique character of projects. Furthermore, the short-term perspective and fluctuating partners make it harder to develop new knowledge in cooperation with parties in the network. The network consists of suppliers, clients, governmental institutions and R&D institutions. This paper aims at developing a conceptual framework for research on the relationship between the PBO and its network. We discuss knowledge properties for innovation of the network, trust-based relationships and the impact of the industrial context on knowledge transfer and we present illustrations from the construction industry.

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1 Introduction

The resource-based view is expressly concerned with the rent-generating heterogeneous firm and its origin, function, evolution, and sustainability (Mahoney & Pandian, 1992). The resource-based view (RBV) indicates that, firms with valuable, rare, and inimitable resources have the potential of gaining competitive advantage (e.g. Barney, 1991). A sustainable competitive advantage (e.g. in terms of low costs/prices, better service, faster delivery, innovativeness) can be described as the development of

a unique product market combination, by using resources and taking specific strategic decisions concerning the business. Unique resources or combinations of resources (sometimes also referred to as distinctive capabilities or core competencies) can be categorized as uncodified institutional knowledge (in networked people; in embedded processes) versus sunk costs and irreversible investments (investments in reputation; in legal protection; in specialized assets) (cf. Van der Heijden, 1996: 63). Wiklund and Shepherd (2003) discuss in this respect property-based resources, which refer to tangible input resources, vis à vis knowledge-based resources, which are the ways in which firms combine and transform these tangible input resources. Within the RBV, knowledge is gaining increasingly attention as an important source of competitive advantage (Amit & Schoemaker, 1993; Grant, 1996; Kogut & Zander, 1992; Krogh & Roos, 1996; Peteraf, 1993; Spender, 1996). In this paper we apply a knowledge-based view (KBV). This view stresses that knowledge is the most strategically important resource of the firm (Grant, 1996).

In the KBV, the primary goal of the firm is the application of existing knowledge to the production of goods and services (Grant, 1996). Knowledge and skills give a firm competitive advantage, because it is through this set of knowledge and skills that a firm is able to innovate new products and processes, or improve existing ones more efficiently and or effectively (Nonaka & Takeuchi, 1995). Recently more interest arose in knowledge transfer in the context of project-based enterprises. The project-based enterprise is defined as a company formed to pursue one or more specific project outcomes. The project-based organization (PBO) is found when complex, non-routine tasks require temporary employment and collaboration of diversely trained specialists (DeFillippi & Arthur, 1998). Especially in project-based firms the development of core competencies, which is important from a knowledge-based view, is difficult. Furthermore, the fluctuating workforce complicates the transfer of knowledge. In PBO, knowledge, capabilities and resources are built up in the firm through executing projects over time (Hobday, 2000). Because of the temporary character of projects, the PBO is inherently flexible and reconfigurable. PBOs organize their structures, strategies and capabilities around the needs of projects, which often cut across conventional industrial and firm boundaries (Hobday, 2000). Within the context of PBOs, parties cooperate with several external parties for a certain period of time to finish a project, and within this period of time they can create innovative ideas. However, the main challenge is to develop and diffuse new knowledge that can be applied across several projects, with changing constellations of partners. Various forms

of collaboration can be relevant, i.e. subcontracting, consortia, strategic alliances, and (innovation) networks (Tidd et al., 2002). Especially, innovation is an issue that is not resolved in this context. We define innovation as the intentional introduction and application within a role, group or organization of ideas, processes, products (incl. services) or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, organization or wider society (West & Farr, 1990). Authors have argued for the pursuit of cooperative strategies as a means of creating new knowledge or gaining access to knowledge and skills outside the boundaries of the firm (Wathne, Roos & Krogh, 1996), however many questions are still unanswered. There is little research performed from a knowledge-based view on innovation in project-based firms and the impact of (changing constellations of) cooperating partners in this development of products and processes (Gann & Salter, 2000). In this paper, we address this perceived gap.

New product development is a field in which project basing has been the mode of organization for activities that are concerned with knowledge creation, sharing and learning. Sectors such as construction and aerospace present examples of complex decision spaces, in which new product development coincides not only with non-routine production processes, but also with complex inter-organizational relationships (Bresnen, 1990; Bresnen et al., 2003; Hobday, 2000). In order to illustrate the conceptual discussion we present examples from a project-based industry, i.e., the Dutch construction industry. This paper discusses a conceptual framework for knowledge exchange for innovation between network parties in project-based industries.

This paper is organized as follows; in the following we first discuss more in-depth knowledge, networks, and innovation. Subsequently, we present the conceptual framework and discuss the building blocks. Based on this we end with a discussion and propositions for further research.

2 Knowledge, networks and innovation

As indicated, the KBV can be considered a subset of the RBV. The role of the firm and its source of unique advantage, rest in its ability to integrate the knowledge of individuals in the production process of goods and services (Grant, 1996). An important issue in KBV is the transfer of knowledge and the difficulty of transfer (Nonaka, 1994; Szulanski, 1996). Another issue in the KBV literature concerns the different categories

of knowledge (Grant, 1996; Nonaka, 1994). The main categories are tacit knowledge (knowing how) and explicit knowledge (knowing about facts and theories). Some researchers suggest that explicit knowledge is easier to transfer since it can be codified, while tacit knowledge is more costly and uncertain, since it cannot be codified (cf. Kogut & Zander, 1992).

From the resource based view it is clear that firms have the potential to provide enduring competitive advantage when they are inimitable and not readily substitutable (Peteraf, 1993). An important source of the creation of inimitable value-generating resources lies in a firm's network of relationships (Gulati, Nohria & Zaheer, 2000). Gnyawali and Madhavan (2001) distinguish four sets of arguments why resources in external networks are important to a firm: (1) Relationships in a network are potential conduits to internal resources held by connected actors; (2) External economies (i.e. capabilities created within a network of competing and cooperating firms) often complement firms' internal resources; (3) The rate of return on internal resources is determined by how well structured the firm's network is; (4) A firm's position in a network contributes to its acquisition of new competitive capabilities. In the context of this paper, we are especially interested in the knowledge flows (next to asset flows and status flows) as a consequence of a firm's network.

A firm's network allows it to access key resources from its environment, such as information, access, capital, goods, services and so on, in order to gain potential to maintain or enhance a firm's competitive advantage (Gulati et al., 2000). We refer to absorptive capacity, which deals with both internal and external transfer of knowledge in the organization. Absorptive capacity is the ability of a firm to absorb new knowledge (Cohen and Levinthal, 1990). An organization has various ways to enhance the firm's & capacity, e.g. by special departments such as R&D, business development, knowledge management, and setting up collaborative relations or networks. Our focus is on the relationship between internal and external collaborative networks for absorbing knowledge within an organization's innovation process. This relationship between the internal knowledge resources of the firm and the external knowledge resources of the network is generally influenced by a set of governance mechanisms that can either inhibit or enhance knowledge transfer. These governance mechanisms are: (1) authority as a control mechanism within the firm; (2) prices and contracts for market coordination of the external network; (3) Trust as a governance mechanism between the firm and the external network. Moreover, also (4) the context of institutional

regulations and (5) the culture or values and norms within an industry can be considered as governance mechanisms in this context (Nooteboom, 2000). These governance mechanisms are complementary and sometimes substitute for each other, e.g., in a situation of enduring relationships building trust replaces extensive contracting. Particularly in innovation and learning, it can be useful to make use of various governance modes simultaneously (Nooteboom, 2000: 107).

The knowledge-based view can be explicitly related to product and process innovation (cf. Leonard-Barton, 1992). This research discusses several dimensions of knowledge that have an impact on the development of a product or process. In our research we mainly focus on the knowledge resource relationship between the PBO and its network that has an influence on the performance of the firm (i.e. innovation). From innovation literature it becomes clear that there are several parties that can be the source of innovation in firms; clients (von Hippel, 1988), suppliers (Pavitt, 1984); universities and R&D institutions (Leonard-Barton, 1995) and regulations and government (Seaden & Manseu, 2000). Within project-based firms, problem solving within projects and internal networks is another source for innovation (Slaughter, 1993; Winch, 1998).

In the following figure we present the conceptual framework discussed above. The conceptual model focuses on the knowledge exchange between the PBO (internal knowledge resources) and its network (external knowledge resources), for performance in the form of innovation, which is affected by governance mechanisms and the institutional/cultural context. Important aspects in this model are that PBOs and their network develop and learn through the innovation process and that they are able to develop dynamic capabilities to gain competitive advantage.

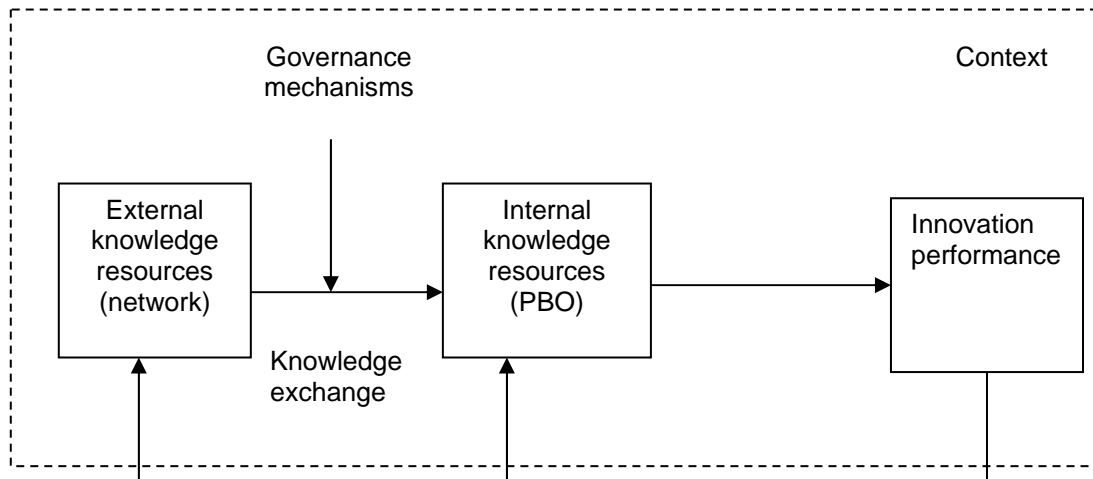


Fig. 1: Conceptual model of the research

The core factor in this model is knowledge exchange. We refer to four knowledge properties that influence knowledge transfer and application (Szulanski, 1996; Teece, 1977): (a) the properties of the knowledge transferred include what kind of knowledge is transferred (i.e., tacit and or explicit) within the relationship between the PBO and its network. (b) The characteristics of the knowledge sources (the external network) involve which parties transfer knowledge towards the project-based firm (e.g., project problem solving, suppliers, customers, R&D institutes, and governmental institutions). (c) The characteristics of the knowledge recipient (the project-based firm) and (d) the context of knowledge transfer, the context of not only the firm is of importance but also the institutional context of the market in which the PBO is working has an affect on the success rate of innovations. Also, the various governance mechanisms might influence the knowledge exchange between internal and external parties. In the following section the knowledge dimensions are discussed in more detail.

3 Knowledge dimensions

Transfer of knowledge emphasizes the movement of knowledge within the organization and depends on the characteristics of everyone involved (Szulanski, 1996). As indicated, above, the knowledge properties, sources and recipient and the context of knowledge are important factors for transfer (Leonard-Barton, 1992; Rogers, 1962; Teece, 1977).

Properties of knowledge

Several authors have discussed properties of knowledge for transfer. Some authors focus on the types of knowledge (Grant, 1996; Nonaka & Takeuchi, 1995), others

discuss difficulties and costs of transfer (Rogers, 1983; Szulanski, 1996; Teece, 1977). We focus on the transfer of new ideas (innovation) of different parties to project-based firms. Grant (1996) discusses transferability of knowledge and mentions two types of knowledge: (a) tacit knowledge: *knowing how*, which is revealed through its application (Kogut & Zander, 1992; Von Hippel, 1988) (also referred to as experiential knowledge or knowledge by doing). Knowing how is often deeply rooted (Nonaka, 1994) or found in routines (Nelson & Winter, 1982) and is difficult to transfer. (b) Explicit knowledge is *knowing about* facts, in which communication is a fundamental property. The ability to codify knowledge into a set of identifiable rules and relationships improves transfer of especially tacit knowledge (Kogut & Zander, 1992).

Characteristics of knowledge recipient (PBO)

The project-based, service-enhanced forms of enterprise are not adequately addressed in innovation literature (Gann & Salter, 2000). Project-based organizations (PBO) rely upon combining expertise from several organizations in order to deliver their own capabilities, usually in one-off processes. PBOs have the following characteristics (Gann & Salter, 2000; Hobday, 2000):

- The design and production processes are organized around projects;
 - They usually produce one-off products and services;
 - They operate in diffuse coalitions of companies along the supplier-customer chain.
- A strong focus on the project and its economy entails a rather short-term perspective emphasizing competitive bidding as the main tool in supplier evaluation (cf. Dubois & Gadde, 2000: 210). Moreover, transferring knowledge is difficult because of a short-term perspective, and the fluctuating workforce (DeFillippi & Arthur, 1998; Prencipe & Tell, 2001). Research on project basing in the construction industry mentions that little benefit is gained from shared learning or synergy between parties as the fragmentation leads to individualism and self-seeking interest (Thompson, Cox & Anderson, 1998:32)

The project-based firm is concerned with several dimensions of coordination (Dubois & Gadde, 2000): (1) coordination of individual projects. (2) Each firm has to coordinate its activities and resources among the different projects in which the firm is involved. (3) Coordination of resources and activities on firm level, not related to specific projects and (4) coordination between sub-contractors and their suppliers. Coordination in this respect includes both control and communication. The most prominent coordination dimensions are on project and on firm level. Dubois & Gadde (2000) mention “the network within the network” of PBo, in which the first network layer is the permanent

network of actors and resources. The other network is the temporary network formed around each project. The permanent network is characterized by standardization in terms of products and routines and a low degree of interdependency among individual actors (Dubois & Gadde, 2000: 213), while the temporary network has a high degree of interdependency between different firms.

Besides the structure of the PBO, the technical and managerial competence of the transferee is important for the ease with which technology can be absorbed (Teece, 1977). Others mention managerial systems that guide the control and creation of knowledge and values and norms within the firm as dimensions for core capabilities (Leonard-Barton, 1992). Furthermore the skills and knowledge of the PBO (within people and technology) are important for the absorption and creation of new knowledge. An important characteristic of the transferee is its absorptive capacity, which concentrates on how the firm deals with internal and external knowledge for developing innovative products and processes.

Characteristics of knowledge source (external network)

The infrastructure in which new initiatives are embedded is commonly not the single organization, but a wider network of inter-organizational and institutional relationships (Grabher, 2002). Coordination among firms in the permanent network (Dubois & Gadde, 2000) can enhance productivity and performance in the form of partnerships (Bresnen & Marshall, 2001). Several authors have pointed towards different parties that influence innovation within a firm (Leonard-Barton, 1995; Pavitt, 1984; Von Hippel, 1988). For a project-based industry several parties are important to take into account (Gann & Salter, 2000): such as clients, projects, suppliers, governmental institutions and research institutes and universities. Although literature states that these parties are sources for innovation, little research has been performed from a knowledge-based perspective on what kind of knowledge is transferred and to which party in the network knowledge is distributed. We mainly concentrate our research on the permanent network of a project-based industry and we illustrate the discussion with examples from the construction industry.

There is a growing realization that external sources (such as innovation networks) can bring about benefits for innovation (cf. Nooteboom, 2000). Note, that there is also increasingly recognition that potential risks might be associated with collaboration: such as leakage of information; loss of control or ownership; and divergent aims and

objectives, resulting in conflict (Tidd et al., 2002: 170). Organizations view cooperation as a risk because of uncontrolled information disclosure and asymmetric diffusion of core competencies to partner organizations (Hamel, 1991). Wathne, Krogh and Roos (1996) report significant effects of trust, richness of the channel of interaction, perceived openness and the partner's prior experience on knowledge transfer in a cooperative context.

Context of knowledge transfer

A large amount of studies discuss the importance of context for transferring knowledge. In project basing knowledge and learning obtained from one project are difficult to transfer to another project since they are crucially dependent upon context and because the uniqueness of the project makes people fail to see the opportunities of learning (DeFillippi & Arthur, 1998). Several aspects are important in this respect: values and norms (Leonard-Barton, 1992), organizational and industrial context (Szulanski, 1996) and institutional characteristics (cf. Teece, 1977). The recipient has to be able to understand the knowledge within its context in order to absorb this knowledge. A large amount of tacit knowledge is context related and therefore it is important to investigate the context of the network of PBO in order to understand the process of innovation and knowledge transfer.

Governance mechanisms

As indicated there are various governance or coordination mechanisms relevant for governing working relationships between internal and external parties. Authority relationships, contracting/pricing and trust come to the fore (the contextual aspects are discussed above). Authority relationships concern the PBOs internal networks. Contracting/pricing and trust reflect mainly the relationships with external networks. The latter two may be combined or can substitute for each other. Each contractual relationship assumes a certain level of trust. But the more trust develops between parties, the less extensive the contracting can be (Nooteboom, 2000). Both mechanisms mitigate relational risk and performance risk (Das and Teng, 2001) that pops up in network relationships. Note that trust can be defined as the confidence that in an exchange of some kind (i.e. knowledge) the partners will not be harmed or put at risk (Van Ees & Postma, 2003). From the literature, we can conclude that trust is a multifaceted, multilevel and dynamic concept (Lewicki and Bunker, 1996). From our reading of the literature we come to the following types with respect to knowledge exchange: reliance trust (quality of knowledge), disclosure trust (disclosure of

knowledge), calculative trust (restrict spillover of knowledge). In the following section we illustrate the discussion above with examples from the construction industry.

4 Illustration of the Dutch construction industry

The construction industry

Construction is a complex industry involving a number of discrete transactions usually undertaken on an ad hoc, one-off geographically specific basis (Thompson et al., 1998). Innovation (performance) in the construction industry is taken as an illustration for innovation in the project-based industry. Performance of the construction industry in terms of productivity, quality and product functionality has been low in comparison to other industries (Winch, 1998). However, the Dutch construction market is changing and more interest (from the government) is placed on increasing innovation and long-term cooperation constellations with network parties. Several reasons are mentioned in literature for the low rate of innovation in the construction industry. These reasons are: (a) Immobility of the final product; innovations that require controlled environments or conditions during implementation may be limited (Slaughter, 1998); (b) Prototyping is expensive since full-scale prototypes are most reliable, but difficult to perform (Gann & Salter, 2000; Slaughter, 1998); (c) Longevity of the final product (building). Innovation of construction must be assessed over a very long time period (Slaughter, 1998); (d) Construction innovations exist within a temporary alliance among independent organizations concentrated on a single project. When the project is finished, the alliance dissolves (Bresnen, 1990) and learning is disrupted. Cooperation is on an ad hoc basis and long-term relationships are difficult to find in the Dutch construction industry (Pries & Janszen, 1995) and (e) innovation is dependent on the social and political rules, norms and regulations (Seaden & Manseu, 2001; Gann et al. 1998). Strict regulations (environmental, safety and quality) have positive and often negative consequences for innovation.

From several studies it becomes clear that the supplier industry contributes to a large extent to innovation in the construction sector (Dolmans et al., 2003; Pavitt, 1984). The general idea is that the supplier industry delivers technology to the construction companies, who aim at optimal process innovation, while suppliers are more directed to the market and aim for product innovation. Technological trajectories in these industries are defined in terms of cutting costs, not on basis of technological advantage or other attributes (Pavitt, 1984). Besides suppliers, other parties initiate innovation:

governmental institutions and regulations (Seaden & Manseu, 2001), problem solving in projects (Slaughter, 1993; Winch, 1998) and customers (Von Hippel, 1988).

The construction industry mainly focuses on the temporary network in which projects are performed in cooperation with several different parties (Bresnen et al., 2003; Dubois & Gadde, 2000). Several authors state that project basing inhibits innovation and organizational learning in the construction industry (Gann & Salter, 2000; Winch, 1998). Relationships between parties are confined to the discrete duration of the project contract. In these relationships, aspects like trust, commitment and reciprocity, associated with long-term collaborative relations, are essentially absent (Thompson et al., 2000). Moreover the parties tend to rely heavily on the formality of the governing contractual conditions instead of on relational conditions like trust.

The Dutch construction industry suffers from the economic recession in which demand is decreasing. Strict financial and technical regulations (from the government) provoke to one extent innovation, on the other hand they influence competition, business licensing conditions, procurement and working conditions (Pries & Janszen, 1995). The construction industry has a high cost consideration and focuses to a large extent on price-based competition. Research states that cost consideration hinders innovation (Veshosky, 1998).

Concluding we can state that the influence of the permanent network parties is unclear for innovation in the construction industry. Furthermore, the context and culture of the construction industry is of importance to the way firms behave and cooperate with each other.

5 Discussion and propositions

Within the project-based industry, little research has been performed on the knowledge acquisition and transfer for innovation. The project based industry works with several internal and external parties in order to fulfil a project in a specific period of time. Due to its temporal nature and the fluctuation of members in the projects, it becomes more difficult to develop a competitive advantage and increase performance in the form of innovative products and processes that can be applied company or industry wide. Projects are often one-off, self-contained tasks, which have specific objectives, finite life cycles and dedicated teams (Bresnen et al., 2003). Several authors state that discontinuities, which are created between projects in tasks, personnel, resource and

information flows in the project-based firm imply that knowledge and learning from one project can not easily be transferred to another project (Bresnen et al., 2003; Prencipe & Tell, 2001). Below we focus on some aspects that came forward in the discussion held above. Based on this we develop a set of propositions.

Knowledge exchange

Based on the discussion in the previous sections, we can develop the core proposition related to the main relationship of the conceptual model. This relationship concerns the knowledge exchange between the external network partners and the PBOs internal resources. Core proposition:

Proposition 1: More efficient and effective exchange of knowledge between external and internal parties of PBOs leads to higher innovation performance

PBO-characteristics

On the one hand project organizations are able to develop, adopt or adapt new ways of working and embed them in organizational routines and practices (Bresnen et al., 2003). On the other hand a contradiction is noted between the short-term task objectives of a project and the longer-term development nature of organizational learning processes (including innovation processes) (Grabher, 2002). Others state that project based working can act as a major limiting factor for innovative potential (Winch, 1998). Projects can create barriers to change, by privileging short-term localised task performance over long-term knowledge accumulation and learning (Bresnen et al. 2003). The project-based industry often focuses on ad hoc strategies for specific projects. Once the projects are finished the cooperation between different parties disbands and learning from the project and the cooperation is hardly evaluated or transferred to new projects. Changes in the environment make it important for PBOs and their networks to change the way of working. For example in the Dutch construction industry, these changes are based on the economic recession, market regulation efforts, new regulations from the government and the EU on safety, environment and contracting agreements and the request from the government for an increase in performance (in the form of new products and processes). Due to these changes, more and more firms are merging into larger firms and several (smaller) firms go bankrupt. Due to changes in the construction market (from a sellers market to a buyers market), the economic situation and increased international competition, it becomes more and more important that the PBOs start developing strategies and long-

term cooperation activities with the parties in their network. Several researchers, governmental institutions and R&D institutes claim that the construction business should focus more on customer based approaches, strategy development and alliances. Research has demonstrated how project basing militates against organizational learning and the diffusion of new management ideas by affecting the firm's absorptive capacity (Dubois & Gadde, 2002; Gann & Slater, 2000; Winch, 1998). This leads to

Proposition 2a. A long-term view in project-based firms enhances the firm to adjust to changes in the environment and increase innovation performance.

We also discussed absorptive capacity of PBOs. Absorptive capacity deals with the permeability of external knowledge (cf. Cohen & Levinthal, 1990). Absorptive capacity refers to the capacity of a firm to open up its innovation capabilities for external knowledge. In order to transfer knowledge between parties in the network of a PBO, the focus of the firm should not be internally oriented e.g., on efficiency and costs, but on obtaining new skills or combining skills to create new knowledge and to have a competitive advantage in the market. This suggests

Proposition 2b. The better developed the absorptive capacity of the PBO, the higher the innovation performance

Governance/Coordination

Research shows that project-based firms deal with four levels of coordination (Dubois & Gadde, 2000), in which coordination on project and firm level are most prominent. However, the coordination between the PBO and its sub-contractors and suppliers becomes more important for innovation and reactions to a changing market. This extra level of coordination increases the complexity within PBO. An important task is put aside for project-based firms to coordinate (in the form of communication) the relationships between parties in the permanent network in order to gain competitive advantage. Hence

Proposition 3. Coordination between the PBO and external knowledge resources can help to gain competitive advantage.

This coordination between the external knowledge resources can be applied in several ways, in the form of building up long-term relationships, development of mutual trust and respect, increasing openness between the different parties, development of social ties and understanding each other's values and norms.

In a project based industry, two kinds of networks are denoted (Dubois & Gadde, 2000): the temporary project network and the permanent network of available partners in the market. Several authors have discussed that more coordination among the firms in the permanent network would enhance productivity and performance (i.e., in the form of partnerships, Bresnen & Marshall, 2001). In the temporary network, firms usually cooperate on the basis of extensive contracting, in which risks, failures, extra work and the final responsibility/accountability are discussed. Parties tend to rely heavily on the formality of the governing contractual conditions: the focus of the transaction is contractual rather than relational (Thompson et al., 1998). Within the projects, the network parties cooperate; however, the main focus is on optimizing their own performance and work, instead of creating win-win situations for all parties. These contracts are an expression of the risks of opportunism between the different parties. The majority of standard forms of contract are reactive mechanisms designed to apportion blame between the parties (Thompson et al., 1998). Extensive contracts hinder information exchange since parties are afraid to disclose information or knowledge (Hamel, 1991) and focus on a strategy in which they optimize the work from their own firm, instead of creating win-win situations for several firms. Thus

Proposition 4a. Coordination in the temporary network, in the form of detailed contracts, has a negative impact on the exchange of knowledge for competitive advantage between the internal and external knowledge resources in a project-based industry.

On the other hand when a long-term relationship in the permanent network between PBO and network parties are more based on trust, the parties respect each other and perceive mutual value for their involvement in the long term cooperation. Within a long-term cooperation based on trust, knowledge is more easily transferred, since parties understand that they can learn from each other's competence. However, it takes a long time to develop a long term and trusted relationship (Dubois & Gadde, 2000). Literature on construction partnerships focuses primarily on client-contractor partnerships (Bresnen & Marshall, 2000). Partnerships between suppliers and contractors are

discussed in supply management literature (cf. Dubois & Gadde, 2000). The partnerships that occur in a project-based industry build, to a large extent, on complementing value or knowledge, instead of competing knowledge. This leads to

Proposition 4b. Coordination of the permanent network, in the form of trust, has a positive impact on the exchange of knowledge for competitive advantage between internal and external knowledge resources in a project-based industry.

Dubois & Gadde (2000: 214) indicate that if the potential benefits of different types of relationships were recognised by primary contractors the prerequisites for adaptations and development of network substance would be considerably enhanced. These authors perceive a relationship between firm learning and the existence of connections between different relationships.

Context

Within the project based industry the context for transferring knowledge is rather important. Within the Dutch construction industry, regulations, the economic recession and the culture to perform business, which developed historically, have an enormous impact on the way the PBOs currently work and distribute information and knowledge to other parties. Regulations on safety, environment and rural planning have influenced decision-making and product and process development in the Dutch construction industry. Due to new regulations, several products and processes were developed over time that complied with these new rules. Note, that these regulations forced firms to investigate specific alternatives instead of a larger number of alternatives. The economic recession in the world has had negative consequences for the demand for constructions. The demand is decreasing and clients gain more influence in the final product compared to former years. The historically developed culture is another aspect, which has impact on the way the industry operates. The culture contained price agreements between large firms and a strong focus on cutting costs. Due to new regulations, these price agreements are no longer legal and construction firms have difficulty changing their former culture into something new. So

Proposition 5a. A context with standardisation of products and routines, regulation and a strong culture has a negative impact on the development of new knowledge for innovation in a project-based environment.

A context in which a less heavy influence of the governmental institutions is present and in which firms can choose from several alternative decisions for cooperation with other firms, developing products and processes, the creation and diffusion of knowledge can be positively influenced. Furthermore, a culture that is able to adjust to changes in the environment is more inclined to adopt alternative solutions. This leads to

Proposition 5b. A context with less strict regulations and restrictions and matching culture has a positive impact on the development of new knowledge for innovation in a PBO environment.

Summing up. The project-based industries gain more interest in current discussions and a knowledge perspective is applied to deal with the problems of knowledge transfer, acquisition and storage of innovation processes in PBO. Furthermore, most research focuses on the project management or the project itself, instead of on the importance of the different external knowledge resources that have an impact on long-term innovation development and diffusion. Focussing on knowledge flows between different parties contributes to current literature for PBO, because it presents a different picture on innovation than from a traditional point of view (R&D expenditure and patents). The propositions discussed above will be investigated in future research. Note, that this research is explorative, which implies that the current propositions should be developed and operationalized further and ultimately tested with help of empirical material.

Acknowledgements

We would like to acknowledge Dirk-Jan Kamann and Derk Welling for fruitful discussions on this topic and we appreciate the comments of the two anonymous reviewers of the OKLC conference.

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