

Mechanisms for Resource Integration in Business Networks

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Research paper

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Purpose: The purpose of this research is to understand how operant resources, such as knowledge, are developed and shared in business-to-business networks. In particular, we examine how contingent factors such as social integration mechanisms, power, and regimes of appropriability influence the networks' willingness and ability to generate operant resources. We apply a cognitive theoretical approach, which seeks to understand the structures of cognitions in individuals, in a network context. We address both the ninth and tenth SD logic foundational premises in this study, in that we consider both the issue of resource integration in the network and the phenomenological nature of value co-creation.

Design/methodology/approach: An exploratory in which semi-structured depth interviews were conducted with 27 design team managers involved in the construction of two different major construction projects. We also asked each respondent to draw a "network picture" (their subjective mental representations of their relevant business environment) of the project.

Findings: We find evidence that the phenomenological nature of value creation and the sense-making activities of network members have important implications for resource integration in the network. In addition, such resource integration may be moderated by important contingent factors.

Research Limitations/implications: While this study cannot be generalised to other network settings, it does present guidance for future research.

Practical implications: A better understanding of how to facilitate operant resource creation in business networks.

Originality: The application of cognitive network theory to the understanding of resource integration and value creation in networks.

1) Introduction

Vargo and Lusch (2008a) state in their fourth foundation premise that knowledge is the fundamental source of competitive advantage, and that in the terminology of SD logic knowledge and skills represent “operant resources.” The SD logic notion of *service* as the fundamental basis of exchange recognizes the subjectivity of knowledge, and advocates a shift to a process of mutual service provision (2008b). It is explicitly stated in their first foundation premise: “The application of specialized skill(s) and knowledge is the fundamental basis of exchange” (Vargo and Lusch, 2008a). The insights of Polanyi (1958) a half century ago established a foundation for this school of thought. He stated that processes of tacit integration - where tacit knowledge (the hidden experiences and skills we possess) and the human cognitive processes we engage in - are the root of what we know and what we do. Providing a managerial perspective, Schlegelmilch and Penz (2002:6) define knowledge as “...the tangible creations of human intellect which include technical expertise, problem-solving capability, creativity and managerial skills which are embodied in the employees of the organization.”

Lusch and Vargo (2006) view both the firm and the customer as resource integrators, and call for the refinement and elaboration of this resource integration concept in their ninth foundation premise of SD logic. In particular, they highlight the need for a more explicit connection to the interactivity and networking literature, and the recognition that “... the venue of value creation is the value configurations - economic and social actors within networks interacting and exchanging across and through networks (2008a:5). Lusch and Vargo (2006:283) recognized that “...organizations exist to integrate and transform micro-specialized competences into complex services that are demanded in the marketplace.” To do this effectively, networking with other firms that are willing to partner is key (cf. Schembri 2006). Therefore SD logic has much to offer in understanding value creation in business-to-business networks, where the economic actors (rather than producers and consumers) interact, and these economic actors originate from both the supply network and the customer network (Cova and Salle, 2008).

Building from this new perspective we examine the subjective and contextual natures of an individual’s knowledge, and the contingent factors that may influence how such knowledge is shared in a network context. We thus extend the notion of value co-creation by consumers and marketers (as extolled in SD logic) to include the notion of meaning in ‘value-in-exchange’ and in ‘value-in-use’ (Penaloza and Venkatesh, 2006), and place the formation of such meaning within a network context. Borrowing from the work of Schembri (2006), we contend that to create true value that is beneficial to all, the customer, the organization and the organizational network partners must all recognize the same reality in terms of value. This echoes what Vargo and Lusch (2008a) recognize in their tenth foundation premise - that value co-creation is in fact phenomenological and experiential.

2) Cognitive Theory and Network Learning

To help understand how integration mechanisms influence knowledge and learning in business networks, we draw upon cognitive theoretical approaches to understanding network-learning processes (Monge and Contractor, 2003).

Traditionally, cognitive theoretical approaches seek to understand the structures of cognitions in individuals. When applied to networks they focus on the shared interpretations that people have for message content, such as network goals and stories. In particular, Cognitive Consistency Theory seeks to explain the mechanism by which individuals' fulfil their aspirations for consistency in their cognitions (Monge and Contractor, 2003), and is seen as a prime motivation for changes in beliefs, attitudes, and/or behaviours if these are not psychologically consistent (Festinger, 1957). As an example, in personal friendship networks the theory would argue that individuals are more satisfied when their friends are friends with one another. This translates at the network level as the extent to which a drive for consistency is manifest in network membership, attitudes, and relations.

This drive for consistency will tend towards a state of balance, which is a homeostatic state in which further motivations to change recede (Simon et al. 2004). To achieve this balance, Simon et al. (2004) point out that it is a bidirectional relationship of change and adjustment between evidence (the object of judgement) and conclusions (the judgement of the object). Thus, actions may reform beliefs and attitudes, which may recursively alter further actions. We therefore find cognitive consistency may in fact be heavily reliant upon interactive and dynamic processes of information assessment, behavioural action, and the emergent 'reality' that is constructed from this interaction. This is a process of coherence-driven processing (Simon et. al., 2004), that enables confidence in decision-making by reaching out to bring the various pieces of the cognitive field into consonance (Simon and Holyoak, 2002). The capability of firms and networks to innovate and to recognise the value of new knowledge, assimilate it, and apply it to creating business value has been seen as a major factor in organisational learning and coherence-driven processing. This capability has been termed "absorptive capacity", and Todorova and Durisin (2007) recognise several contingency factors that may enhance or inhibit this capability. The specific contingent factors identified by Todorova and Durisin (2007) as moderators in the development of absorptive capacity capabilities are: regimes of appropriability; social integration mechanisms; and power relationships.

Regimes of appropriability are "...the institutional and industry dynamics that affect the firm's ability to protect the advantages of (and benefits from) new products or processes." (Zahra and George, 2002:196). They determine the incentives to invest in learning and innovation, and thus moderate the relationship between absorptive capacity and its antecedent knowledge sources (Cohen and Levinthal, 1990) and the relationship between absorptive capacity and its outcome of sustainable competitive advantage (Zahra and George, 2002). Regimes of appropriability would therefore encourage or inhibit the motivation of network members to engage in value co-creation activities.

Social integration mechanisms help build connectedness and shared meanings. Merali (2000) recognised that actors form knowledge schema (the structure of their knowledge) by acting in an organisational context, which itself is dynamically redefined by the schema they form. Thus, collective schema are formed which will underpin the collective consciousness and determine how knowledge is retrieved, utilised and made coherent with group actions. Todorova and Durisin (2007) argue that the ability to identify and absorb new external knowledge can be hampered by the embedded knowledge, well-established capabilities, and traditional managerial

cognitions of firms. Thus, learning in networks may be inhibited because traditional ways of working and thinking are firmly embedded in the network and therefore blind participants to the opportunities present.

Power relationships are said to interact with cognitive processes, learning, and capabilities in the organisation and so should be considered as a contingent factor (Todorova and Durisin, 2007). At the network level, learning processes may be influenced by the allocation of resources (both inside an organisation, and between organisations and external markets and stakeholders), and thus power relationships help to explain why only some of the available new knowledge is used by the firm or network, and why some organisations are better able to exploit external knowledge from their network partnerships. Therefore, power relationships will influence exposure to and the exploitation of new knowledge (Todorova and Durisin 2007).

We now go on to examine the mechanisms for resource integration in business networks by examining how regimes of appropriability, social integration mechanisms, and power relationships operate in two project networks in the construction industry. Theorists such as Nahapiet and Ghoshal (1998) have suggested three dimensions to what they termed social capital. Social capital is defined by them as the actual and potential resources which are embedded within, available through, and derived from a network of relationships. They proposed three dimensions relevant in building and understanding social capital; structural, cognitive and relational. The following discussion reflects these dimensions. We explore the structural features of the network by examining the practice of novation in the construction industry, we apply cognitive consistency theory to understand network cognition, and we look at the relations between network members by exploring their network pictures and relating this to patterns of communication and power dependency. Thus we relate resource integration mechanisms with the building of social capital in network activities.

3) Methodology

3.1 Case study selection and context

Because construction network relationships can change radically from project to project, the ability of members to form cognitive structures that support learning is difficult (Dubois and Gadde, 2002). Such changes limit the learning processes of trial, feedback and evaluation. However, they may also support the development of new ideas and innovation because of the variation in network activities and membership (Weick and Roberts, 1993), although this innovation may not be shared or disseminated beyond the project network.

Against the foregoing discussion, we aim to understand how resource integration mechanisms may help and/or hinder network learning through two case studies undertaken. The context for the research was managers in the UK construction industry. The construction industry displays certain characteristics that render it particularly complex including short-lived site-specific project-based activity and uncertainty due to a lack of complete specification (Dubois and Gadde 2002), and loose couplings in the permanent industry level network. Such loose couplings between network actors for the majority of the time greatly restrict firms' abilities to learn thus inhibiting sustained cognitive structures (Teece 1998). Therefore,

understanding the processes that industry actors engage in to enhance network learning given these circumstances would seem valuable.

Case study one was a project creating office space and conference and training facilities (Project A). The second case related to the construction of a combined heat and power plant (CHP) for a large-scale institutional user (Project B). The management teams (consisting of the client representatives, architect, design team, and contractor representatives) were of approximately equal size on each project. Due to the anonymity agreement between researchers and informants, we can provide only general information for the nature of each project.

3.2 Data Collection

The data collected for this study consists of 27 in-depth semi-structured interviews conducted with members of the main UK design and build teams construction projects. The interviews were conducted at the offices of the respondents and at the construction sites with respondents. The interviews lasted on average 90 minutes and were digitally recorded. Some forty hours' of interviews were recorded. The theme of the discussions focused on the acquisition, interpretation, dissemination and utilisation of knowledge within the network.

As part of each interview, respondents were asked to draw and comment upon their network picture of the project in order to identify the changes in the network. Network pictures, according to Oberg, Henneberg and Mouzas (2007), are how managerial sense making and cognition affects managers and companies in the way they 'see' their network environment and the options they perceive are available to them.

3.3 Validity and reliability

Three aspects of validity (internal, construct and external) were adopted in order to ensure rigour in the data collection and results. The first, internal validity (or logical validity) refers to the plausibility and credibility of research results and conclusions (Yin 1994; Cook and Campbell 1979). This was controlled in two ways. In order to aid internal validity, multiple perspectives were collected through interviewing actors at different points in the network (Yin 1994), and through a process of pattern matching (Denzin and Lincoln 1994; Eisenhardt 1989) by comparing empirical patterns established in previous studies (e.g. Dubois and Gadde 2002) and between each of the participants interviewed.

Construct validity refers to "...the quality of the conceptualization or operationalization of the relevant concept" (Gibbert et al. 2008, p. 1466) or, does the study investigate what it purports to be investigating. To help ensure construct validity and to aid triangulation (Denzin and Lincoln 1994), different data collection strategies and sources were employed in order to gain alternate perspectives of novation and knowledge within the network, namely: in-depth interviews, network pictures, minutes of meetings and attendance at meetings.

External validity refers to the generalisability of a study's findings (McGrath and Brinberg 1983). Although case studies and interpretivist methodologies cannot provide statistical generalisation, this does not mean that they are "...devoid of generalisation" (Gibbert et al. 2008, p. 1468). Case studies can strive for analytical

generalisation; generalisation to theory using empirical evidence (Eisenhardt 1989). Eisenhardt (1989) suggests that case studies can facilitate theory development by conducting multiple case studies. Although this is reduced in the present study (two case studies), cross-case comparison was possible.

Reliability refers to the extent that similar insights can be produced by subsequent researchers replicating the study (Denzin and Lincoln 1994). Gibbert et al. (2008) suggest that transparency and replication are two primary methods to help aid reliability. Initially, transparency can be controlled through the use of a case study protocol, while replication can be controlled through creating a case study database. For the present study, a case study protocol was developed that outlines how the study was conducted and a database of case study notes, transcribed interviews, network pictures, surveys, minutes of meetings and observations of meetings, in order to facilitate case study replication (Leonard-Barton 1990).

4) Findings and discussion

4.1 Regimes of Appropriability

As stated before, regimes of appropriability determine the incentives to invest in learning and innovation, and may encourage or inhibit the motivation of network members to engage in value co-creation activities. The motivation to participate in the two construction projects by the firms involved was strong in both cases. At the level of the individual team members, one of the reasons that the various design team members wanted to be involved in these projects was because they offered them the opportunity to be involved in using innovative building methods and technologies, and in innovative team working processes which allowed earlier involvement of the main contractor in the design process. Thus many participants felt that the project gave them a competitive edge over other supply chain competitors in terms of product and process innovation and key learning opportunities.

In relation to Project B a lot of time was spent looking at the relative costs and feasibility of what was a very new technology in the UK. It was changes in the relative costs of fuel, the expansion of the business (and therefore an increased need), and the desire to be a “low carbon emission leader” that led to the approval for the project by the client. Thus regimes of appropriability changed the cognitions of the project initiators and made the project more attractive to invest in. At the same time, delays in starting construction (because the regimes of appropriability were initially less favourable) meant that all aspects of the design process were now under intense time pressure. This was something of a problem on Project B because the innovative (and still emergent) technology being used did not lend itself to early decision making, and thus many unknowns had to be tolerated as the project went through each stage of design and development. This lack of detail presented many challenges to the design team, and directly contradicted their traditional construction network practices. We can see from these situational factors that there were strong motivations in each case for the two projects to take place and for those involved to be fully engaged with the integration of resources in their respective project networks. Nevertheless, there were significant challenges to these integration processes. We will now examine how social integration mechanisms were a feature in addressing these challenges.

4.2 Social Integration Mechanisms

We examine here two main social integration mechanisms used by the projects under study. Firstly, the ways in which communication practices influenced cohesion and learning. Secondly, the structural changes brought about by altering the position within the network of key individuals, termed “novation”, in which individuals are moved from the client team to the contractor team mid-way through the project in order to facilitate consistency of expertise and design intent.

4.2.1 Communication Practices

In making sense of the communications and actions of oneself and others, individuals draw upon interpretive schemes that help them produce and reproduce structures of meanings. Haythornthwaite (2002) argues that learning groups, and collective learning, may not be guided by a single individual but instead guided by the sharing of information and the building of a repertoire of knowledge within the network. Here the communication among network members matter most, suggesting the need for mutual exchanges among learners. Such exchanges are also essential building blocks in establishing more effective communities of practice. Thus, knowledgeable individuals are embedded within social practices and structural contexts, which influence their interactions, and are in turn influenced by their actions. The availability of communication opportunities was seen as one important factor in allowing the network to engage in resource integration.

One key individual in the network is the project manager. It is the role of the project manager to bring together all the areas of expertise in a co-ordinated way. This is done through regular face-to-face (monthly) design team meetings and a system of signing off (or traffic lights) at each stage of the design and construction process. The attendance at site meetings as well as the more formal monthly progress meetings is important. Because this need to meet face-to-face is great, design team network partners are often located in the same geographic area (sometimes within streets of each other).

However, on Project B, the lead contractor in the fit-out stage (taking over once the building shell was completed) was located several hundred miles from the project itself. His specialist expertise made it necessary to overcome the difficulties that this geographical distance presented. Nevertheless, the project administrator was concerned about the availability and distanced communication with the key fit-out contractor. He talks in one interview about the importance of face-to-face communication, even though there are detailed plans and drawings. “It helps link understandings between people, and the lack of it is one reason why the project is so late.” He termed it a “lack of intimate design review process” and felt that it made them vulnerable. In order to counter this vulnerability, Project B conducted a wide consultation with the construction network members in order to know how to design the building for the later activities of fitting-out the building shell with the power generation equipment. However, there were some problems in getting the fit-out team to understand how to communicate and work with the building design team. At times those designing and building the shell that would house the CHP had to contend with questions left unanswered, details missing, and key equipment suppliers not yet appointed.

Even where face-to-face meetings are attended, interpretive issues arise. Value co-creation as a phenomenological and experiential activity means that the meaning conveyed and the meaning understood by those communicating will affect the value that results. Thus, we have a paradox, and the paradox is that collective learning, by definition, encompasses both divergence and convergence of the meanings that people assign to their surroundings (Fiol, 1994). Fiol (1994) states that even if individuals disagree about their interpretive pictures (or communication content), they may still converge around a framework that is broad enough to encompass those differences. Giddens (1984) would describe this as the interpretive scheme, and would see its role as helping individuals to share in a common stock of knowledge without the need to assume that those individuals have common meanings and values which are somehow – at the level of the organization - identical and replicable across space and time (Boland, 1996). Polanyi (1958) placed consciousness partly outside the mind, in the world of intentions and in the observable activities that we can share with others. Thus, collective learning is an action in which knowledgeable individuals perform intentional actions not in isolation, but as embedded actors in active systems of social relations. There were many instances observed in the design team meetings of time and effort being spent framing the problem, or potential solutions, in numerous different ways so that they would be understood by team members with very different professional backgrounds. This effort could at times be both exhausting and enlightening. Finding successful ways to frame information and convey understanding was a primary factor in gaining cognitive consistency.

One of the common actions used to help frame information observed in the face-to-face meetings was the use of technical drawings and diagrams to build a consensus of meaning between different technical disciplines. The training of engineers includes the ability to use technical drawings and the ability to translate those into 3D mental models. In meetings they often shared drawings and make impromptu sketches. Architects would draw sketches to illustrate their ideas, and engineers would translate technical drawings into detailed solutions to specific problems. While technical drawings in particular were shared and discussed via email, in order to ensure that the interpretation (or framing) of the information was understood correctly by those concerned it was felt that face-to-face contact was vital and made this process less risky. It was also clear that in the framing of this information, individuals differed in their approach. While the engineers tended to visualise technical drawings as 3D elevated models and could imagine how the finished structure would look, the architect talks about this as a potential weakness. He comments that in the technical visualisation of drawings there tends to be a lack of the more specific finishing details. He stated that they could not visualise what it was like to be in the building, to actually experience it. They recognised that to achieve cognitive consistency and a common framing of the information being shared, compromise was often needed. The architect on Project A commented: *“It is a balance of an emotive thing as well as a substance thing. I try and inspire people, but people join half way through and so I do what I do and try and listen and compromise if I have to, particularly if there are cost issues.”*

While the more formal progress meetings gave everyone the opportunity to check their own understandings with those of others, the site meetings were devoted to more practical and often very specific problem solving. The architect in particular

liked getting involved with the contractor and sub-contractors on site, and described how the different mind sets of the contractor and his team (practical) and himself (artistic) could come together in a focused and practical way through such interactions. *“It feels family friendly, like a conductor and an orchestra....You would think we would not get on as he is trying to save money and I am trying to spend it But on this project we get on and all work together. It is one of the best working teams I have been on in a long time.”* The time and effort devoted to establishing a common aim through communication, in particular recognising and addressing the issue of framing information and understanding as an explicit part of the design process, would appear to have helped facilitate resource integration on Project A in particular.

4.2.2 Novation and Network Structures

Novation is a legal term and refers to the act of replacing either an obligation or a party to an agreement with a new obligation or party. Novation is a common feature of network management in the construction industry (Doloi, 2008), where it is used to transfer members of the original design team on earlier phases of a construction project (e.g. architects and engineers) from the client centred design team to the contractor’s build team for the later stages of actual construction. Why is this process of novation seen as an important feature of so many construction industry networks? Primarily it relates to continuity of design intent, and the placement of risk between network partners. As a consequence of novation, the design team’s obligation to the client is transferred to the contractor who becomes responsible for carrying out the detailed design work in the later stages of the project life cycle (Doloi, 2008).

Under novation, the configuration of the network is demonstrably reconfigured as the novated individual has a new obligation to a different actor within the network: *“When you novate, the links you had between [the client] and design team, you effectively break that contract, you novate and now those consultants are contracted now to [the contractor] under a separate contract”,* and *“This team migrates across to us [the contractor] and then has a very similar relationship that we have with [the client]”*. Hence, as a consequence of novation, the novated actor changes position in the network, moving from a central position to a more peripheral location, affecting both network couplings and network dynamics.

This change of position was evidenced in several of the network pictures we elicited. A network picture is an actor’s “...explicit or implicit representation of the context in which business interactions take place and which forms the basis of his thinking and operations” (Henneberg et al. 2006). Linked to this is the issue of network picture representations regarding one’s own position within the network, in terms of centre and periphery (Oberg et al. 2007). In Figure 1, we show an example of such a network picture. When novated individuals change position in the network, they tend to move from a central to a more peripheral location. From the point of view of both the client and the contractor, novation leads to a change in the focal network of the novated individual. We see in Figure 1 an example of how the design team members are positioned (pre-novation) at the centre of the network. Post novation their position is moved to the periphery, under the main contractor (as denoted by the red dotted line). This pattern was observed in a number of the network pictures from both the client representatives and the contractors. In contrast, in Figure

However, the implications of this shift may be that the schemata they bring to this new network position (with its new network linkages) may not be congruent, and thus may affect their effectiveness. To achieve such congruence, Merali (2000) proposed relationship scripts (which filter new information to determine its relevance to existing knowledge) and relationship enactment (where relationship schema are linked to action) as processes that help to embody social capital and to link individual and collective learning. Diversity of individual perceptions can be harnessed to augment the collective schema.

However, there is often a learning process to address with novation. As one respondent observed: *“When [the contractor] first came in they are taking it as a more traditional contract where the design was finished and they then just build it, basically, instead of being integrated into the team, giving advice, and also taking on the risk associated with not having the design fully finished.”* Thus, inconsistent schemata caused initial doubt and reticence in those design team members who were intended to be novated, and inhibited resource integration. Proactive steps (including a team-building away day event for the contractor and those team members that were to be novated) were needed to overcome this. This is an example of how relationship enactment (linking relationship schema to action) helped to improve the novation experience.

As design team members are removed from the core design team and novated to the contractor, the context of their situation changes and this new situation may require real efforts to alter and adapt the way in which they frame information, and may cause them to assign different meanings to their action than might have otherwise have been expected. This may have implications for another important benefit of novation, the desire for continuity.

The rationale for novation is often seen as a way of sharing knowledge and ensuring the consistency of design decisions and project intent. The primary rationale for employing novation was that *“It allows for continuity”*, and *“Continuity of design thinking”*, through the various design phases by *“...importing people who have a stake in the project”*. Continuity was frequently raised by respondents as a particularly important issue for the construction industry given that it is subject to stringent regulations: *“The structural engineer is novated to ensure that the building is structurally sound and meets building regulations”*, and *“For this project the architect, us and [the structural engineer] have all been novated to ensure that what is built complies with statutory building regulations”*. Conversely, deciding not to novate certain actors and the loss of continuity it affords was seen as causing a fracture in one project and its project network: *“It is almost two jobs rather than a continuous nice smooth flow”*. Thus one of the main drivers of resource integration is to ensure continuity of intentions and actions. Although it is not without its difficulties, the act of novation is seen as a viable mechanism for attaining such resource integration.

4.3 Power Relations

We consider power relationships and important aspect of resource integration, as they are said to interact with cognitive processes, learning, and capabilities in the

organisation (Todorova and Durisin, 2007). As stated earlier, they maintain that power relationships will influence exposure to and the exploitation of new knowledge.

Firstly, respondents recognised that there can be problems regarding “defending your expertise” on projects. One stated that: “... you can only go so far as a team, but on site and at a greater level of detail decisions may be made by individuals”. One of the constructors noted that under novation they would work with a novated architect to reduce the costs of the building in order to improve their profit margins and also in the face of material supply increases: “...*there is always an issue with any novated consultant to really look at what has been designed and see if it can be improved. The architect is often asked to revisit the design due to issues of buildability and cost. [With materials] like reinforcement bars that you put in concrete has gone up over two hundred pounds a ton in the last month. So, we want to look at that to see where we can make reductions but not reduce the quality of the building.*” While these efforts may not present conflicts (and may in fact provide benefits for both client and contractor), the possibility of conflicting aims is something that the novated individuals are well aware of. One novated member commented that they sometimes felt they were being asked to exercise the “wisdom of Solomon”. Just as Solomon tested the legitimacy of two women (both of whom claimed they were the mother of a child) by observing their response when he judged that the child be divided in half, the novated individual had to judge the legitimacy of both client and contractor wishes. The importance of integrity to the novated individual was also apparent: “*We still have to be responsible for everything we did pre-novation. We can’t wash our hands of that, it wouldn’t be professional.*” Another novated team member commented that: “*You have to fight for what you are there for, but also life is a compromise.*” Thus power balance and conflicting aims may explain why some resource integration mechanisms (such as the use of novation) might be more successful in some circumstances than in others.

Power has also been seen as a function of certain network structures and the position of the individual within their network. Researchers such as Burt (1992) have argued that network linkages enable and constrain the flexibility, autonomy, and consequently the effectiveness of organizational members. He suggests that individuals seek to enhance their power within a network by forging ties with two or more unconnected others, thus creating indirect ties between the people with whom they are linked. This enables them to broker the relationship between these otherwise unconnected network members, and makes them particularly valuable in terms of knowledge transfer and as potential resource integrators within the network.

Reagans and McEvily (2003:240) point out that researchers have inferred the association between networks and knowledge transfer by observing the association between network structure (or its surrogate, strength of network ties) and network performance rather than to examine the effect of networks on knowledge transfer directly. In particular, they focus on the role of cohesion (the extent to which a relationship is surrounded by strong third-party connections) and range (the extent to which network connections span institutional, organisational, or social boundaries) as facilitators of knowledge assimilation and transfer in networks. These following network pictures show the cohesion and range of the network, from different respondent perspectives. Notice in particular how the relative role and place of the respondent (marked by an “X”) and the client is pictured in each one. They are also

presented in a hierarchical order, from the main contractor to the project manager, project administrator, to a member of the client team.

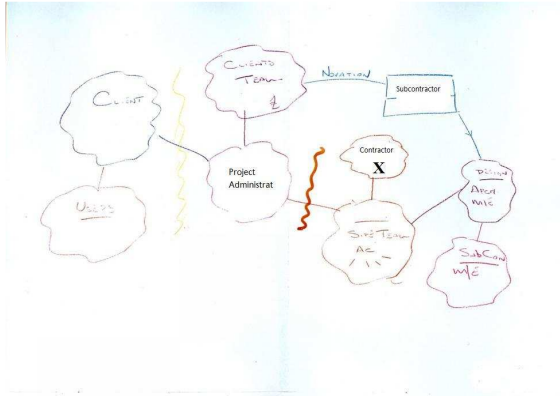


Figure 3: Main Contractor Picture

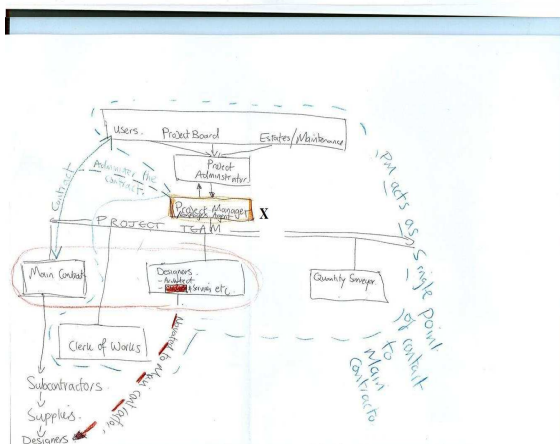


Figure 4: Project Manager Picture

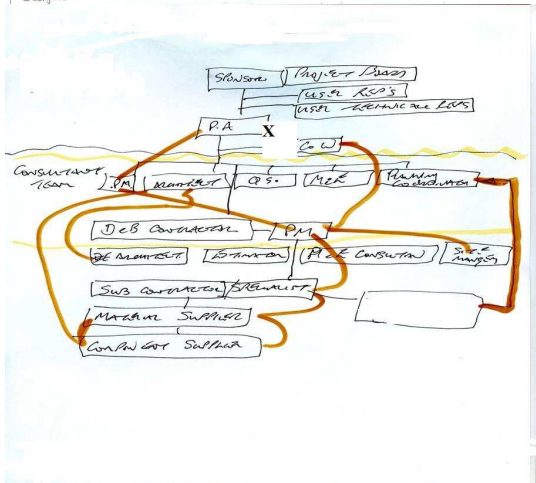


Figure 5: Project Administrator Picture

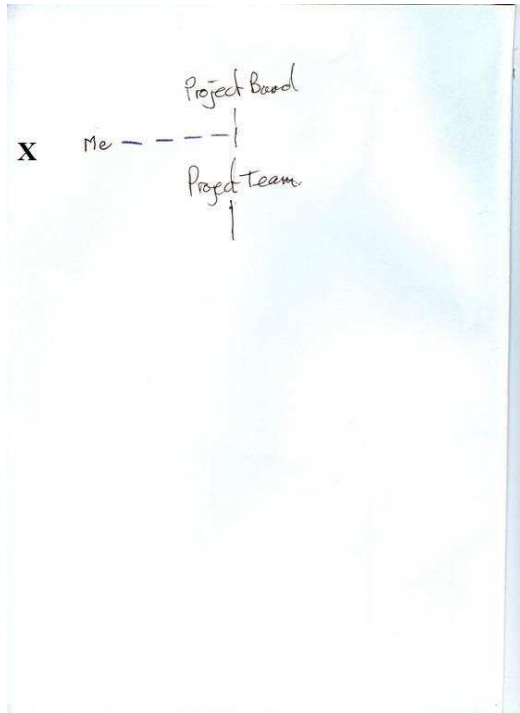


Figure 6: Member of Client Team Picture

We can see from their network positions that the project manager and the project administrator (in particular) are key resource integrators in translating client wishes into construction activities. The relative complexity and greater range found in their network pictures may provide ways to challenge established practices, but also places them as fundamental resources integrators in bringing cohesion to the overall network. Without them, learning might be inhibited because of the limited cohesion between the client and the design teams. Their network position infers power, as discussed by Burt (1992), and highlights network position itself as a mechanism for resource integration through the relationships that are facilitated and the social capital which may be built as a result. As we can see from the network pictures in figures 3 to 6, the isolation of the client from the design team could inhibit their learning. In fact, the role of the project manager and the project administrator would be to connect knowledge from the client in terms of value sought with the actions and capabilities of the design team and the contractor in terms of what is needed to make that value a reality. Without them, both the client and the other network members might not be able to identify and appreciate how to translate knowledge into value.

5) Conclusions

The purpose of this research was to understand how operant resources, such as knowledge, are developed and shared in business-to-business networks. In particular, we examined how contingent factors such as social integration mechanisms, power, and regimes of appropriability influence the networks' willingness and ability to generate operant resources. The development of such operant resources can be seen as a way of building social capital and thus gain important benefits in terms of value for the firms and individuals with it, and for the network as a whole.

We applied a cognitive theoretical approach, which seeks to understand the structures of cognitions in individuals, in a network context to understand how

cognitive consistency might influence knowledge sharing and learning. We also explored how structural features of the network, such as cohesion, range, and network position might influence knowledge and learning. Finally we examined how network relationship behaviours, such as communication and power dependency, might influence knowledge sharing and learning in the network. However, we also explored how these aspects of social capital building were interrelated, by focusing on network members as resource integrators and by examining how contingency factors such as social integration mechanisms, power, and regimes of appropriability moderate knowledge sharing and learning. In doing so we addressed both the ninth and tenth SD logic foundational premises in this study, in that we consider both the issue of resource integration in a network context, and the phenomenological nature of value co-creation.

While regimes of appropriability may provide powerful motivations for members to support learning in networks and to actively pursue the co-creation of value with their network partners, this motivation alone is not sufficient to ensure value creation. We saw evidence of the importance of communication mode (face-to-face), and a shared language through mediums such as technical drawings and industry standards which helped to facilitate value creation. However, cognitive consistency required more than just these facilitators, and the establishment of a shared framing of knowledge and information by network partners is critical in developing value.

Network structure, and the impact of moving network members to different positions in the network through novation, was also an important feature in value co-creation. On the one hand it may facilitate consistency in design intent and expertise, and allow resource integration by moving expertise to new network positions. On the other hand, it may inhibit cognitive consistency and raise issues of power balance and dependency through altering previously established network positions.

The limitations of our study reside primarily in its reliance on inductive methodology, and therefore its limited ability to statistically generalise to other construction industry relationships and to other industries. However, as an exploration of how network partners may act as resource integrators, the issues raised should be of interest to researchers in the area of knowledge transfer, learning, and innovation. The data collected and presented in this paper should be of value in guiding further empirical research in these areas.

6) References

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